Environmental Impact Statement to accompany the Draft Amendment No. 3 to the Storm Bay off Trumpeter Bay North Bruny Island, Marine Farming Development Plan, July 1998
ENVIRONMENTAL IMPACT STATEMENT TO ACCOMPANY THE DRAFT AMENDMENT NO. 3 TO THE STORM BAY OFF TRUMPETER BAY NORTH BRUNY ISLAND MARINE FARMING DEVELOPMENT PLAN, JULY 1998

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GLOSSARY

ADCP Acoustic Doppler Current Profiler
AGD Amoebic Gill Disease
AMD Aquaculture Management & Development
AMT Aquaculture Management team
BEMP Broadscale Environmental Monitoring Program
CAMBA China-Australia Migratory Bird Agreement
CSIRO Commonwealth Scientific and Industrial Research Organisation
DPIW Department of Primary Industries and Water
DPIPWE Department of Primary Industries, Parks, Water and Environment
EIS Environmental Impact Statement
EMP Environmental Management Plan
EPA Environmental Protection Authority
EPN Environmental Protection Notice
EPP Environmental Protection Policy
EPBCA Environmental Protection and Biodiversity Conservation Act 1999
FCR Feed Conversion Ratio
GCM General Circulation Model
GDA Geocentric Datum of Australia
GPS Global Positioning System
GTM Group Technical Manager
HAB Harmful Algal Bloom
HOG Head-on, gutted
IMAS University of Tasmania Institute for Marine and Antarctic Studies
JAMBA Japan-Australia Migratory Bird Agreement
LMRMA Living Marine Resources Management Act 1995
MAST Marine and Safety Tasmania
MIC Marine Inspection Cleaner
MF Marine Farm or lease
MFDP Marine Farming Development Plan
<table>
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<tr>
<td>MFPA</td>
<td>Marine Farming Planning Act 1995</td>
</tr>
<tr>
<td>MFPRP</td>
<td>Marine Farming Planning Review Panel</td>
</tr>
<tr>
<td>MLA</td>
<td>Maximum Leasable Area</td>
</tr>
<tr>
<td>MPINZ</td>
<td>The Ministry of Primary Industry, New Zealand</td>
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<td>Remote Operated Net Cleaners</td>
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<td>Remote Observation Vehicle</td>
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</tr>
<tr>
<td>SCUBA</td>
<td>Self-Contained Underwater Breathing Apparatus</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure(s)</td>
</tr>
<tr>
<td>TPDNO</td>
<td>Total Permissible Dissolved Nitrogen Output</td>
</tr>
<tr>
<td>TAFI</td>
<td>Tasmanian Aquaculture and Fisheries Institute</td>
</tr>
<tr>
<td>TARfish</td>
<td>Tasmanian Association for Recreational Fishing</td>
</tr>
<tr>
<td>TSGA</td>
<td>Tasmanian Salmonid Growers Association</td>
</tr>
<tr>
<td>TSIC</td>
<td>Tasmanian Seafood Industry Council</td>
</tr>
<tr>
<td>TSPA</td>
<td>Threatened Species Protection Act 1995</td>
</tr>
<tr>
<td>VHP</td>
<td>Veterinary Health Plan</td>
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<td>YC</td>
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2 EXECUTIVE SUMMARY

2.1 Proposed Amendment Description

Huon Aquaculture’s growth strategy reflects the company’s longstanding commitment to innovation, and subsequently the evolution of the company’s marine farming operations and management.

A key driver for Huon Aquaculture’s, and the wider salmon industry’s success to date has been the ability to satisfy domestic market demand. Around 90% of Huon Aquaculture’s salmon is sold in Australia, however over 70% of all seafood consumed is Australia is imported.

To ensure Huon Aquaculture mitigates against the risk of import replacement of Australian production and to continue to meet market demand, Huon Aquaculture needs to increase production at 10% per annum to supply its share of domestic demand growth.

To address the continued growth being experienced domestically and internationally, Huon Aquaculture must expand its marine farming operations and consolidate the company’s experience in offshore farming, whilst meeting community and stakeholder expectations.

This expansion will be approached with six principles in mind:

1. Increasing production responsibly and safely
2. Improving the health and welfare of our fish
3. Improving safety for our workers
4. Reducing our environmental footprint
5. Continuing to positively engage and participate in the community
6. Producing world-class salmon products in Tasmania.

The proposed amendment is to:

1) Secure a new zone with a Maximum Leasable Area (MLA) of 230 Hectares referred to in this document as East of Yellow Bluff (Yellow Bluff) to introduce smolts into the sea in proximity to the company’s first genuine ‘offshore’ or ‘exposed’ fish farm sites in Storm Bay.

2) Modify the company’s four existing South of Trumpeter Bay zones 1 to 4 (SB 1–4) through increasing the MLA from 50 to 75 Hectares for each zone. This will provide an additional buffer of ~75m to ensure that all farming infrastructure remains within the lease boundaries in such exposed conditions. This will also decrease the risk of any environmental impact outside the lease area. Huon Aquaculture is also seeking to rotate the zones and leases through 18 degrees clockwise to optimise well-boat operations. These have been key
learnings from early experience in offshore marine farming operations in Storm Bay.

3) Through the creation of the east of Yellow Bluff zone the proposed amendment will also allow for improved disease management and biosecurity between different year classes or different cohorts within a single year class through greatly increasing the distance between them.

4) Fully considers and minimises potential impacts on other waterway users, stakeholders and the wider community.

The new zone (east of Yellow Bluff), coupled with the expansion of the Company’s existing South of Trumpeter Bay (SB 1-4) footprint, accommodates Huon Aquaculture’s anti-predator net-pen design (Fortress Pens) greatly improved operational and production efficiencies with world’s best wildlife management. The company believes that it is only through the use of best available technology including the new net-pen design, combined with a well-boat for servicing/bathing the fish, that Huon Aquaculture can sustainably farm offshore sites.

The marine farming zone modifications proposed by this amendment will enable Huon Aquaculture to apply learnings from its early offshore marine farming by allowing safer production, and accommodating equipment specifically designed to tolerate the high-energy of Storm Bay. Huon Aquaculture’s total leasable area in Storm Bay will increase by 330 hectares through the current proposed amendment.

### 2.2 Stakeholder Consultation

Huon Aquaculture has undertaken a range of stakeholder consultation and community engagements to inform the preparation of this EIS. Consultation and engagement has been undertaken in the context of the company’s wider changes to farming, including the use of new technology (such as the well-boat and fortress pens) and farming methods that the company’s growth is largely predicated on.

The stakeholder engagement program was designed to provide opportunities to participate in a range of consultative activities in relation to the proposed amendment to secure a suitable lease site to introduce smolts into the sea in close proximity to Huon Aquaculture’s first genuine ‘offshore’ or ‘exposed’ fish farm sites in Storm Bay.

An important feature of consultation has been the company’s willingness to engage and also to respond to the concerns of stakeholders. This is evidenced by the re-siting of the proposed new zone further offshore (Trumpeter Bay off Storm Bay lease area to new zone east of Yellow Bluff) in direct response to feedback from regulators (MAST and Tasports), commercial and recreational boating and fishing industry feedback. Since the preparation of this EIS, Huon has also responded to concerns from local residents in relation to visual impacts and has consequently made a further modification to the proposed lease site by dropping it 200m further south. This change is reflected in all maps and viewsheds contained in the EIS.
Finally, whilst initial consultation has been undertaken, Huon Aquaculture considers consultation to be an ongoing activity and will continue to engage with the local Bruny Island communities and stakeholders throughout the process.

2.3 Existing Environment

The Storm Bay marine farm zones are in an exposed, “offshore” farming area influenced year round (at least at depth over the shelf) by intrusions of the subantarctic current, and possibly more seasonally by the East Australia and Leeuwin currents. The interplay between these currents means that the physical and chemical properties, especially nutrient levels can vary significantly between seasons and years.

The exposed nature, predominant influence of the oceanic currents combined with offshore water flow circulation to the southeast and therefore away from the coast towards the open ocean (and New Zealand) provides evidence that the new zone will be located in an area with potentially very low risk of any significant ecological impacts as would be expected by the move offshore.

Our existing marine farming operations in Storm Bay demonstrate that it is a suitable region for sustainable growth.

The seafloor is characterised by coarse sands and a relatively smooth profile. There are no indications of any rocky reefs of any size in the proposed and amended zones. The composition of the substrates combined with observations of bioturbation/rippling across the whole zone suggest that the seafloor will have excellent recovery characteristics both post and potentially also during the stocking cycle. There is therefore a very low/negligible risk of significant seafloor souring due to organic carbon deposition under the pens in these zones at the planned maximum levels of production.

After extensive consultation with stakeholders, it was decided to position the proposed east of Yellow Bluff zone in line with the SB1-4 zones. The lease within the proposed east of Yellow Bluff zone will now be located at least 1.5km from the eastern shore of Bruny Island. This provides a number of advantages such as; better passage for vessels travelling along that eastern shoreline with a clear line of sight between the zones and the coast, it also maintains the zone well outside of the TasPorts shipping lanes, and creates a lease further offshore of the weetapoona reserve than the original Trumpeter Bay lease. Further to this, the position of the East of Yellow Bluff zone and lease decreases the already low risk that any nutrient outputs from the farm might affect the intertidal and subtidal vegetation of the adjacent rocky shoreline.

2.4 Potential Effects and Their Management

- Huon Aquaculture has developed comprehensive Environmental and Veterinary management systems that support and ensure sustainable marine farming practice. These systems are subject to continuous risk assessment and
review based on adaptive management principles and supported by rigorous in-house and industry/regulator developed monitoring programs and defined limits (e.g. Total Permissible Dissolved Nitrogen Output (TPDNO) limit, licence conditions and management controls). The TPDNO acts as a stocking biomass limit by restricting fish feed nitrogen inputs to the system taking into consideration the nitrogen content of the feed, waste feed levels and the soluble (direct – water column) and insoluble (indirect – seafloor) waste outputs from the fish.

- At maximum utilisation (e.g., presuming there to be no regulatory TPDNO limit), Huon Aquaculture could harvest approximately 25,000 HOG tonnes Atlantic salmon per annum from the proposed and amended zones (Yellow Bluff and SB 1, 2, 3 and 4). This would result in a forecast maximum Dissolved Nitrogen Output of 1,800 tonnes in a twelve-month period.

- Huon Aquaculture acknowledges that the overall nutrient loading or planned farming intensity for the whole of Storm Bay will be controlled by a TPDNO which will be managed by the EPA. This region-wide TPDNO will be apportioned into the farming zones.

- Production in the Huon Aquaculture zones (east of Yellow Bluff, SB 1, 2, 3 and 4) located in the Storm Bay off Trumpeter Bay MFDP will remain within any TPDNO apportionment determined by the EPA.

- Storm Bay is a high-energy dynamic body of water that has had limited levels of salmonid farming to date. As there is currently limited environmental scientific information about the effects of salmonid farming in the Storm Bay region, if the developments proceed, the regulatory authority intends to adopt a precautionary staged approach to development, initially limiting TPDNO to reflect approximately 30,000t cumulative biomass production across the region.

- The environmental impacts considered in this EIS are based on 1147.5 tonnes TPDNO apportionment equivalent to approximately 16,000 tonnes HOG harvested fish, or 20,000 tonnes biomass as notified to Huon by the Planning Authority on 13th October 2016. This is 36% less than the dissolved nitrogen output that Huon Aquaculture would intend to produce if nitrogen outputs were not limited. The total proposed Storm Bay TPDNO limit for the region is similar to that provided to fish farms under the Huon River and D’Entrecasteaux Channel MFDP’s.

- Huon Aquaculture asserts that the predominant flow characteristics of Storm Bay and the exposed nature of the site ensure that the rate of mixing and dilution of all waste products associated with farming fish is far greater than for the Huon and Channel, and submit that the proposed TPDNO is more than likely to be sustainable.
• Huon Aquaculture is committed to the development of a regional, risk-based and adaptively managed Broadscale Environmental Monitoring Program (BEMP) to provide data on environmental performance indicators for assessment of interactions between salmonid farming and the marine environment in a whole of ecosystem context. This data and subsequent assessment will be used in an ongoing adaptive management framework to assess the physical environment for future management decisions.

• The development of a biogeochemical model will provide further information on the natural assimilatory capacity of nutrients from associated salmonid farming activities in Storm Bay. This management tool will provide valuable information on the predicted environmental effects of salmonid farming at varying levels of production across different temporal and spatial scales in Storm Bay. Huon Aquaculture is fully supportive of the development and use of a biogeochemical model for this region.

• Ongoing sustainability will be further supported by the continued commitment to proper falling of pen sites and broadscale monitoring, process studies and the development of modelling tools to further understand farming effects in the region.

• The proposed zone does not show any sign of Gunn’s Screw Shell. The new net-pen design should ensure that all birds and mammals interactions including threatened species are minimal. Further, Huon Aquaculture’s stringent biosecurity protocols will decrease the risk of spread of any introduced pests.

• Diseases and chemical usage are subject to a comprehensive in-house Veterinary Health Plan linked to low density stock management. The move to 240m pens at stocking rates of 110-130,000 fish per pen will reduce final (harvest) stocking density to 8-10kg/m³, the lowest of any marine farm worldwide.

• The proposed and amended zones will provide improved fish biosecurity through separating year classes and/or cohorts within year classes through creating a smolt (feeder) lease at East of Yellow Bluff at which the fish are no closer than 4.3km to the ongrowing/harvest fish at sites SB 1-4.

• Management of mortalities and fish escapes are subject to stringent in-house Standard Operating Procedures (SOP’s) and collaborative initiatives and planning for such events with the rest of the industry and the Department of Primary Industries, Parks, Water and Environment (DPIPWE). General waste disposal and management will not be significantly affected by the amendment.

• The new fish farm operational system incorporating the well-boat, feed barges on site, minimised movement of stock, and reduced requirement for net changes will ensure reduced boat traffic between the amended zones and North West Bay and the Huon River estuary/D’Entrecasteaux Channel.
Specifically, the use of the well-boat will eliminate the need for towboats in the D’Entrecasteaux Channel.

- Surface-located marine farming equipment and equipment less than 5m below the surface will occupy no more than 50 ha within each of zone 1, 2, 3 and 4.

- The requirements for marking in Storm Bay may differ from what is in place in other marine farming areas around Tasmania, due to the exposed location. MaST and DPIPWE are expected to determine marking requirements with primary consideration given to safety of operations and safety of navigation for vessels transiting and using the proposed zone. The draft special management controls provide flexibility for marking requirements that maximise safety and also allow for public access where possible.

- Local residents and waterway users will experience an increase in fish farm boat traffic travelling between the zones and Electrona/North West Bay. These changes and their potential effects (noise, visual and wake related) are detailed in this EIS. Noise levels both at the zone itself and related to the vessels servicing the zone will all fall well within current regulatory guidelines.

- It is anticipated that three privately held properties would have visual impacts because of the amendment. “Murrayfield Station” will experience an overall decrease in visual impact whilst neighbouring properties “Waterview” and “Oceanview” will experience an increase although the proposed site is south of the landholding. There is negligible visibility from settlements and roads in the surrounding region and the proposed zone amendments will not change this. The existing lease has low visibility to vessels greater than approximately 1km away and again this will not change.

- Finally, this and associated recent amendments for leases in the Huon River estuary and lower D’Entrecasteaux Channel will provide for a significant economic benefit to both the local Kingborough (including Bruny Island) and Huon regions and Devonport and for Tasmania in general. Demand for salmon has outstripped supply and we are seeing increased imports into the domestic market to meet that demand. The present proposal forms part of company growth strategy to target that supply shortfall, a strategy that will have commensurate benefits to the local, state and national economies.

### 2.5 Summary of Effects and Their Management

The likely effects of the Proposed Amendment are summarised in Table 47. These classify each effect as per the Proposal Specific EIS guidelines issued on 2 August 2016 and list the avoidance and mitigation measures that Huon Aquaculture will undertake and the likely overall effect of the operations as detailed in the amendment.

In summary:
– Nutrient discharge/planned farming intensity will remain within the Total Permissible Dissolved Nitrogen Output limit prescribed by the Regulatory Authority.

– Wildlife interactions (birds and mammals) will be minimised due to the use of Fortress Pens.

– Biosecurity and disease transfer risks are managed under Huon Aquaculture’s Veterinary Health Plan, low fish stocking densities and appropriate lease separation distances.

– Increases in boat traffic travelling between the zones and Electrona will be managed as detailed and noise levels will comply with current regulatory guidelines and be the subject of ongoing community consultation and interaction.

2.6 Conclusion

The amendment sought will provide the basic marine farming zone and lease characteristics required to ensure the continued success and sustainable expansion of Huon Aquaculture’s operations, while minimising any significant negative effects for stakeholders or the broader public. It provides for the ongoing commercial and operationally safe expansion by Huon Aquaculture to exposed, more offshore sites ensuring long term environmental and commercial sustainability through commitment to world’s best biosecurity and environmental standards. The amendment will provide for an increase of 330 hectares in Huon Aquaculture’s maximum leasable area under the Storm Bay off Trumpeter Bay North Bruny Island MFDP, allowing the company to increase production in the area.
3 PROPOSED AMENDMENT DESCRIPTION

3.1 Proposal overview

Under the current amendment the vision of Huon Aquaculture is to:

Create a new farming zone of 313ha’s east of Yellow Bluff with a maximum leasable area (MLA) of 230 hectares to grow smolts up to approximately 1.5kg before transfer to the more exposed Storm Bay (SB) farming zones further south. In addition, the amendment seeks to increase the size of the MLA by 25 hectares in zones 1-4, south of Trumpeter Bay (abbreviated to zones SB 1-4 for the remainder of the present EIS) so that all farming equipment and environmental effects can be better maintained within the lease boundary, and to rotate the SB 1-4 zones and leases through 18 degrees to improve safety during bathing and fish transfer operations. This will then have the potential for a doubling in Huon Aquaculture’s production capacity in the Storm Bay off Trumpeter Bay North Bruny Island Marine Farm Development Plan July 1998.

3.1.1 Proponent Details

Huon Aquaculture Company Pty Ltd
P.O. Box 42
Dover
TAS 7117
ABN 86 067 386 109

Phone: (03) 6295 8111
E-mail: huonaqua@huonaqua.com.au
Fax: (03) 6295 8161

Since its establishment in 1986 by founders and current owners Peter and Frances Bender, Huon Aquaculture Group Limited (“Huon Aquaculture”, or “Huon”, or the “Company”) has grown to become Australia’s largest, majority privately owned and vertically integrated salmon business. Huon Aquaculture has positioned itself as the premium producer of Atlantic salmon in Australia, harvesting in excess of 16,000 tonnes in FY15 and 20,000 tonnes in FY16 and producing revenues of more than $233 million in FY16.

Huon Aquaculture is generally acknowledged by the industry to be a model of excellence locally and around the world. Operations span the value chain comprising hatcheries, marine farming, maintenance, harvesting, processing, value adding, marketing, and distribution.

Huon Aquaculture presently own and operate seven fish farm leases in the Huon River and Port Esperance and D’Entrecasteaux Channel Marine Farm Development Plan (MFDP) areas and two in Macquarie Harbour MFDP area, with an agreement to sub-lease MF 216 at Pelias Cove. The company also owns the current 200 hectares MF261 marine farm lease in the Storm Bay off Trumpeter Bay North Bruny Island MFDP (July
The Huon Aquaculture Group has a number of subsidiary companies, including Southern Ocean Trout P/L (SOT) and Huon Aquaculture Company P/L (HAC). The present amendment proposal is being submitted by Huon Aquaculture Company P/L.

**3.1.2 Proposed Development**

The proposal forms part of Huon Aquaculture’s strategic plan for the sustainable growth of its production capabilities to meet the growing demand in domestic markets out to 2030 (refer also to Section 3.1.5). It continues the execution of the Industry Development Plan for Tasmania as provided by the Tasmanian Salmonid Growers Association to the Department for Economic Development during 2010.

Huon Aquaculture holds an existing marine farming lease, Lease No 261 of 200 hectares, which is split into 4 equal 50 hectare areas within four zones as prescribed by Amendment No 1 to the Storm Bay off Trumpeter Bay North Bruny Island Marine Farming Development Plan July 1998 (MFDP).

Huon Aquaculture is proposing to establish a new lease, East of Yellow Bluff, north of Trumpeter Bay to be stocked with smolts with the fish grown out to an average weight of approximately 1.5-2Kg. This would provide for a minimum fish separation distance of 4.3kms from the current SB 1-4 leases.

The SB 1-4 zones would receive the 1.5-2kg sized fish from East of Yellow Bluff and grow these to harvest. This optimises the distance between production zones, thereby reducing the risk of disease transfer between year classes in the MFDP area.

The proposed location for the East of Yellow Bluff zone has been arrived at through stakeholder consultation, particularly with the commercial rock lobster sector, and so as not to interfere with any TasPorts or MAST navigation lanes or significant lines of sight.

The proposed amendment seeks to increase the MLA of SB 1, 2, 3 and 4 to allow for floating farm infrastructure to remain well within the lease boundary given the exposed conditions experienced in our current operations in MF261. Huon Aquaculture requires an increase in maximum leasable area from 50 hectares to 75 hectares in each SB zone, in order to provide an additional 75m perimeter distance between the grids and the lease boundary. This would also act to increase the distance between the fish pens and the lease boundary, thereby decreasing the risk of any significant environmental effects occurring at the compliance sites that may arise due to the increased dispersion of waste products encountered at such exposed sites. Further, SB 1-4 leases and fish pen grids are to be rotated through 18 degrees to improve safety during well-boat operations in and around the grids by better orienting the well-boat with respect to the prevailing swell.

The existing Storm Bay off Trumpeter Bay North Bruny Island MFDP area is 660.4 hectares split into zones 1-4 (both zones and the leases within those zones termed SB
1-4 in the present EIS) as prescribed in Amendment No 1 of the Storm Bay off Trumpeter Bay North Bruny Island MFDP (Figure 1).

Therefore, the following amendments are proposed to the Storm Bay off Trumpeter Bay North Bruny Island MFDP (refer also to Figure 2).

- Create a new marine farming zone located east of Yellow Bluff, 313 hectares in size with a maximum leasable area of 230 hectares.
- Amend the boundaries of the Plan area to add the east of Yellow Bluff area that can accommodate a 313 hectares zone.
- Amend the maximum leasable area of the SB Zones 1, 2, 3 and 4 south of Trumpeter Bay by increasing the MLA from 50 hectares to 75 hectares in each. This will increase the size around all four boundaries of each lease by 75m.
- Rotate the south of Trumpeter Bay zones 1-4, clockwise through 18 degrees.
- The total combined area of the proposed Zones will be 973.4 hectares. This represents an increase from the existing zoned area of 313 hectares. The combined maximum leasable area of the proposed Zones will be 530 hectares (area of exclusive occupation).

The new ratio of total maximum leasable area to total zone area (530 out of 973.4 hectare or 54.4%) will be an increase from the current situation (200 out of 660.4 hectare or 30.3%). This provides a larger buffer around the pens, grids and general infrastructure within the lease areas to ensure that they do not cross over the lease boundary due to the oceanic conditions experienced at the sites, as well as decreasing the risk of any environmental effects occurring at the lease boundary.

If the proposed amendment is approved, it is Huon Aquaculture’s intention to request a variation to the lease boundaries of MF 261 to be in four parts of 75 hectares each and located within Zones 1, 2, 3 & 4 and to establish a new lease area in proposed east of Yellow Bluff zone of 230 hectares.
Huon Aquaculture intends to grow its fish from smolt through to 1.5-2kg in the new proposed east of Yellow Bluff zone, transferring those stock at that size to SB 1-4 zones where they will then be grown out to Harvest size (>5kg).

In the long term it is Huon Aquaculture’s intention to stock 40-48, 168m circumference ‘Fortress’ design net-pens of Atlantic salmon in the proposed east of Yellow Bluff zone from May/June and subsequently upsize the pens for those fish to 240m pens in February of the following year at the SB 1-4 zones. This will allow for whole site fallowing for 2-3 months at the east of Yellow Bluff lease (Feb, Mar) and 2
months for individual SB 1-4 leases (spread through parts of Spring, Summer and Autumn). This will effectively double the long-term production capabilities of the south of Trumpeter Bay (SB1-4) zones.

*Figure 2 - Stock deployments at amended east of Yellow Bluff and south of Trumpeter (SB) zones*
Shore bases

Huon Aquaculture has a number of existing shore bases to service the current amendment (refer also to Figure 11):

- Electrona, 21 Pothana Road Electrona will become a full service shore base once completed. Likely services from the site include; well-boat filling (freshwater), feed deliveries, workshop, dive facilities, and office.
- Gunpowder Jetty, transfer terminal for employees working on the lease and for the provision of smaller equipment to the leases, to be phased out as the Electrona site is developed.
- Hideaway Bay, where Huon Aquaculture’s harvesting operations are located.
- Port Huon, Whalepoint Road, a net operations site and a contractor pen building facility.
- Port Huon Wharf, a boat and ancillary equipment fabrication facility.
- Port Huon, Hideaway Bay, Stringers Bay and Flathead Bay freshwater fill stations for fish bath facilities (there is also a sea-based water bathing facility at the East of Redcliffs lease).

Given the ongoing relocation of operations from Gunpowder to Electrona then the proposed zone changes will not require or lead to any significant changes to the shore bases or servicing arrangements that would apply to the existing zone.

3.1.3 Rationale / Need for the Proposal

A key driver for Huon Aquaculture’s, and indeed Tasmania’s salmonid industry success has been its ability to satisfy domestic market demand. As early as 2008, however, there were warning signs that demand might outstrip production leading to the development of the Tasmanian Salmon & Trout Industry Strategic Plan, FY2010 to FY2030, as provided by the TSGA to the Departments for Economic Development and DPIPWE during late 2010. At that time demand was forecast to grow at 10-15% per year. However, more recently domestic market demand has outstripped even those expectations and already imports are increasing to increase supply, as shown in Figure 3.
Huon Aquaculture has identified two key options for keeping pace with domestic demand: decrease exports or increase production. Exports have fluctuated in recent years however; the overall trend is a reduction in exports from around 30% of production to approximately 5% of production.

The potential for increased production in Macquarie Harbour has been constrained by prevailing environmental conditions and Huon Aquaculture has adaptively managed production in that growing region in response to deteriorating environmental conditions.

In addition, the significant changes to farming methods and practices at Huon Aquaculture means that preferred farm sites are reflective of world’s best farming practice and hence the move into more exposed offshore sites.

In 2016, Huon Aquaculture completed its $200m Controlled Growth Strategy which saw the Company invest in significant resources such as marine farming lease area, growing equipment (pens, grids service equipment) and hatchery capacity to keep pace with market demand through to 2020. This investment has underpinned Huon Aquaculture’s move into offshore farming and the potential to increase production safely and sustainably in order to meet market demand.

Supporting Huon Aquaculture’s growth strategy is the company’s long-standing commitment to innovation and subsequently the reinvention of the company’s marine farming operations and management in order to:

1. Maximise production efficiency given the company’s existing maximum usable area and current regulatory marine farming environment and in particular the Huon and Channel TPDNO.
2. Further expand and relocate other leases to offshore growing areas and identify new farming areas. This will necessitate further Proposals in the next 3-5 years.

For Huon Aquaculture, offshore or exposed fish farming follows the broad definition provided by Drumm (2010), and employed in FAO Fisheries and Technical Paper 549, entitled; ‘A global assessment of offshore mariculture potential from a spatial perspective.’

“In general Offshore Aquaculture may be defined as taking place in the open sea with significant exposure to wind and wave action, and where there is a requirement for equipment and servicing vessels to survive and operate in severe sea conditions from time to time. The issue of distance from the coast or from a safe harbour or shore base is often but not always a factor”.

The production growth strategy is based on the following five principal drivers of farming sustainability:

• Fish husbandry – world’s lowest stocking density at 8-10kg per m³.
• Siting of leases in deeper, high energy sites – moving away from higher amenity areas.
• Improved biosecurity – greater distance between farming companies, and Huon Aquaculture’s own leases, and creating opportunities for “all-in, all-out” stocking and year class separation – world’s best practice.
• Improved predator protection – complete replacement of all current net-pens by Huon Aquaculture’s new predator proof design of net-pen (Walker, Austasia Aquaculture, vol 27(3) 2013).
• Improving Huon Aquaculture’s social licence to operate – a core requirement is for Huon Aquaculture to develop its resources in a co-ordinated and transparent manner. Huon will achieve this through active consultation and action.

In order to fulfil the strategy and address these drivers, Huon Aquaculture’s marine farm operations will be re-designed so that the company can:

• Run up to 44-48 x 168 pens at the east of Yellow Bluff lease, and 10-12 x 240 metre circumference pens per SB 1-4 lease (current proposed amendment) for harvest year class fish at any one time.
• Produce 600-700 tonnes of fish in 240m pens.
• Have a maximum stocking density of 8-10kg/m³.
• In the medium term, retain the fish in the same pen from smolt to harvest.
• Hold 6,000-8,000 tonnes on each lease, dependant on the size of the lease.
• Generally, feed each lease individually by feed barge, although for east of Yellow Bluff as many as 4 feed barges may be required to service 44-48 pens.

• Run improved bathing systems through using well-boats that put the fish back in the same pen and recycle water.

• Bring fish back to a shore base for harvest in a well-boat.

The first step in achieving these efficiencies was the reconfiguration of the company’s zones/leases under the D’Entrecasteaux Channel and Huon River & Port Esperance MFDP’s. The current EIS relates to an amendment of the Storm Bay off Trumpeter Bay North Bruny Island Marine Farming Development Plan, July 1998 to increase the MLA of zones 1-4 south of Trumpeter Bay and to create a new marine farming zone (east of Yellow Bluff) that would provide for an increase in production via an additional offshore exposed site in Storm Bay.

The desired implementation timeline for lease development and operation is detailed below (Figure 4). This meets Huon Aquaculture’s forecast market growth rate and highlights the requirement for scheduled review of the TPDNO and provides an indication of new zone development schedules. Note that this timeline assumes that other salmon producers meet their share of market growth. This timeline will also be dependent on the adaptive management process utilised by the EPA that will likely require planned assessments of the design and operation of a system wide monitoring program along with biogeochemical modelling (validation) against EPA proposed interim production levels.
Figure 4 - Implementation timeline for the development of the draft amendment. A) TPDNO timeline, also showing individual lease occupation, B) stock standing biomass timeline
3.1.4 Anticipated Establishment Costs

Any anticipated establishment costs should be considered in the context of the overall company initiative described in Section 3.1.3 Rationale / Need for the Proposal.

The anticipated establishment costs are shown in Table 1. Development of shore-base refers to any works that might be required on and around the Electrona site in North West Bay.

The costs cover:

- the development of the east of Yellow Bluff lease only, as there is minimal change anticipated in establishment costs associated with the rotation of the SB 1-4 leases
- the deployment of the moorings and cage and net systems.

Table 1 - Anticipated establishment costs for the changes

<table>
<thead>
<tr>
<th>Establishment Costs for Draft Amendment No. 2 to the Storm Bay off Trumpeter Bay North Bruny Island MFDP</th>
<th>Grids</th>
<th>Units per</th>
<th>$per unit</th>
<th>Total</th>
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<tr>
<td>Net and cage systems (168m)</td>
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<td>6</td>
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<td>Mooring grid</td>
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<td>Feed barges</td>
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<td>Feed delivery vessel</td>
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<td>$3,000,000</td>
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<td></td>
<td><strong>$53,840,000</strong></td>
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</tr>
</tbody>
</table>

3.1.5 Existing and Likely Markets for Product

With domestic sales growth continuing at the rate described in Section 3.1.3 Rationale / Need for the Proposal, together with forecasts for domestic fish consumption (Figure 5), Huon Aquaculture will necessarily be focussing sales in the domestic market so as to minimise competition from imports. However, Huon Aquaculture also values those already established international markets particularly in Japan and will continue to develop relationships and sales opportunities as production allows.
Given the current trends and growth trajectory, it is anticipated that per capita consumption will grow to 2.5kg to 3.0kg per year within the next 3 years.

### 3.1.6 Relationship to other Proposals/Developments

The proposal addressed by this EIS forms part of an integrated strategic plan for sustainably increasing production. This amendment is linked through that plan to recent amendments to the D’Entrecasteaux Channel (Amendment No. 5) and Huon River and Port Esperance (Amendment No. 3) MFDP’s, but in particular to the amendment to the Storm Bay off Trumpeter Bay North Bruny Island MFDP (Amendment No. 1).

Each amendment has formed part of a coordinated reconfiguration of Huon Aquaculture leases, which will result in improved environmental outcomes through a move to convert all of Huon’s marine based operations to Fortress Pen systems located further offshore in well mixed and/or exposed environments. The principle changes to marine farming operations allowed for under the previous amendments in the Huon River and D’Entrecasteaux Channel MFDP’s included choosing new leases with increased depth to allow for the Fortress pen predator nets, and relocation of leases to waters with better flushing characteristics.

As noted in Section 3.1.3, the increase in production follows the conclusion of the Company’s Controlled Growth Strategy that involved the investment of around $200m in a range of assets and improvements. This proposal will assist asset utilisation and achieve economies of scale for that investment.

### 3.1.7 Socio-Economic Benefits

Socio-economic benefits are considered at a state-wide level as well as a fine-scale level in terms of benefits to specific regions or communities. With respect to the socio-economic benefits of Huon’s Draft Amendment, Huon is a very significant employer in regional and remote communities.

Huon currently employs around 550 people with more than 500 employed in Tasmania predominantly in regional and remote locations. Within Tasmania, Huon employees
are drawn from 20 of the 29 Local Council Areas with significant presence in the Huon Valley, Kingborough and Latrobe Council areas with almost 60% of employees coming from the three local council areas. Other council areas that Huon Aquaculture is well represented in, in terms of employment, include; West Coast, Scottsdale, Central Coast, Glenorchy, Clarence and Hobart which make up a further 17% of employees.

Huon is committed to the communities in which it operates and which is evidenced in a range of ways.

Huon actively participates in the community by proactively seeking the community’s views through; participation in community groups and forums, membership of regional bodies and associations, community attitude research, and direct engagement with community members and groups facilitated by the Company’s Community Engagement Adviser. Appropriate resourcing, in terms of both funding and labour, is a feature of the Company’s efforts to engage with communities and stakeholders in an authentic way.

Notably, Huon Helping Hand Grant program was established in 2013. Since 2014, Huon has contributed in excess of $500,000 in donations, small grants and local sponsorships to local community groups and charities.

In relation to the Draft Amendment, Huon is well placed to extend employment and community participation in the Kingborough and Huon Valley Council regions with specific focus on Bruny Island.

Since commencing operations in Storm Bay in 2014, Huon has built a local team of 25 FTE’s with 70% of the team (17 FTE’s) drawn from regional and remote communities.

**Employment**

**Direct**

Huon currently maintains a workforce of 25 individuals (all positions are full-time) for its operations in Storm Bay (SB 1-4) to service existing farming activity. Based on current market growth rates and the resulting increase in production rate, Huon Aquaculture estimates the workforce at Storm Bay to grow to approximately 80 FTE’s as the Company moves toward an estimated full production in Storm Bay in 2022. Figure 6 below shows the projected increase in employment as a result of the Draft Amendment.
Based on the current ratio of regional and rural employees versus city or suburban employees, Huon estimates that 56 FTE’s will be drawn from regional and remote communities to service operations resulting from this Draft Amendment. In addition to employment created directly at the farm site, Huon anticipates the flow on effect of the Draft Amendment to result in an estimated further increase in employment at the company (refer to Figure 7). This shows the potential employment increase across the business based on the assumption that market growth will continue at the current rate. The increase in employment will be required across the breadth of the business including but not limited to; processing, environmental management and safety, engineering and projects, as well as support functions.
Indirect

In May 2015, The Tasmanian Salmon Growers Association (TSGA) commissioned an Economic Impact Assessment by KPMG (the Report). The Report found that the Tasmanian Salmonid Aquaculture Industry (Industry) provided support for over 2,700 FTE jobs in the state. This is based on both direct and indirect employment. At that time, the industry directly employed 1,365 FTE's and generated a further 1,421 FTE's from both industry effects and consumption effects.

For the purpose of estimating the indirect employment generated from Huon in Tasmania the calculation has been based on industry effects only (i.e. excludes consumption effects) and uses the same multipliers as contained in the Report.

Figure 8 sets out Huon’s net employment effect for Tasmania based on both direct and indirect FTE jobs at a range of biomass limits for the Company’s Storm Bay operations noting that Huon has already commenced production in Storm Bay. Huon’s direct employment currently generates a further 130 indirect FTE jobs. This increases to approximately 215 FTE jobs at full production on the proposed East of Yellow Bluff zone and SB zones 1-4. Importantly, the indirect employment is likely to impact in regional and remote areas particularly.
Huon notes that should consumption effects of its production be included in job-creation estimates then the total potential jobs created as a result of this Draft Amendment increases to 1,707.

**Economic benefit**

Since 2014, Huon’s Storm Bay operations has resulted in significant economic benefit and payment of operational costs to Tasmanian suppliers and service providers.

For example, Huon has invested more than $30m in capital to support the Company’s current operations in Storm Bay. Further, in FY2016 the company expended more than $8.5m to directly manage and maintain Storm Bay operations (excluding bathing, harvest and other central services) utilising the goods and services of around 100 Tasmanian companies.

With estimated establishment costs of over $50m, Huon expects that the economic benefit to local companies and the Tasmanian economy to continue to increase.

Wherever possible, Huon purchases goods and services locally.

**Social investment in the region**

Huon is committed to the communities in which it operates and this is evidenced in a range of ways.

Huon actively participates in the community by seeking out the community’s views through: participation with local community groups and representative bodies;
attendance at local events; developing specific events, such as Huon Aquaculture’s large-scale Open Day’s; and commissioned community research (as provided earlier in this document).

In addition, the Company provides resources, both financial and human, to ensure there are open and appropriate opportunities for the community to access Huon Aquaculture as well as contribute more broadly to the social fabric of the region.

Huon’s Helping Hand Grant program was established in 2013. Since 2014, Huon has contributed around $500,000 in direct funding to community organisations, clubs and charities around Tasmania. The funds have contributed to a range of activities including resurfacing of the Bruny Island Primary School sports oval.

Huon expects to continue to actively participate in the Bruny Island community and surrounding region as operations develop in Storm Bay.

Social investment in the region also stems from Huon’s employee’s participation in the community. A recent internal employee sample survey showed that:

- Over 80% of employees with school aged children have them in local schools
- One third (33%) of employees regularly participate in organised sport or community groups in the area such as football, basketball, bowls and Landcare
- 40% of employees regularly volunteer at local organisations including Landcare and SES.
- 66% of employees have another member of their immediate household regularly volunteering

In regional and remote communities, the efforts of Huon’s employees, and the support provided by Huon, directly contributes to their sustainability and vibrancy.

Huon will continue to support the wider community through support of projects and initiatives as well as supporting its employees and their families to be active participants in the community.

### 3.2 Proposed Plan Area

#### 3.2.1 Proposed changes to plan area

The new and amended marine farming zones proposed by this amendment are shown in Figure 9. It should be noted that a marine farming zone is where a marine farming lease or leases may be located. The proposed amendment will enable Huon Aquaculture to establish a 230 hectares lease for growing smolt in 168m pens through to a size where they can be transferred further offshore to Huon’s existing South of Trumpeter Bay leases in Zones 1-4 (termed SB 1-4 leases for the purposes of the
current EIS). The 230 hectares lease is specifically designed to accommodate 8*6 pen grids for 168m net-pens with the fortress anti-predator design. The amendment also allows for both the expansion of the existing leases SB 1-4 in order that all hardware will remain inside the lease boundaries, and their rotation through 18 degrees so as to ensure maximum safety for the service vessel, the *Ronja Huon*, during bathing transfer and harvesting operations. The amendment therefore seeks to change the MLA for the plan or zone by 330ha’s. The maximum leasable areas proposed in the current amendment relate to the maximum area that may be leased for salmonid aquaculture within a marine farming zone.

Under the current amendment the vision of Huon Aquaculture is to:

Create a new farming zone of 313ha East of Yellow Bluff with an MLA of 230ha to grow smolt up to approximately 1.5-2kg before transfer to the more exposed south of Trumpeter Bay (SB 1-4) farming zones. Increase the size of the MLA by 25ha in each of the SB 1-4 zones in order that all infrastructure and effects from farming can be better maintained within the lease boundary.

### 3.3 Proposed Zone and Lease Details

#### 3.3.1 Location of Proposed Zone

The proposed east of Yellow Bluff zone is located to the east of the northern part of Bruny Island approximately 3 to 4kms north of Trumpeter Bay. It is situated approximately 1.5kms offshore east of Yellow Bluff (refer to Figure 10). The changes requested to the south of Trumpeter Bay (SB) Zones 1-4 are; an increase in MLA from 50 to 75 hectares, and, the rotation of all of the zones and leases within the zones by 18 degrees.

#### 3.3.2 Proposed Zone Area

The new zone east of Yellow Bluff would be 313ha in size.

It is also proposed to develop a maximum leasable area (MLA) of 230ha in the new east of Yellow Bluff zone, and to increase the MLA of each of the south of Trumpeter (SB 1-4) zones from 50 hectares to 75 hectares.

The new zones and leases are designed to ensure an adequate buffer for moorings, taking the increased depth of the zones and the possible doubling of anchors/blocks along each mooring line. This is primarily so that all surface equipment such as pens, grid cans, moorings etc., will not move or be displaced up to or possibly over the lease boundary due to the increased wave/swell activity and stronger currents at these exposed sites. Consequently, this will also help prevent any associated effects this might have on the environmental monitoring compliance sites. The SB zones are also
to be rotated through 18 degrees to increase safety and decrease the risk of the service well-boat dragging the moorings during harvesting transfer and bathing operations.

The proposed amended boundaries of the proposed east of Yellow Bluff zone are shown in Figure 9 and Table 2 lists the zone details.

*Figure 9 - Boundaries and coordinates of the proposed east of Yellow Bluff and SB zones 1-4 (to be read in conjunction with Table 2)*
Table 2 - Boundaries and coordinates of the proposed east of Yellow Bluff and SB zones 1-4 – to be read in conjunction with Figure 9

<table>
<thead>
<tr>
<th>Zone Co-ordinates</th>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
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</tbody>
</table>

<table>
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</thead>
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<table>
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<th><strong>Element</strong></th>
<th><strong>Current area</strong></th>
<th><strong>Proposed area</strong></th>
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</thead>
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<td>East of Yellow Bluff and south of Trumpeter Bay SB 1–4 Zones</td>
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<td>973.4</td>
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<td>Maximum leasable area</td>
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</table>

(Boundary coordinates expressed in GDA 94)
The East of Yellow Bluff zone is located 1500m from the nearest shore. The rotation of the SB zones clockwise through 18 degrees has made a very minor change in the shortest distance of these zones to the shoreline (Figure 10).

The new and amended zones/leases will be serviced from the Waterworth Drive, Margate shore base in North West Bay, from the lower Channel and Huon water fill stations, and from Gunpowder jetty in North West Bay (Figure 11). The latter will act as a personnel transfer terminal whilst the Margate site is being fully developed.

Distances from the new and amended zones to other marine farm zones are shown in Figure 12. The closest fish farm zones/leases Tinderbox (Zone 1B D’Entrecasteaux Channel MFDP) and Creeses Mistake (Tasman Peninsula and Norfolk Bay MFDP) are approximately 10.5km to the north and 21.5km to the east respectively. These are also the closest lease areas held by another leaseholder.

*Figure 10 - Distances of proposed amendment zone boundaries to the nearest shoreline.*
Figure 11 - Approximate distances from proposed amendment zones to Huon shore bases and water fill stations.
3.3.3 Location of Proposed Lease

Collectively the proposed leases (as shown in previous maps) are oriented NNW-SSE in general alignment with the coast of Bruny Island. The SB 1-4 zones are to be re-oriented individually by 18 degrees clockwise for operational safety and to decrease the risk of the service vessels dragging the pen grid moorings. As stated earlier the SB leases are all to be expanded so as to provide an additional buffer between the pen grids and the lease boundary, so that surface equipment will not cross the lease boundary at these exposed sites (due to currents, waves, swell and wind), and the risk of environmental effects occurring beyond the lease boundary is reduced. The proposed zones and leases are all designed to give some flexibility in grid and moorings orientation and design in case any modifications due to severe weather/waves are required in future.

The amendment will provide for adequate zone area to contain one 230 hectares and four 75 hectares leases. The proposed lease positions and coordinates within the zones are shown in Figure 13 and Table 3.

Figure 12 - Distance to the closest existing marine farming zone and lease area(s)
Figure 13 - Boundaries and coordinates of the proposed lease areas for the new and amended zones (to be read in conjunction with Table 3)
Table 3 - Boundaries and coordinates for the proposed lease areas for the new and amended zones – to be read in conjunction with Figure 13

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<table>
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<th></th>
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</thead>
<tbody>
<tr>
<td><strong>SB1</strong></td>
<td>Easting</td>
<td>Northing</td>
</tr>
<tr>
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<td>535459</td>
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<td>8</td>
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| **SB2**                  | Easting | Northing |
| 9                        | 535939 | 5218768 |
| 10                       | 536581 | 5218714 |
| 11                       | 536481 | 5217553 |

| **SB3**                  | Easting | Northing |
| 13                       | 536416 | 5216722 |
| 14                       | 537058 | 5216668 |
| 15                       | 536957 | 5215506 |
| 16                       | 536315 | 5215563 |

| **SB4**                  | Easting | Northing |
| 17                       | 536895 | 5214644 |
| 18                       | 537537 | 5214590 |
| 19                       | 537437 | 5213429 |
| 20                       | 536794 | 5213485 |

(Boundary coordinates expressed in GDA 94)

The dimensions of the leases and zones for the proposed east of Yellow Bluff and SB zones 1-4 are provided in Figure 14 below.
Figure 14 - Approximate dimensions of the east of Yellow Bluff (top) and SB (bottom) zone and lease areas.
3.4 Infrastructure and Servicing

3.4.1 Mooring and Grid system

Huon has developed its own mooring systems for its new Huon Fortress Pens. These mooring systems have been deployed within every growing region Huon is currently farming and come in two grid sizes: 100x100m for F168m pens and 140x140m for F240m pens. The number of grids per mooring is based on the available lease size and environmental conditions. Within the D’Entrecasteaux Channel, most moorings for the F168m pen have been 20-grid systems and the moorings for the F240m pens have been 10-grid systems. Due to more exposed conditions in Storm Bay, the F240m pens have been deployed within 6-grid moorings and the same is planned for the F168m pens, with a greater number of 6-grid moorings being deployed rather than having too many pens on the one mooring system. The 6-grid 100x100m moorings for the F168m pens have been modelled for the conditions likely to be experienced in Storm Bay by Aquastructures Norway and will incorporate 38 x 2T anchors to maintain them in place (Figure 15). Full design specifications are available for this mooring system.

![Figure 15 - Huon's mooring system designed to accommodate 6x F168m pens in 6 x 100m x 100m grids.](image)

The environmental conditions that the moorings and pens were modelled for include conditions where there are significant wave heights of 6.5m (Table 4).
Table 4 - Environmental variables used to determine design specifications of the mooring systems.

<table>
<thead>
<tr>
<th>Load condition</th>
<th>Sector</th>
<th>Hs [m]</th>
<th>Tp [s]</th>
<th>Wave direction from [°]</th>
<th>Current [m/s]</th>
<th>Current direction towards [°]</th>
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<tbody>
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<td>0.66</td>
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<td>10 year waves 50 year current</td>
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<td>6.3</td>
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<td>225</td>
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<tr>
<td>3</td>
<td>E</td>
<td>3.42</td>
<td>6.3</td>
<td>90</td>
<td>0.66</td>
<td>270</td>
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<td>4</td>
<td>SE</td>
<td>5.90</td>
<td>7.7</td>
<td>135</td>
<td>0.66</td>
<td>315</td>
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<tr>
<td>5</td>
<td>S</td>
<td>5.70</td>
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<td>0.66</td>
<td>0</td>
<td></td>
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<tr>
<td>6</td>
<td>SW</td>
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<td>0.66</td>
<td>45</td>
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<td>W</td>
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<td>0.59</td>
<td>135</td>
<td></td>
</tr>
</tbody>
</table>
A total of eight (8) 6-grid moorings will be located within the proposed east of Yellow Bluff lease providing positions for up to 48 x F168m pens (refer to layout in Figure 16 below).

Figure 16 - Proposed layout of the eight separate grids or mooring systems at Yellow Bluff.
Figure 17 - Dimensions of grids, and approximate distances between the fish pen grids. Top – within the Yellow Bluff lease, Bottom – within the SB 1-4 leases

At Yellow Bluff the grid will comprise 2 x 3 rows of F168m pens, each within a 100x100m square mooring (side and end elevation – presented in Figure 18 and Figure 19). At the SB leases the grids will also comprise of 2 x 3 rows but of the larger F240m pens within a 140x140m square mooring.

Proposed management controls will prescribe that surface-located marine farming equipment and equipment less than 5m below the surface will occupy no more than 50 ha within each of zone 1, 2, 3 and 4.

The requirements for marking in Storm Bay may differ from what is in place in other marine farming areas around Tasmania, due to the exposed location. MaST and DPIPWE are expected to determine marking requirements with primary consideration
given to safety of operations and safety of navigation for vessels transiting and using the proposed zone. The draft special management controls provide flexibility for marking requirements that maximise safety and also allow for public access where possible.

Figure 18 - End view of mooring system to be used with the F168m pens.

Figure 19 - Side view of mooring system to be used with the F168m pens.

### 3.4.2 Size and Configuration of Sea Pens/Netting

Huon will use the recently developed ‘Fortress Pen’ designs for its new F168m pens at the Yellow Bluff lease. This design has been successfully used by Huon for F120m, F168m and F240m pens and over 100 of these pens have now been successfully deployed. The ‘Fortress Pens’ incorporate a lighter-weight inner net to contain the fish, set within a heavier outer net to keep predators away from the fish (refer schematics below). A light-weight bird net set on flexible poles attaches to the inner fish net, keeping birds away from the fish feed and the fish.

Figure 20 - Huon’s new Fortress Pen system showing the outer predator net, inner net and bird net with a lift-up mort collector located within the inner net.
The inner net that holds the fish will be F168m in circumference at the water-line. It will extend to a depth of 20m when fully weighted and will have a volume of 27,116m$^3$. The outer predator net will have a circumference of 181.43m at the water-line. It will extend to a depth of 22m when fully weighted and will have a volume of 44,391m$^3$. There will be a minimum of 2m separation between the two nets. The specifications of the F168m nets is shown in Figure 21.

All nets are constructed using an Ultra-High Density polymer that produces a very light-weight net for its weight. The inner net will comprise a 15mm mesh with a 220kg break load. This net will be tensioned to the outer predator net. The outer predator net, designed to keep seals out, will comprise of 125mm double-knotted mesh with a break load of 1200kg. This net will be tensioned with a sinker tube and weighted in the base. The predator net will at all times maintain a separation distance of >2m between itself and the inner net. The bird net will comprise 60mm mesh with a break load of 70kg and will be set on flexible poles to allow the net to distort as the pen changes shape in adverse weather. The bird net mesh is 60mm to prevent cormorants from being able to enter the pen environment. The inner 15mm mesh net will be deployed to allow stocking with smolt, hence the requirement to keep cormorants out. Again, there are no changes envisaged for the fish farm equipment currently
deployed in zones 1-4. The F240m Fortress pen was previously described in Amendment No.1 to the Storm Bay off Trumpeter Bay North Bruny Island, MFDP.

All pens will be inspected at least fortnightly by net-cleaning staff. These staff will clean the inner net using in situ remote operated net cleaners or more regularly as required. These staff will view underwater footage in real-time of the net condition and can report any issues with the nets. The outer predator net will be monitored and cleaned as required (expected interval every 1–2 months). Additional to the net cleaning operators inspecting the nets, a dedicated remotely operated vehicle (ROV) team will inspect the inner nets before and after each bath (~30 days) and the outer predator net every second month. Bird nets are checked on a daily basis by feeders and other personnel on site. The mooring systems will be checked annually and, if any components show signs of wear in a particular grid, the whole grid will be lifted in sections and checked.

The net-pen design presented above will be the primary anti-predation measure for all of Huon’s marine farming leases. Huon no longer uses anti-fouling paint on the nets to reduce biofouling, but instead deploys in situ net cleaners to clean the nets on a regular basis. The outer predator net has been designed to set very tight and requires no additional coating to provide seal protection.

All pens will be assembled at Whale Point Road, Port Huon by Mitchell Plastic Welding.

3.4.3 Construction Aspects

Deployment of each mooring system is anticipated to take 2–3 weeks with additional time required on land for preparation of the ropes, chains, shackles etc. Assembly of the F168m pens will take approximately seven working days and can be deployed to sea within one working day. The pens will then be towed to the Company’s Hideaway Bay lease, where the nets will be set before being towed to the proposed leases. Setting of the nets and sinker tube and then tensioning of the whole system and placement within the grid is expected to take ten working days.

There may be a requirement for an extension to the zone on at least two boundaries during deployment of the mooring system, as trip lines to the anchors are required for positioning of the moorings. It is possible these will stretch outside the zone area as the moorings are being deployed, stretched and tightened. This practice has been common and requires a Notice to Mariners generally to cover the 4–8 weeks of deployment of the moorings. The additional area required when installing moorings is generally a further 200m outside the zone area on the relevant sides of the lease. The mooring system will require at least one dedicated works vessel for deployment of the grid and associated equipment. This vessel will position anchors and ‘set’ the grid in place.

For pen assembly, Whale Point Road at Port Huon will be utilised which has ample space to accommodate the 100 x 100m area required. The main activity will be welding
together the flotation-collar pipes, and addition of the cage brackets, walkway plates and handrail pipe. The sinker tubes will also require the welding together of lengths of pipe and insertion of the sinker tube chain, that provides the weight. When towing the pen to the site, the pens will require a similar 100m access width, which has proven not to be an issue when in transit from Port Huon to the lease site.

Huon undertakes pen site fallowing at its leases using two basic principles. The first involves the seasonal restriction of pen stocking over a particular pen site. The second is employed when pen sites do not recover as quickly, generally in higher organic areas, and this is when the whole grid is flip-flopped within the lease area. The proposed lease area does not allow for a flip-flop arrangement, as presently Huon’s experience (e.g. East of Redcliffs/Zuidpool leases and Storm Bay) is that exposed sites such as Yellow Bluff and the SB leases will fallow relatively quickly (within a few months only) and there is sufficient time (‘seasonal stocking’) allowed for fallowing in the stocking rotation of the four leases.

3.4.4 Servicing the Proposed Zones

Vessels

The operational and net-pen design changes described above are aimed at increasing efficiency across all areas of marine farm operations. These changes will significantly decrease the number of vessels required to service the lease and the number of visits the remaining vessels make to the lease.

Where previously two feed boats would have made return journeys three times a day there will now only be need for one crew transport vessel to make two return journeys per day to and from the Gunpowder Jetty shore base. With feed barges on each lease, the large feed supply vessels such as the Southern Condor will only need to make three trips in total to the zones per week. During reasonable weather conditions, the general workboats for the leases (such as the works boat and the in situ cleaning vessel) will be moored within the lease.

Table 5 - Vessels required to service the new lease

<table>
<thead>
<tr>
<th>Boats</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-boat (75m length)</td>
<td>Fish transfer, freshwater bathing and harvesting operations, transport of large equipment from Huon River shore bases.</td>
</tr>
<tr>
<td>Feed supply boat</td>
<td>Transport of all feed to feed barges.</td>
</tr>
<tr>
<td>2 larger (20m+) landing barge/works vessels</td>
<td>Initial transport of grids systems, feed and all large equipment from Port</td>
</tr>
<tr>
<td>Huon Aquaculture Company</td>
<td>Trumpeter EIS Storm Bay MFDP</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Huon.</strong> Thereafter, occasional transport of larger equipment from the Huon river to the leases. Moorings replacement and servicing and all other major works around the farm. Weight boat, and general works boat, sometimes moored at the marine farm lease.</td>
<td></td>
</tr>
<tr>
<td><strong>Tow boats (interim measure)</strong></td>
<td>Initial transport of empty net pens from Port Huon or Huon/Channel leases only.</td>
</tr>
<tr>
<td><strong>Net cleaning boats</strong></td>
<td>Clean all nets at all leases.</td>
</tr>
<tr>
<td><strong>Crew transfer vessel</strong></td>
<td>To operate between North West Bay and the five leases as transport for crew.</td>
</tr>
</tbody>
</table>

**From North West Bay**

The personnel transfer boat will make 1-2 return trips per day to Gunpowder Jetty, and in the event of bad weather the small works boat and the in situ net cleaning vessel will be returned to moorings close to Gunpowder Jetty. Huon’s feed supply vessel (*Southern Condor*) will supply the proposed zones an estimated three times a week and is proposed to operate from Electrona. In the early period of setting up the proposed leases, there will be a need for a second personnel-transfer vessel from Gunpowder. All feed delivery and works boat operations (servicing and working of the pens and moorings, in situ cleaning of nets) will be carried out during daylight and in general between 8am and 5pm. Generally, all trips from North West Bay to the leases will be made in daylight hours.

**From the Huon River**

The well-boat will travel to the proposed new and amended zones from sites in the Huon River and Lower D’Entrecasteaux Channel generally via the D’Entrecasteaux Channel at a maximum frequency up to 4-6 times a week (maximum of one trip on any given day). The vast majority of fish handling operations will be undertaken during daylight hours however, as with well-boats overseas the vessel will be in operation 24 hours a day including steaming between the Huon River and the leases. During summer it is likely that bathing operations will extend into the night to take advantage of calmer conditions. It is envisaged that trips to the Huon River will be made either via the Channel during daylight hours or Tasman head and Cape Bruny at night-time.
A larger works boat will also occasionally deliver larger equipment such as nets to the zones. During initial set up of the leases at least one of the works boats will return to the Huon River up to 2-3 times per week.

With the use of *in situ* net cleaning technologies, net changes will be eliminated in all but exceptional circumstances. The changes to the farming strategy will eliminate the requirement to tow fish resulting in only empty pens being towed, either when initially being deployed or when occasionally being repositioned. Consequently, operations at Huon Aquaculture leases in general will be greatly reduced and there will be significant reductions in the traffic volume to and from the site above than experienced historically by the industry.

The current estimated vessel operational plan for servicing the lease is provided in Table 6.
Table 6 - Estimated vessel movements to and from the zones

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Period</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Works boat (&lt;20m)</td>
<td>D: 7 am to 6 pm</td>
<td>E: 6 pm to 10 pm</td>
<td>N: 10 pm to 7 am</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>In situ cleaning</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Rough weather back to Gunpowder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Works boat (&gt;20m)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Rough weather back to Gunpowder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Personnel Transfer</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>Feed supply</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>Wellboat</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

D: 7 am to 6 pm | E: 6 pm to 10 pm | N: 10 pm to 7 am
Platforms

Four feed barges of steel construction will be permanently moored at the proposed East of Yellow Bluff lease. Each feed barge will service two of the 6-grid systems. The feed barges will be filled by a dedicated feed delivery vessel. When this is not available, the barge can unload feed from any vessel alongside using an on-board 22 tonne crane.

Each feed barge will have a black water sewage tank and macerator. Sewage will be stored on the barge and removed to shore by a supply vessel for disposal to a municipal waste system (grey water will discharge directly from the barge). The contracted feed vessel will also bring fuel to the barge, again reducing the number of vessels.

Oxygenation barges may be used within the grid systems; Netox grids will be deployed with the pens and the oxygen supplied from the barge (with the current pen arrangements, a small barge approximately 3 x 5 m next to the pens is used).

There are no expected changes to feed-barge use and type as identified in Amendment 1 to the Storm Bay off Trumpeter Bay North Bruny Island, Marine Farming Development Plan, July 1998 for SBI-4.

Noise generation

The feeding system will run dawn to dusk. The power generators are in insulated cabinets below deck level within insulated spaces and noise emissions are minimal and will not be audible from shore (refer to Section 6.2.6 Noise) other than under exceptional weather conditions. This removes the need for the currently used open raft mounted generators which are difficult to sound insulate. The noise characteristics of vessels, including the well-boat are described in Section 6.2.6.

Harvesting

There will be no harvesting system at the lease. Live harvest fish will be transferred into a well-boat for transport to the harvest facilities at Hideaway Bay.

Lighting

External lighting on barges will be directed at foot traffic areas and windows will have block-out blinds. The control room (highest deck on the barge) will not be manned during the hours of darkness, so there will be no light spill at this level.

The feed barge will also supply power to the below surface lighting to be employed on the lease. This is currently supplied by cabinet mounted generators on separately moored small rafts.
Light is required for the control of sexual maturation. Continuous subsurface lighting may be used in the first year of fish at sea from June through to the end of October. The subsurface lighting will comprise 20 to 25 400-watt sub-surface metal halide or LED lights per pen. This lighting produces a diffuse underwater glow, which can be visible from above but which is unlikely to be visible from a lateral viewpoint. The lights will be powered by the raft based generators described above for the feeding system.

Visual characteristics of vessels including the well-boat lighting are described in Section 6.2.1.

**Smolt delivery**

Smolt and larger fish will be transferred to the leases via well-boat.

**In situ net cleaning**

Clean nets allow for better water flow through the pen, which means more oxygen reaches the salmon, making them more comfortable and healthier. Cleaning also ensures that fouling organisms, such as algae, mussels and squirts, are removed from the nets.

Huon Aquaculture uses state-of-the-art *in situ* net cleaners called Remote Operated Net Cleaners (RONC’s) which move up and down the nets, controlled by an operator in a boat (Figure 22). The cleaning is carried out by spinning high-pressure water jets.

*Figure 22- In situ net cleaning operations, deployment of the RONC*
In peak fouling times during summer and in parts of spring Huon Aquaculture cleans its nets as often as once a week. This reduces to every two to three weeks in winter.

**3.4.5 Infrastructure Maintenance**

**Maintenance programs**

Moorings will be checked and serviced annually. Net-pens will be checked on an ongoing basis by works and dive crews.

Diesel generators and ship engines owned by Huon Aquaculture will be serviced in-house, while contractors will service leased equipment. Servicing will occur monthly or every 250 hours, whichever comes first.

Generators on feed barges will be serviced every two weeks. Larger vessels and feed barges will be slipped every second year in Hobart and Margate respectively. Smaller boats will be serviced at shore based facilities at Hideaway Bay or Port Huon.

The well-boat (*Ronja Huon*) will be slipped in accordance with Australian Maritime regulations and is the responsibility of the owners, Solvtrans A/S.

**Shore bases**

Huon Aquaculture will use the Gunpowder Jetty, south of Howden as a personnel transfer terminal to and from the zones. It is expected that a site at Electrona in North West Bay will provide feed storage, large vessel pier access, freshwater water storage, berthing for all work vessels and arrange of other services, similar to that provided at Huon’s Hideaway Bay shore-base. In bad weather smaller vessels will also be returned to moorings in North West Bay.

Initially, the shore-base used to generally service the lease will be at Hideaway Bay (where Huon Aquaculture’s harvesting operations are also located). Net mending and annual cleaning will be undertaken at the net operations site at Whalepoint Road, Port Huon. Pen construction will continue to be undertaken by contractors at the existing pen construction site adjacent to the Whalepoint Road jetty.

**Disinfection protocols**

Huon Aquaculture has strict biosecurity controls on anything moving between its growing areas.

Detailed operational procedures are contained in Section 3.4.3 of Huon Aquaculture’s Veterinary Health Plan. The basic disinfection protocols are as follows:
The basic process for gear and equipment between leases/sites in the Huon River/lower D’Entrecasteaux Channel and the Storm Bay off Trumpeter Bay North Bruny Island MFDP will be:

1. Make sure the item is clean. The process will depend on the item, but preferably hot wash with detergent – preferably pressure wash larger items (dirty items cannot be disinfected effectively);

2. Immerse in, or spray with Virkon Aquatic (1:200 dilution). Read the Health and Safety information for Virkon Aquatic before use;

3. Leave at least 20 minutes – then wash off with clean water or leave on to dry/dissipate. It is preferable to wash the Virkon Aquatic off metal objects. If water is used to wash the item, the water must not be contaminated (i.e. don’t use water from the harbour).

Disinfection needs to occur both ways through the use of Virkon (e.g., through footbaths) and disinfection protocol outlined above on entering and leaving the Gunpowder jetty/Electrona, Hideaway Bay, Huon leases in southern D’Entrecasteaux Channel and Huon River, Port Huon and Whalepoint Rd.shore bases, to prevent the spread or proliferation of disease organisms e.g. Pilchard Orthomyxovirus (POMV), Rickettsia-like organism (RLO), Tasmanian Aquareovirus or other unknown disease issues between areas and/or leases.

Items such as clothes just need to be machine washed in the normal way if moving between areas, i.e., from the Huon to Trumpeter Bay.

If items such as computers, folders etc. come in contact with contaminated material they can be brushed clean and wipe over with a cloth soaked in alcohol (e.g. methylated spirits).

In addition, Huon will follow all guidelines and protocols contained within the TSGA Biosecurity Program.

**Equipment lifespans**

Huon Aquaculture has 30 years’ experience in the fish farming industry and has developed detailed procedures and protocols for the maintenance for all equipment and, therefore, a firm understanding of the lifespan of all major equipment. Drawing on this experience, lifespans of 10 years for nets and pens and up to 20 years for boats can be expected. Generators are expected to have a lifespan of 6 years.

### 3.5 Stock Husbandry Aspects

#### 3.5.1 Fish Size / Stocking Density

It is Huon Aquaculture’s intention to stock the proposed east of Yellow Bluff zone with Atlantic salmon – *Salmo salar* smolt in 168m Fortress Pens. A total of eight (8) 6-grid moorings will be located within the proposed zones providing positions for up to
48 x F168m pens. Each of the F168m pens will be stocked with approximately 110,000-130,000 smolt (100-200g), transported to the lease via the well-boat and grown through to approximately 1.5-2kg, before being transferred to the growout or harvest year class (YC) SB 1-4 leases. The amended SB 1-4 zones will be stocked with 1.5-2kg fish, grown through to 5-6kgs harvest weight. The fish will be stocked in F240m pens, in two (2) 6 grid moorings (refer to Figure 19) per SB1-4 lease, giving a total of 48 pen positions.

All fish where and when possible will be maintained at maximum stocking densities of 8-10kg/m$^3$.

The stocking plan for the proposed and amended zones will comply with the relevant TPDNO, license conditions and management controls.

Under the proposed TPDNO the proposed biomass to be produced on the proposed Yellow Bluff zone is approximately 4,500 tonnes. The proposed harvest HOG biomass to be produced on the amended SB 1-4 zones is approximately 16,000 tonnes. These biomass amounts have been calculated assuming 4.25% of feed fed is excreted as dissolved nitrogen by the fish and the fish grow with a feed conversion ratio of 1.35kg of feed per 1kg of fish produced.

### 3.5.2 Fish Feeding

The feed used on the lease will be dry extruded sinking pellets from Biomar (Grangemouth, Scotland) and Skretting (Cambridge, Tasmania). Feeds are formulated specifically for Atlantic salmon. The projected monthly totals of feed to be used on the proposed lease will vary depending on market expansion.

The proposed scenario is to utilise the Yellow Bluff zone as a smolt site. Fish will be stocked from April with 100-200g smolt and held at this lease until January/February the following year. Fish will then be split out into the amended SB 1-4 zones and on-grown through to harvest in November/December. This scenario will allow individual pen bays at the smolt site to fallow for a minimum of 1-2 months and individual pen bays at the growout sites to fallow for a minimum of 2-3 months. Under this scenario the annual feed use would be 26,507 tonnes at the proposed east of Yellow Bluff and SB 1-4 zones.

The percentage spread of feed over the 12 months of each year under the proposed TPDNO scenario is shown in Table 7 below.
Table 7 – a) Spread of feed use over the year under the proposed Huon Aquaculture apportionment of the proposed Total Permissible Dissolved Nitrogen (TPDNO) limit of 1,147.5T. b) – Proportion of total feed used in table 7a per month.

a)

<table>
<thead>
<tr>
<th>Feed Tonnes</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>East of Yellow Bluff</td>
<td>153</td>
<td>-</td>
<td>-</td>
<td>42</td>
<td>273</td>
<td>440</td>
</tr>
<tr>
<td>Storm Bay 1</td>
<td>416</td>
<td>353</td>
<td>368</td>
<td>382</td>
<td>488</td>
<td>543</td>
</tr>
<tr>
<td>Storm Bay 2</td>
<td>416</td>
<td>353</td>
<td>368</td>
<td>382</td>
<td>488</td>
<td>543</td>
</tr>
<tr>
<td>Storm Bay 3</td>
<td>416</td>
<td>353</td>
<td>368</td>
<td>382</td>
<td>488</td>
<td>543</td>
</tr>
<tr>
<td>Storm Bay 4</td>
<td>416</td>
<td>353</td>
<td>368</td>
<td>382</td>
<td>488</td>
<td>543</td>
</tr>
<tr>
<td></td>
<td>Jul</td>
<td>Aug</td>
<td>Sep</td>
<td>Oct</td>
<td>Nov</td>
<td>Dec</td>
</tr>
<tr>
<td>East of Yellow Bluff</td>
<td>675</td>
<td>852</td>
<td>1,254</td>
<td>1,565</td>
<td>709</td>
<td>133</td>
</tr>
<tr>
<td>Storm Bay 1</td>
<td>570</td>
<td>512</td>
<td>393</td>
<td>269</td>
<td>344</td>
<td>463</td>
</tr>
<tr>
<td>Storm Bay 2</td>
<td>570</td>
<td>512</td>
<td>393</td>
<td>269</td>
<td>344</td>
<td>463</td>
</tr>
<tr>
<td>Storm Bay 3</td>
<td>570</td>
<td>512</td>
<td>393</td>
<td>269</td>
<td>344</td>
<td>463</td>
</tr>
<tr>
<td>Storm Bay 4</td>
<td>570</td>
<td>512</td>
<td>393</td>
<td>269</td>
<td>344</td>
<td>463</td>
</tr>
</tbody>
</table>

b)

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>East of Yellow Bluff</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
<td>4%</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Jul</td>
<td>Aug</td>
<td>Sep</td>
<td>Oct</td>
<td>Nov</td>
<td>Dec</td>
</tr>
<tr>
<td>East of Yellow Bluff</td>
<td>11%</td>
<td>14%</td>
<td>21%</td>
<td>26%</td>
<td>12%</td>
<td>2%</td>
</tr>
<tr>
<td>Storm Bay 1-4</td>
<td>8%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>10%</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>Jul</td>
<td>Aug</td>
<td>Sep</td>
<td>Oct</td>
<td>Nov</td>
<td>Dec</td>
</tr>
<tr>
<td>Storm Bay 1-4</td>
<td>11%</td>
<td>10%</td>
<td>8%</td>
<td>5%</td>
<td>7%</td>
<td>9%</td>
</tr>
</tbody>
</table>

The predicted Dissolved Nitrogen Output in the table 7a and 7b above assumes 4.25% of feed mass is excreted to the water column as per calculation used by the Regulatory Authority.

All fish will be fed using a spy ball video camera controlled from a centralised feed system (AKVA Group Bryne, Norway; or Steinsvik Aqua, Haugesund, Norway). The new spy ball systems are connected to both vertical and horizontal winches, allowing the operator to situate the camera in the optimal position at all times. This will allow the operator to assess the appetite and ingestion rate of the fish to feed to satiation without waste.

Sediment monitoring methods follow those employed to assess seafloor condition as outlined in the monitoring protocols of the applicable fish farm licence. Through Huon Aquaculture’s own technical staff or environmental consultants, AMD, the company will use video monitoring to assess sediment condition.
3.5.3 Fish Health and Biosecurity

Good fish health and biosecurity are fundamental for any successful commercial fish farming operation.

There are many overseas examples where poor planning and implementation of fish health and biosecurity has ultimately resulted in the collapse of the salmon farming industry due to disease issues. Recovery has only been possible through the rationalisation of the industry in each country and the implementation of strict biosecurity measures. The following references provide a good insight into the fish and biosecurity measures implemented in overseas countries and form an important component of the background for Huon’s information in this EIS

- (Appendix O - Bakka frost, 2016 “Presentation to Intrafish and DNB Investor Forum – London”)

Web links include:


It is critical that the Tasmanian industry learns from the overseas experience to avoid such a collapse here in Tasmania. While there are legacy biosecurity issues from previous lease allocation and planning that need to be addressed, it is very important that all new farming areas like Storm Bay are planned and developed with serious consideration of biosecurity in mind, and advice taken from the Chief Veterinary Officer, DPIPWE. Key issues include:

- Appropriate distances between leases,
- Separation of year classes,
- Effective fallowing.

(Specific measures will be discussed in more detail in Section 6.1.10)

Detailed management controls for both are provided in Huon’s Veterinary Health Plan.

The key fish health problems experienced in the marine farm planning area and biosecurity region to date are listed in Table 8. From recent experienced gained in
farming in Storm Bay, it is likely that Pilchard orthomyxovirus (POMV) along with AGD will be the most significant fish health issues.

*Table 8 - Fish health problems experienced to date in the south east Tasmania marine farm planning areas and biosecurity region*

<table>
<thead>
<tr>
<th>Health Issue</th>
<th>Treatment/Management</th>
<th>Use of antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilchard orthomyxovirus (POMV)</td>
<td>Isolation of affected pens and minimising stress. Industry is in the process of developing a vaccine.</td>
<td>Not relevant</td>
</tr>
<tr>
<td>Tasmanian Aquareovirus</td>
<td>Only an issue in certain years with the occasional sign of overt disease. May act in an immunosuppressive way in subclinically infected fish. Isolation of affected pens and minimising stress. Industry is in the process of developing a vaccine.</td>
<td>Not relevant</td>
</tr>
<tr>
<td>Rickettsia like organism (RLO)</td>
<td>Only an issue in certain years with the occasional sign of overt disease. Isolation of affected pens and minimising stress. Industry is in the process of developing a vaccine.</td>
<td>Antibiotics have been used on occasion in other southeast leases but not for many years and their use is not anticipated at Trumpeter Bay</td>
</tr>
<tr>
<td>Yersinia ruckeri</td>
<td>Can occasionally occur as a self-limiting infection after smolt transfer, but rarely significant enough to require treatment. Vaccine by injection at the trial stage but should further reduce likely occurrence.</td>
<td>Minor issue in the past two years</td>
</tr>
</tbody>
</table>

Huon Aquaculture has a general policy of only using antibiotics if absolutely necessary for animal welfare. Any antibiotic use (if required) is undertaken under the strict control of a veterinarian. In the past two years only small amounts have been used in the Huon River area on post transfer smolt to control *Yersinia, Tenacibaculum*
maritimum and marine Flavobacterium. Ongoing development of injection vaccines for Yersinia (currently underway) should further decrease any antibiotic use in the area.

Like all salmon farms in south east Tasmania, Huon Aquaculture farms also experience amoebic gill disease (AGD). Some early stage experimental work is being undertaken by industry at the University of Tasmania on the potential for using low doses of hydrogen peroxide in combination with freshwater to increase the effectiveness of AGD treatment, however freshwater bathing remains the treatment of choice at this stage.

Freshwater treatment of AGD will be undertaken using the same broad management protocols as employed in the Huon and Channel regions. Bathing will be undertaken using the Company’s well-boat, the Ronja Huon. The well-boat increases the efficacy of bathing and allows for multiple reuses of the freshwater, and fewer trips to the freshwater fill stations. The well-boat also removes the need for towing liners between leases and the fill stations.

3.5.4 Predator Control

The principal predators currently encountered at the Huon and Channel MFDP leases are Australian and New Zealand fur seals and cormorants. This has not changed significantly with the expansion into Storm Bay.

Fur seals usually attack large fish, whereas cormorants mainly attack fish less than 1kg and therefore can be a particular problem with smolt. Seagulls also act as a pest and are attracted to fish pellets.

Sharks may also be more numerous in Storm Bay. However, in Huon Aquaculture’s experience sharks are only attracted to fish pens if there are dead fish (termed morts) lying on the bottom of the nets. This has rarely been the case during the past 16 years or more since the company increased mort collection to 2-3 times per week. At the new and amended zones, mort collection will be daily through the use of the mort lift-up systems attached to all of the new net-pens and remotely operated mort retrieval system. The incidence of sharks is not presently increasing around Huon Aquaculture’s existing leases.

The principal means for protecting against predator attacks is the new net-pen design. As described previously in Section 3.3.2, the pens proposed for the amended zone will have an integrated system of predator netting designed by Huon Aquaculture. This anti-predator net-pen system and well-boat are regarded by the company to be the fundamental requirements to making the successful transition to offshore (high energy site) farming in Tasmania.
3.6 Waste Management

3.6.1 Solid Waste

Blood water

Harvesting operations will not take place at the lease. Fish will be taken live to Hideaway Bay for processing. The blood-water from processing is transferred directly to the ensiling facility at the Hideaway land-base. The ensiled material is then transferred to or to fish waste processing contractors in accordance with established practices.

Sewage

Sewage from the feed and accommodation barges will be collected in holding tanks and returned to Port Huon for transfer to the local municipal sewerage scheme.

Mortalities

Mortalities will be collected daily through the lift up systems on the pens and transferred by boat to ensiling facilities on the feed barges or the larger central system located at the Hideaway Bay land-base. Periodic collection (monthly) will be made from the feed barges by the works vessel (but not the well-boat) servicing the leases from the Huon River and the ensiled material will be taken to Hideaway Bay for intermediate collection and storage and thereafter to either compost contractors, Huon Aquaculture’s own composting operation or to fish waste processing contractors in accordance with established practices.

Biosolids

Biosolids from the nets will be collected at the Whalepoint Road site where equipment cleaning operations are located. These will then be spread as organic enriched ‘fertiliser’ on local farmland, subject to the relevant EPA approvals, in accordance with established practices.

Uneaten feed

Uneaten feed has been estimated at 3% of total fed (Cromey et al 2002).

Faeces

The proportion of dry feed estimated to be lost by Atlantic salmon to faeces is approximately 15% (after Reid et al., 2009, with slight correction for feed composition), this factor has been used in Table 9.
Nitrogen

The amount of Nitrogen lost in solution (Dissolved Nitrogen Output) has been estimated at 4.25% of feed amount, (Wild-Allen et al., 2005, Wang et al., 2012) and this is shown in Table 9.

Carbon

Estimates of Carbon (Hall et al., 1990) discharged to the benthos are also included in Table 9.

Table 9 - Expected monthly solid waste emissions (in tonnes) for the Proposed zones

<table>
<thead>
<tr>
<th>Solid Waste Emissions</th>
<th>East of Yellow Bluff</th>
<th>SB 1-4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td>Feed Loss</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Carbon</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Faeces</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                       | Jun | Aug | Sep | Oct | Nov | Dec | Total |
| Feed Loss             | 4   | 21  | 47  | 21  | 4   | 183 |
| Nitrogen              | 1   | 5   | 11  | 5   | 1   | 43  |
| Carbon                | 6   | 32  | 70  | 32  | 6   | 274 |
| Faeces                | 20  | 106 | 235 | 106 | 20  | 914 |

All fish are fed using camera systems which allow response to the appetite and ingestion rate of the fish to feed to satiation without waste. This keeps uneaten feed pellets to an absolute minimum. As at Huon Aquaculture’s other leases, the build-up of fish faeces under the pens will be managed through the use of temporal and spatial fallowing practices.

Net cleaning

Net cleaning will be undertaken using in situ blasting cleaners and solids and liquids will be naturally dispersed into the environment. Huon Aquaculture cleans nets on very short rotations which prevents growth on the nets from exceeding 20-30% occlusion.
of the net apertures (this also protects the fish from solids that might cause gill damage). Fouling at any given time is therefore relatively light and blast cleaning detritus will naturally decompose without excessive accumulation.

Nets may occasionally be taken to the existing net cleaning facilities at Whalepoint Road where biosolids will be collected through the netwasheer waste collection system. However, the net management regime for the new pens will lead to a significant reduction in the number and frequency of nets being returned to shore for cleaning and hence to the volume of net cleaning biosolids collected by the facility.

### 3.6.2 Liquid Waste

**Sewage water and sullage**

Black water (from toilets on the feed barges) will be collected in holding tanks with the sewage and returned to Port Huon for transfer to the local municipal sewerage scheme under an agreement with TasWater. Sullage (grey water from sinks and showers etc.) will be discharged directly into the surrounding water.

**In situ net cleaning**

Nets will be cleaned *in situ* by water blasting. The water will be pumped seawater and will remain in the environment. Estimates for the production of the major variables of concern are provided in Sections 6.1.1 & 6.1.2.

**Net maintenance liquids**

There will be no need to modify any of the current resources at the net mending and cleaning facility at Whalepoint Road.

Net cleaning wastewater is currently disposed of through a combination of reuse, recycling and evaporation, with a contingency for tankering to a municipal wastewater treatment plant if required.

The net management regime for the new pens will lead to a significant reduction in the number and frequency of nets being returned to shore for cleaning and hence to the volume of net cleaning wastewater collected by the facility.

While changes to wastewater management at Whalepoint Road are being considered by Huon Aquaculture, these are unrelated to this proposal and EIS and would be due to other considerations, including changes to the Geeveston wastewater plant by TasWater.
3.6.3 Environmental Monitoring

For a more detailed background on Huon Aquaculture’s Environmental Management Plan please refer to Section 6.1 Impacts on the Natural Environment.

Broadscale Environmental Monitoring will be carried out in accordance with the EPA requirements for the region, an indicative program provided by the EPA is included in Appendix P. Farm-based water column monitoring will comprise continuous monitoring of oxygen and temperature (for fish health) and daily monitoring of other environmental parameters, including salinity, toxic algae, zooplankton and jellyfish.

Water flow characteristics will also be monitored as part of a company strategy to maximise feeding efficiency.

Huon Aquaculture will continue to support FRDC project 2015/024, entitled, ‘An evaluation of the options for expansion of salmonid aquaculture in Tasmanian Waters’ (IMAS). This project will improve our understanding of nutrient cycling and the potential for local scale eutrophication in and around salmon farms on a regional basis. The knowledge will help refine existing management strategies to ensure that salmon farming is managed sustainably in all regions. The project is currently using Huon’s Storm Bay lease to assess these effects in exposed well flushed sites, and the company anticipates that this research will inform the regulatory process for designing appropriate monitoring for the Storm Bay zones.

Benthic monitoring will be carried out in accordance with the EPA baseline requirements for new leases, and then subsequently the yearly monitoring (predominantly video surveys) according to the licence requirements. Seafloor monitoring now includes baseline sub and intertidal macroalgal survey of the adjacent shoreline as undertaken through FRDC project 2014/042, entitled, ‘Understanding broadscale impacts of salmonid farming on rocky reef communities.’ Further sites for ongoing reference and monitoring have also been included through FRDC project 2015/024 (also refer to Section 6.1.3 Marine Vegetation).

3.7 Decommissioning and Rehabilitation

It is Huon Aquaculture’s intention to stock the proposed Yellow Bluff lease in March/April of 2018. At that time there will likely be 3 to 4 grids each consisting of 5-6 pens on the lease.

Huon Aquaculture’s more exposed leases (SB 1-4 leases, Zuidpool, Redcliffs, Flathead) demonstrate excellent seafloor recovery as demonstrated through the regulatory annual video surveys (reported by Aquaculture, Management & Development P/L and Huon Aquaculture Company P/L). There have been no non-compliances with respect to seafloor souring detected since the inception of current Lease No 261. It is therefore expected that the original Trumpeter Bay lease area will take less than 6 months to recover, at least visually, once the pens have been removed.
Huon Aquaculture has committed $300,000 for the removal of infrastructure in the water column and on the seabed.
4 STAKEHOLDER CONSULTATION

4.1 Stakeholder Engagement Activities

A communication and engagement plan was developed specifically to provide information and opportunity for consultation on Draft Amendment No. 3 to the Storm Bay off Trumpeter Bay Marine Farm Development Plan, July 1998. The proposed development is to create a new marine farming zone located East of Yellow Bluff on the Eastern side of Bruny Island in Storm Bay, the proposed development is 313 hectares in size with a maximum leasable area of 230 hectares. In addition, the proposed development seeks to amend the SB 1-4 zones by increasing the size around all four boundaries of each lease by 75m. Potential stakeholders were identified and a range of activities undertaken in order to gather information and inform the development of this proposal whilst developing and maintaining positive and open relationships. Importantly, community engagement with stakeholders and the wider community is ongoing.

4.1.1 Stakeholders identified

Stakeholders that have been identified include (but are not limited to):

Community

- Residents and shack-owners from Bruny Island
- Bruny Island Community Association
- Bruny Island Advisory Committee (to Kingborough Council)
- Wider southern Tasmanian community.

Aboriginal community

- weetapoona Aboriginal Corporation (wAC) (Murrayfield Station)
- Aboriginal Heritage Tasmania
- Aboriginal Heritage Council

Government

- Kingborough Council
- Huon Valley Council
4.1.2 Stakeholder engagement activities by segment

Community segment engagement activities and outcomes

Residents and shack-owners from Bruny Island

Representatives of Huon Aquaculture met with near-neighbours of the proposed new site on several occasions since October 2016.

Specifically, Huon met with property owners from “Waterview” and “Oceanview”. The two properties are the closest properties to the proposed lease.

Waterview has been utilised as a holiday home for approximately 7 years by the existing owner and more recently has had a barn on the site converted to tourist accommodation. Likewise, Oceanview is also utilised as a holiday home by the owners and their extended family.
Huon Aquaculture provided viewsheds of the proposed lease to help inform the engagement process. Through the engagement process a number of concerns were raised by the owners of the properties. Specifically:

- The owners of Waterview expressed concern regarding the potential visual impact that the lease would have on existing vistas from parts of the property. The owners opinion was that walks are regularly undertaken by visiting guests and would be an “eyesore” and incompatible to the tourist operation taking place. In addition, the owners expressed concern regarding; changes in seal behaviour, potential for increase shark activity, potential for light and noise intrusion from increased boat traffic and use of equipment. In addition, the owners felt it would be an intrusion on One Tree Point that they consider to be historically significant as it had one of the first telegraph poles on it. The owners requested the proposed lease be moved further south.

- The owners of Ocean view expressed concern regarding the potential visual impact the lease would have on the vistas from the home and various points on the property. In addition, the owners expressed concern regarding; potential impact from increased nutrients on local seaweed species that they collect and consume. The owners requested the proposed lease be moved further south and specifically south of Yellow Bluff.

Huon also discussed the proposal with the weetapooana aboriginal corporation who manage the “Murrayfield” property at Trumpeter Bay. Through early discussion and consultation, Huon committed to not attempting to seek a lease in Trumpeter Bay and when considered in context of the advice received by TasPorts and MAST in relation to maintenance of searoom and clear sight lines for shipping and boating as well as biosecurity needs for the Company, drove the location of the proposed lease site.

Huon has responded to the specific concerns expressed by the near neighbours which is detailed in section 4.1.3.

Huon Aquaculture direct-mailed all Bruny Island residents in January 2017 regarding the proposed new lease. The community information pack contents direct mailed to residents can be found in Appendix K.

In addition, information regarding the proposed changes and Huon Aquaculture’s Controlled Growth Strategy was published in the Kingborough Chronicle and Huon Valley News.

Huon also scheduled a range of meetings with local community organisations on Bruny Island to provide further opportunity to the Bruny Island community to ask questions and share views and feedback on the proposal.

Outcomes of consultation with Bruny Island community organisations is provided below.
Bruny Island Community Association

Huon provided an information pack and was invited to present at and provide a briefing to the Bruny Island Community Association in February 2017. Approximately 19 members were in attendance.

Bruny Island Advisory Committee (to Kingborough Council)

Huon provided an information pack and briefing to the Bruny Island Advisory Committee in February 2017.

Wider southern Tasmanian community

Huon Aquaculture has actively disseminated information pertaining to the proposed new lease since October 2016. Specifically, the brochure shown in Appendix K was provided to media outlets and was, and continues to be, available online. Figure 23 below shows an example of media coverage following the release of the brochure.

Figure 23 - Media coverage of brochure in Tasmanian Country, page 7 (7 October 2016)

In addition, Huon Aquaculture held an Open Day on 30 October 2016 at Princes Wharf as part of its communications plan for the proposed new lease. The event was attended by over 4,000 people.

To understand community attitudes towards Huon Aquaculture's proposed new lease amongst the southern Tasmanian community more broadly, Huon Aquaculture commissioned independent research company EMRS to undertake an exit survey following attendance at the Open Day.
More than 200 Tasmanian adults were surveyed to explore current perceptions of both the salmon industry in general and Huon Aquaculture in particular following the Open Day and also to gauge awareness of changes to farming practices and Huon Aquaculture’s move into offshore farming in Storm Bay. The outcomes of the research are shown in Section Community survey results.

**Aboriginal Community**

Murrayfield Station is located on Bruny Island on land adjacent to Huon Aquaculture’s original Trumpeter Bay and SBI leases.

Murrayfield Station (owned by the weetapoona Aboriginal Corporation) is described on Bruny Island Accommodation Services’ website as “an iconic Tasmanian farming property on Bruny Island (Australia)…that grows premium lamb and fine wool from sheep that have not been mulesed. Murrayfield works to the ideals of valuing its rich Aboriginal cultural heritage while working as a sheep station and respecting its biodiverse environment... The station is also a venue for Aboriginal people undertaking agriculture and land management training, hosts Aboriginal cultural workshops and offers accommodation for Aboriginal and non-Aboriginal people.”

Huon Aquaculture has worked closely with the weetapoona Aboriginal Corporation for a number of years and through the development of this proposal. This has included cultural awareness training for key management and staff that work in the area, presentation of information to members, and seeking direct feedback on what is proposed. Significant changes were made to the proposal as a result of engagement and are detailed in Section 4.1.3.

In addition, Huon Aquaculture is actively partnering with weetapoona to improve education and employment outcomes for young indigenous people in southern Tasmania, and develop tourism opportunities on Murrayfield.

**Local Government**

Huon Aquaculture has engaged with the Huon Valley Council, Kingborough Council (and the Councils Bruny Island Advisory Committee) as well as with Government authorities including TasPorts and Marine and Safety Tasmania (MAST).

**Huon Valley Council**

Huon Aquaculture representatives presented to the Huon Valley Council and council officers on 6 September 2016 to outline the changes contained in this proposal as well as the company’s broader controlled plans. Since then, the Council has been replaced...

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by a Commissioner and Huon Aquaculture provided a briefing to the Commissioner and council General Manager in early February 2017.

**Kingborough Council**

Huon Aquaculture has written to Kingborough Councillors and provided the information contained in Appendix K. Information and a briefing regarding the proposal was provided to the Councils "Bruny Island Advisory Committee" in February 2017 and a summary of the outcomes is provided in the following section. In addition, Huon representatives presented information relating to the Draft Amendment to a Kingborough Council workshop in March 2017.

**TasPorts and MAST**

Huon Aquaculture met with TasPorts and MAST on several occasions through the development of this proposal. Guidance was provided by both MAST and TasPorts in relation to “straight line navigation” up the eastern side of Bruny Island for recreational vessels and appropriate sea-room for commercial shipping. The outcomes of this is provided in Sections 6.2.2 and 6.2.10.

**Non-government organisations**

Huon Aquaculture has emailed information packs to the following non-government organisations:

- Friends of North Bruny
- Environment Tasmania
- Tasmanian Raptor Refuge and Wildlife Park

In addition, Huon Aquaculture provided briefings to Friends of North Bruny and Environment Tasmania in early 2017 and discussed the proposal via telephone with the Tasmanian Raptor Refuge and Wildlife Park in late 2016.

**Commercial and recreational waterway users**

Huon Aquaculture has emailed information packs and provided briefings to the following non-government organisations. Specific additional activities for each organisation are provided below:

- Tasmanian Seafood Industry Council (TSIC)
Follow-up meeting to seek further feedback on impacts to specific commercial fishing sectors.

- Tasmanian Rock Lobster Association
Follow-up meetings with local members currently fishing the area and presentation at the organisation’s Annual General Meeting in October 2016 to gauge the views of the wider membership base. A further meeting and updated information, including re-drawn maps was provided in early May 2017.

- Tasmanian Abalone Council
Follow-up email providing further information requested at briefing.

- TARFish
Follow up call to seek formal position of TARFish.
TARFish also provided information regarding the proposed changes and lease chart to members via inclusion in their monthly newsletter.
Review of TarFish policy relating to expansion of salmon farming.

- Yacht Clubs
Email providing information and lease chart. Huon Aquaculture is currently seeking further engagement with Yacht Clubs.

**Tourism Operators**
Huon Aquaculture provided an information pack for distribution to Bruny Island Tourism Inc. members seeking feedback on the current proposal. In addition, Huon Aquaculture briefed Rob Pennicott from Pennicott Wilderness Journeys in September 2016.

**4.1.3 Community engagement outcomes**
The following section details the feedback and major issues raised by each stakeholder segment. The major issues raised through consultation are addressed in Section 6 of this EIS.

**Bruny Island community**
Huon Aquaculture continues to engage with the Bruny Island community and had directly engaged with three near neighbours of the proposed lease site.

The owner of “Waterview”, an agricultural property neighbouring Murrayfield station and north of the current proposed lease site, has expressed strong disapproval of the proposal.

Although not residing permanently at the property, the owner has an existing high-end accommodation facility on the property and also advised that he intends to develop a tourism experience on the island. Specifically, the planned tourism venture is a walking tour of the property and his view is that being able to see a salmon farm would materially impact the experience. It is unclear how this view was formed or if any market testing had been undertaken that would indicate such an impact.

The owner does not support salmon farming generally and has indicated that his preferred outcome would be to see the proposal relocated to another area or possibly further south.

Immediately adjacent to the property “Waterview” is the property known as “Ocean View”. Owners of the property have advised that they do not support the proposal on the basis of visual impact. Specific feedback was provided by the owners that a shift of several hundred meters south to a location adjacent to or below Yellow Bluff would ameliorate their concerns substantially.

In response to the views of both near neighbours, Huon has re-sited the lease a further 200m south than what had been previously indicated. The proposed new location and attending viewsheds were provided to the property owners however both maintain that they remain dissatisfied with the location however, Huon’s decision to act on the concerns of the residents demonstrates the Company’s willingness to try and work respectfully and constructively in relation to this EIS and more broadly by attempting to balance the needs and preferences of a range of stakeholders whilst maintaining the needs of the operation particularly as it relates to biosecurity.

Huon will continue to engage with the landholders to develop a deeper understanding of concerns and any potential to reach a mutually acceptable outcome.

In relation to community representative organisations, a summary for each group is provided below.

Bruny Island Community Association

Discussion following at the briefing related to; timing of the proposal (when it would potentially become operational, process for consideration of the proposal, lights from existing operations (noting that the current lease in Storm Bay has impacted a local resident taking long exposure images of the aurora australis), potential for marine debris, nutrient dispersal, seal management, employment opportunities and potential impacts on local marine mammal populations and fish stocks. There was general concern expressed about the rapid expansion of the industry but not specific to the
proposal. The discussion was wide-ranging and Huon noted that, in relation to the company's proposal, there were no specific issues identified or questions raised requiring further response at the meeting however, Huon wrote to the Association President following the briefing inviting the committee or individual members to contact Huon representatives should they have further questions or concerns. The presentation was also circulated to members not in attendance at the meeting. Since then, the company has not received any further questions and Huon is of the view that whilst there was some general concern over industry expansion, there was not significant or specific opposition to the proposal and many questions or concerns were addressed at the meeting through the provision of more detailed information at the briefing. Huon notes that there was a desire for information to be provided by Government at a broader industry level with regard to how expansion will be guided for all of Storm Bay.

Bruny Island Advisory Council

The presentation was well-received with few specific questions raised at the briefing. In relation to the proposal, the only concern raised was regarding lights from operations. Company representatives provided information on the use of the Ronja Huon (well-boat used for bathing) and working lights for safety, as well as outlined potential "greenish-glow" that may be seen if smolt are being grown under lights between June and late October.

Response from residents to direct mailed information and media coverage in local papers

Huon received no direct feedback following the mail out to Bruny Island residents in January 2017. Huon has some concerns regarding the efficacy of this method of information distribution on Bruny Island given the high level of shack ownership and that information may not be received in a timely way. In addition, there is no ability to confirm through Australia Post the distribution of non-addressed mail.

Feedback on existing operations from Bruny Island residents

It is important to note that Huon has been operating adjacent to Bruny Island for several years and had no complaint or feedback from any resident of Bruny Island during that time.

Community survey results.

Huon Aquaculture commissioned independent research company EMRS to undertake an exit survey following attendance at the Open Day on 30 October 2016.
More than 200 Tasmanian adults were surveyed to explore current perceptions of both the salmon industry in general and Huon Aquaculture following the Open Day and to gauge awareness of changes to farming practices and the planned offshore expansion in Storm Bay.

**Survey Results:**

Respondents were asked “Prior to attending the Open Day, was your general opinion of Huon Aquaculture positive or negative?” Table 10 compares the results of the recent survey with the post-open Day survey undertaken in 2014. As can be seen from the table below, the opinion of Huon Aquaculture has improved over the last two years and the proportion of people who did not have an opinion or were undecided had reduced markedly. In addition, the number of people that had a negative opinion of Huon had reduced to zero.

<table>
<thead>
<tr>
<th>Opinion (%)</th>
<th>2014</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very positive</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>Somewhat positive</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>Neither positive nor negative</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>Somewhat negative</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Very negative</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unsure</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Respondents were also asked “As a result of the Open Day, has your opinion of Huon Aquaculture improved?” Table 11 shows, 82% of respondents had an improved perception of Huon Aquaculture following the Open Day.

<table>
<thead>
<tr>
<th>Opinion (%)</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes – it has greatly improved</td>
<td>36</td>
</tr>
<tr>
<td>Yes – it has somewhat improved</td>
<td>46</td>
</tr>
<tr>
<td>It has remained the same</td>
<td>18</td>
</tr>
<tr>
<td>No – it has somewhat declined</td>
<td>0</td>
</tr>
<tr>
<td>No – it has greatly declined</td>
<td>0</td>
</tr>
<tr>
<td>Unsure</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 12 shows the percentage of respondents aware of changes being implemented in general.

Table 12 - Awareness of changes being implemented at Huon Aquaculture (general)

<table>
<thead>
<tr>
<th>Opinion (%)</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes – I am aware of changes</td>
<td>60</td>
</tr>
<tr>
<td>No – I am unaware of any changes</td>
<td>27</td>
</tr>
<tr>
<td>Unsure</td>
<td>13</td>
</tr>
</tbody>
</table>

Respondents were also given a list of the planned changes at Huon Aquaculture and were asked if they were aware of them. Table 13 shows the percentage of respondents aware of particular changes.

Table 13 - Awareness of specific changes at Huon Aquaculture

<table>
<thead>
<tr>
<th>Opinion (%)</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing new seal-proof pens across the entire operations</td>
<td>60</td>
</tr>
<tr>
<td>New farming operations offshore</td>
<td>74</td>
</tr>
</tbody>
</table>

The highest recall of changes at Huon was the new offshore farming areas, recalled by 74% of attendees. Of the two changes in Table 14 respondents were asked how favourably or unfavourably they were toward them. Table 14 shows that new offshore farming operations were viewed very favourably by respondents, with 74% either very favourable or somewhat favourable toward the planned lease changes. The most important perceived benefits from the proposed changes that Huon is implementing that was offered by the most respondents include:

- reduction in environmental footprint
- reduction in marine debris
- increased employment opportunities for local people
- happier salmon/better quality product.

Respondent comments representative of these themes include:

“Moving fish-farms offshore will improve environmental outcomes, and lead to healthier fish and less reliance on antibiotics.”
“Reduced fish losses, lesser pollution of in-shore waters and improved access for other users of inshore waters and tourism.”

Table 14 - How favourably or unfavourably the public view Huon Aquaculture’s Proposal plans

<table>
<thead>
<tr>
<th>Opinion ( % favourable)</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing new seal-proof pens across the entire operations</td>
<td>82</td>
</tr>
<tr>
<td>New farming operations offshore</td>
<td>76</td>
</tr>
</tbody>
</table>

As can be seen from the table above, there was significant support for both the use of seal-proof pens as well new offshore farming.

Huon Aquaculture provided an information pack to both the weetapooa Aboriginal Corporation and provided a briefing to corporation Chairman Ben Sculthorpe and the Murrayfield Station Manager. This information was then provided on to the wider weetapooa community.

Key outcomes of Aboriginal community briefing

- Generally supportive of Huon Aquaculture’s operations after working in close proximity over the last 2 years. However, some concern was expressed about the initial location proposed by Huon (which was the site of the original Trumpeter Bay lease). As a result, Huon Aquaculture agreed to re-site the lease further north to its current proposed location. The current proposed location is supported by weetapooa.

- Potential to include aquaculture components in agricultural training provided at Murrayfield station (a joint approach to training) and generally support aboriginal youth employment in the southern region. This has been progressed and implemented. The new jointly-managed School Based Apprenticeship Program commenced successfully in early 2017.

- Huon Aquaculture is currently working with weetapooa on a potential tourism trail on Murrayfield Station that includes sharing the long history of the area, its connection to the ocean as a productive waterway, and how it continues today through new offshore salmon farming.

Government organisations

Key outcomes of Huon Valley Council Briefing

There was broad support from Huon Valley Councillors regarding the proposed changes. Specifically, councillors were supportive of the employment created and investment being made in the local community, through use of local suppliers and
services, for the sustainable operation of farm sites and the use of improved farm
technologies to reduce environmental footprint.

However, given the new arrangements at Huon Valley Council (i.e. the removal of
councillors and replacement with a Commissioner), Huon briefed the Commissioner
(Adriana Taylor) and (Acting) Council General Manager to ensure there is current
understanding of what is proposed. The briefing took place in February 2017 with both
broadly supportive of the proposal as it relates to potential employment for Huon
Valley Residents and use of local businesses to support the proposal. The
Commissioner noted that the Kingborough Council Area was most directly impacted
by the proposal.

Key outcomes of Kingborough Council engagement

Huon has engaged with the council through its Bruny Island Advisory Committee
(BIAC) by providing a briefing to councillors.

Outcomes from the briefing with BIAC in February included questions relating to lights
from operations and is provided in Section 6.2.1.

At the councillor briefing in March 2017, there was general support for the proposal
with only a handful of questions raised by individual councillors and included;

- Information on net washing practices which was provided at the meeting;
- Seal interactions, noting the use of the “fortress pens.” Huon advised that pen
  incursions and lethal incidents were transparently reported via the company’s
  “sustainability Dashboard”; and
- If there would be any potential impacts on salmon performance as a result of
  Derwent River influence on Storm Bay. Information about the hydrology of the
  Storm Bay and local water quality was provided in brief. Consultation will
  continue throughout 2017 as the input and feedback from Kingborough
  Council is an important element of engagement regarding this proposal.

MAST and TasPorts

MAST and TasPorts considered Huon’s proposed lease in the context of both
recreational and commercial shipping. Specific feedback was provided in terms of
allowing enough sea-room for vessels and straight line navigation. Huon re-sited the
lease including tilting the lease to ensure it remained outside of the preferred shipping
areas indicated by both MAST and TasPorts. This is discussed further in Section 6.2.2.

Both MAST and TasPorts indicated that they are satisfied that the current siting of the
proposed lease meets their requirements for safe navigation in the area.
Non-government organisations

Friends of North Bruny (FONB)
Huon Aquaculture presented to members of FONB in February 2017. There was significant discussion both during and after the presentation. Specific discussion points include; potential impacts on the waterway, riparian zones, whales, seals, sharks and other marine life. In addition, there was general discussion on the expansion of the industry more broadly, the process for assessment of proposals and a general view that there was a lack of information from government centrally to find out what was being planned for the entire industry.

The amount of waste generated from production at the proposed new lease and other leases in Storm Bay which was provided at the meeting, specifically;

- Nutrient/waste dispersal in Storm Bay; and
- Marine debris management.

Huon notes that an opponent of salmon farming, Gerard Castles, was invited to the meeting to provide an alternate view on salmon farming. Specific topics covered by Mr Castles included;

- History of interaction with Tassal regarding operations adjacent to Rat Bay, North Bruny.
- Issues with noise and that they needed to be addressed specifically to the community through any EIS as it would be more difficult to address once “operational.”

Huon provided further responses to direct questions during Mr Castles proposals.

No further questions or information has been requested of Huon Aquaculture since the presentation in February 2017.

Environment Tasmania
Huon Aquaculture representatives met with Environment Tasmania in September 2016. General feedback to date includes:

- general support for move to offshore farming due to reduced environmental footprint
- general support for new technologies used to support offshore farming including “fortress pens” and well-boat.

Since commencing consultation with Environment Tasmania, the organisation has released a document titled “Cleaning Up Tasmanian Salmon – how the Tasmanian Government can restore social license and secure jobs in Tasmanian’s salmon industry.”
notes that the key recommendation of the document is “a moratorium on approval of further ocean-based salmon farming until an open, evidence-based review of Tasmania’s aquaculture planning and regulation has taken place.” On this basis, Huon assumes that the current position of Environment Tasmania is not to support the current proposal whilst being generally supportive of a move to offshore farming.

**Tasmanian Raptor Refuge and Wildlife Park**

Huon Aquaculture representatives discussed the Company’s proposed new lease and provided information regarding the proposal via email.

Specific feedback included:

- High level of support for new “fortress pens” and the reduction in bird interactions, especially for key species such as White-bellied Sea-eagle and Wedge-tail Eagle that has been experienced since the new pens were introduced. Pleased that a company had invested and taken action to reduce, if not eliminate, interactions with birds.
- Support for new farming technologies generally.
- No strong view on location.

In the context of the new proposal, the Tasmanian Raptor Refuge and Wildlife Park is supportive of the proposal if it uses “fortress pens” which is the company’s intention.

**Commercial and recreational fishers and boaters**

Huon Aquaculture has responded to the specific concerns of the recreational fishing and boating community, as well as the commercial users of the region, to re-site the original planned leases to further north and east so as to retain access to the shoreline and key fishing grounds and allow for safe navigation.

**Tasmanian Seafood Industry Council**

The TSIC Board requested that engagement take place at a sector level and specifically with the abalone, rock lobster and seine fishers. Huon has proceeded with consultation on that basis noting that TSIC is supportive of any proposal that meets all regulatory requirements, is of the highest environmental standard and does not significantly impact another commercial fishing sector.

**Tasmanian Abalone Council**

Huon Aquaculture representatives met with members of the Tasmanian Abalone Council (TAC) in October 2016. The TAC have identified the eastern coastline of
North Bruny to be a site used for commercial abalone diving. TAC, Chief Executive, Dean Lisson, indicated that overall, the Council and members were pleased with the steps Huon Aquaculture was taking into offshore farming and requested further information on a definition of offshore farming. Huon Aquaculture notes that there is no current Australian standard definition for what is considered “offshore” aquaculture. In its absence, Huon has been using the Irish salmonid industry’s definition which the Company uses as a guide in the absence of a formal standard here in Australia. Based on that classification, Huon Aquaculture would say that the proposed lease in Storm Bay would be categorized level 3 (exposed, offshore).

No further specific concerns were advised by the Council at the time of writing.

**Tasmanian Rock Lobster Association**

Huon Aquaculture representatives met with the Tasmanian Rock Lobster Association on a number of occasions, including presenting to the organisation’s Annual General Meeting in October 2016 and a follow-up meeting with the Association President in May 2017.

Key outcomes include;

- Re-siting the proposed lease in direct response to feedback from active fishers in the area that we were in close proximity to “good bottom” that was fished. As a result, Huon changed the proposed location by moving it as far east as possible within the bounds of the commercial and recreational straight line navigation channels indicated by TasPorts and MAST.

**Recreational Boaters (Yacht and Boating clubs)**

**Yachting**

The following yacht clubs have been provided an information brochure including a navigation chart showing the planned changes to Huon Aquaculture’s lease sites, and general information regarding the proposed changes.

This information has been provided to:

- Royal Hobart Yacht Club
- Derwent Sailing Squadron
- Bellerive Yacht Club
- Kingston Boating Club
- Lindisfarne Sailing Club
- Port Cygnet Yacht Club

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2[http://www.bim.ie/media/bim/content/downloads/Farming%20the%20Deep%20Blue.pdf](http://www.bim.ie/media/bim/content/downloads/Farming%20the%20Deep%20Blue.pdf) see page 2 – section 1:1)
• Huon Yacht Club
• Port Esperance Yacht Club
• Kettering Yacht Club.

Huon Aquaculture is in the process of engaging with the Royal Hobart Yacht club and Cruising Yacht Club of Australia specifically in relation to the Sydney to Hobart Yacht Race. At the time of writing, this consultation was in its infancy and will continue in 2017.

Huon Aquaculture notes that the yachting fraternity were keen to engage with the wider salmonid industry in relation to leases in Storm Bay. However, due to concerns about the proximity of a competitors proposed lease site, Huon Aquaculture elected to undertake consultation as a single Company.

Information regarding the Draft Amendment has been provided to the clubs and whilst formal responses and positions had not been clarified at the time of writing (except for Bellerive Yacht Club that declined a further briefing and did not provide any feedback), based on previous proposals, Huon Aquaculture has assumed that the key concerns are likely to include:

• Perceived lack of clarity around navigation marking (especially lighting), this not being well understood by recreational boaters and that the current marking/lighting system can be confusing (e.g., lower D’Entrecasteaux Channel). Refer to Section 6.2.2 for potential effects and mitigation measures for navigational risks.

• Ensuring that charts and GPS information is current was a concern for recreational boaters.

• Maintenance of “sea-room” along the shoreline for navigation in poor weather and access to anchorages. Refer to Sections 6.2.2 and 6.2.10.

• Maintaining access for local boat races. Refer to Sections 6.2.2 and 6.2.10. The re-siting of leases further from shore through the consultation process provides additional “sea-room” and clear line of sight for recreational and competitor vessels to safely navigate between the lease sites and the shore in inclement weather.

TARFish

Huon Aquaculture met with TARFish in September 2016 and followed up again in January 2017.

The official position and response by the organisation had not been ratified by the Board at the time of writing, as the organisation had only recently been made aware of the proposed location of the Petuna lease (in December 2016) and as such was formulating a whole of Storm Bay view on potential impacts on members.
Following the TARFish February Board meeting, the organisation released a salmonid aquaculture statement. A copy of the TARFish Salmonid Aquaculture policy is provided in Appendix N. Huon notes that the policy is general in nature and many of the points raised through the policy can only be addressed through government regulation and policy. However, Huon is of the view that this EIS actively satisfies a number of points in the policy including; research, farm management, move into offshore salmon farming, and potential interaction with recreational fishers through proximity to infrastructure such as boat ramps and jetties, as well as safe navigation through clear lines of sight. Huon provides information on these potential effects and proposed mitigation measures in Section 6.2.9.

**Bruny Island Boating Club**

At the time of writing, Huon had received one response to a direct mail to its 99 Bruny Island Boating Club members. The response was not specific to views or impacts on boating or fishing but rather a request to work collaboratively with other sectors and community groups to protect and enhance the coast. Huon will continue consultation throughout 2017 to proactively seek the views of local boat users.

**4.1.4 Further consultation and engagement**

Huon Aquaculture is committed to open, transparent and ongoing consultation with the Bruny Island community and stakeholders. It is the company’s intention to continue to communicate with the community and stakeholders as this proposal progresses through the assessment process.

Should the proposal be successful, Huon Aquaculture intends to further engage with key stakeholders to determine the most appropriate and effective methods for ongoing engagement.
5 EXISTING ENVIRONMENT

Please note that this section simply describes the environment in the region and any discussion of mitigation measures is provided in Section 6.

Information relating to the proposed amendment addressed by this EIS is presented in the context of the existing understanding of the environment of the Storm Bay region as gathered through:

- The TSGA supported FRDC project(s) entitled:
  - 2009/067. Nutrient and phytoplankton data from Storm Bay to support sustainable resource planning (Crawford et al. 2011), and,
  - 2014/031. Predicting marine currents, nutrients and plankton in the coastal waters of south eastern Tasmania in response to changing weather patterns. (Appendix L)
  - 2014/042. Understanding broad scale impacts of salmonid farming on rocky reef communities (Valentine et al., 2016)
- Marine Farming Development Plan for Storm Bay off Trumpeter Bay North Bruny Island (July 1998)
- Various reports/papers describing individual scientific studies undertaken in the area.
- Baseline Zone Environmental Assessment May 2014 of the SB 1-4 zones at Trumpeter provided by IMAS, and Baseline Environmental Assessment Sept/Oct 2016 of the new Trumpeter zone.
- Data collected by Huon Aquaculture in support of Amendment No 1 and the proposed amendment, e.g. site specific current meter data.

The greater part of the information presented is extracted from FRDC projects 2009/067 and 2014/031 (Crawford et al., 2011, Appendix L) which were designed to provide information on the effects of a changing climate on water quality in Storm Bay and associated potential impacts on fisheries and aquaculture, and to collect nutrient and microalgal data from a targeted suite of sampling sites in Storm Bay to support sustainable development of the aquaculture industry. The data below is presented as for Huon’s previous EIS to accompany the Draft Amendment No 1 to the Storm Bay off Trumpeter Bay North Bruny Island MFDP July 1998. However, the data presented as part of FRDC project 2014/042 has now been updated, expanded and reported to industry by IMAS (2016) and this interim report is provided as Appendix L. Information from that report is included in the broad discussion of the existing environment in this section.
The sampling sites are shown in Figure 24. Site 6 is located slightly inshore of the proposed amendment zones.

![INFORMD sampling](image)

Figure 24 - FRDC project 2009/067 sampling sites (source: Crawford et al. 2011, Appendix L)

As stated in the final report for the FRDC 2009/067 project:

- ‘A major benefit of this project is providing actual data on climate variability in the local Storm Bay area. Although only 12 months of data are available, it provides important information on current water quality and productivity, which has enabled a preliminary comparison with environmental data collected over two decades ago. It also provides a baseline of data for future comparisons. It is hoped that these data will assist awareness raising of industry and the community to climate change issues.

- This project has developed procedures and techniques for investigating and assessing water quality nutrient and productivity data from Storm Bay, which will be used for further monitoring and evaluation. The results from 12 months sampling identify the need for continued sampling to increase the replication and to assess whether unusual results are due to one-off events or are part of the changing climatic conditions.

- The results are also beneficial to the salmon aquaculture industry which is exploring options of expansion into Storm Bay. This baseline data on nutrient concentrations and patterns of water circulation before any farming activity occurs provides dual
benefits to industry and government i) of increased environmental knowledge of sites in Storm Bay already identified by industry as potential new farm locations, and ii) baseline data before farming commences to enable more accurate analysis of environmental effects (or not) of any farms in the future.’

The monitoring commenced under project FRDC 2009/067 was subsequently supported through to late 2013 in the main through IMAS internal funding, however, continuation of the overall study and monitoring programme was further supported by the TSGA through FRDC project 2014/031.
5.1 Environmental Conditions

5.1.1 Bathymetry
A sonar bathymetry survey of the seabed in the vicinity of the proposed east of Yellow Bluff zone was undertaken as part of the CSIRO Geophysical Survey & Mapping (GSM) Survey (Appendix H). The resulting bathymetric map is presented in Figure 25 below.

Figure 25 - CSIRO bathymetric profile for an extended area (>500ha’s) around the Yellow Bluff zone (refer also to Appendix H)
Key: pink rectangle indicates approximate position of proposed east of Yellow Bluff lease. Depth contours at 5m intervals.

The position of the Yellow Bluff proposed lease is indicated by the rectangle in Figure 25. Depths range from 26m through to 32m within the lease area and are shallowest in the north-west corner of the lease and get progressively deeper towards the south-east corner.

As presented in the EIS to accompany Draft Amendment No.1, the IMAS Trumpeter Environmental Assessment (Appendix H in that EIS) noted that the SB zones all lie in waters deeper than 35m with zones 1-3 having a maximum depth of approximately 45m and zone 4 extending down to 47-48m at its south-eastern edge. The depth stratum for the SB zones was shallower on the coastal boundary with the deeper margin on the Storm Bay side. These depths are not significantly altered by either the increase in lease area or the 18 degrees clockwise rotation.

5.1.2 Substrates

For the new Trumpeter zone refer to the CSIRO ‘Geophysical Survey & Mapping (GSM) Trumpeter Lease Extension Survey’ and ‘An Initial Environmental Assessment of a proposed amendment to the marine farming zone at Storm Bay off Trumpeter Bay’ reports (combined as Appendix H).

From the video footage the substrates are described as being characterised by medium to coarse sands and silt. In terms of the relief, the sands were characterised by flat regions with high levels of bioturbation, ripples and shell grit. The grab samples confirmed the presence of the fine to medium yellow-brown sands. The sand/grit nature of the sediments and the rippled morphology supports the theory of relatively high seabed velocities for both the Yellow Bluff and SB 1-4 zones.

The CSIRO Geophysical Survey & Mapping (GSM) Trumpeter Lease Extension Survey (Appendix H) multi-beam acoustics results show the seabed across the whole new Trumpeter zone survey area as smooth (no reefs) and generally featureless.

As presented in the EIS to accompany Draft Amendment No.1, the IMAS Trumpeter Environmental Assessment (Appendix H in that EIS) described the sediments in the SB 1-4 zones as being characterised by medium to coarse sands and silt. The sand was characterised by flat regions with high levels of bioturbation, ripples, drift sponge and shell grit. The grab samples provided slightly more detail describing the sands as ranging from yellow-brown sand to orange-brown sand with pockets of black silt to gravel. The gutters described in the report were characterised by gravel, coarse sand and shell-grit. The gravel/sand/grit nature of the sediments and the rippled morphology supports the theory of high seabed velocities.
5.1.3 Hydrology

Herzfeld (2008) modelled the mean circulation and connectivity of water inferred from particle tracing and passive tracer transport in order to estimate the risk of ‘pollutants’ (excess nutrients) released from the fish farms to accumulate in the Derwent estuary. Sites S1 & S2 located at Trumpeter Bay and Variety Bay were used in the particle source release locations in the study (Figure 26).

Figure 26 - Point source release locations for particle tracking (source Herzfeld, 2008)

Conclusions from the study were as follows (Herzfeld, 2008):

‘The residual flow, passive tracer and particle tracking analysis all provide a consistent picture of the fate of material potentially released on the NE side of Bruny Island. The mean surface flow in the region is predominantly E/SE, and material in the surface layer (passive tracers or particles) are transported in a SE direction to follow a path around southern Tasman Peninsula. Bottom residual flow near north Bruny in Storm Bay is northward into the Derwent,
consequently material released throughout the water column on the NE side of Bruny is also transported in to the Derwent estuary via bottom flows. This bottom up stream flow is driven by the salt wedge circulation in the estuary, where bottom waters are entrained into the surface along the estuary length to be expelled downstream in the surface layers. The surface flow is much stronger then the bottom flow, hence the eastward flux of material is greater than flux into the Derwent. Therefore, the preferred path of material released off NE Bruny appears to be south eastward, with secondary transport capable of delivering material in to the Derwent via bottom flows. 

More recent work by Buchanan et al., (2014) provides further insight into the oceanic currents that influence both Storm Bay and SE Tasmania shelf, in which they conclude:

‘Southern Tasmanian shelf waters are host to the seasonal interplay of Australia’s two poleward boundary currents; the East Australian Current (EAC) and the Leeuwin Current (LC). While the behaviour and properties of the LC remain underexplored, strong research focus has allowed insight into how an intensifying EAC has created greater subtropical influence, leading to changes in the physical and biological oceanography of the region. There is a seasonal increase in the EAC’s southward penetration beginning in October. Despite the seasonal peak in EAC activity, temperature-salinity plots, nutrient, Chlorophyll a and phytoplankton concentrations all indicate the presence of subantarctic waters on the shelf and in coastal waters in summer. Our results are consistent with the description of the EAC as an erratic, eddy-driven current; this itself allowing the periodic influx of subantarctic waters across the shelf. In winter, temperature-salinity plots and nutrient concentrations indicate that the LC was present in southern shelf waters. In addition to its high nitrate signature, the LC displayed low silicate properties in southern Tasmania.’

In order to measure localised current movement and in particular flows or forces that will influence particle settlement and re-suspension under the pens, and also to aid moorings design, an Acoustic Doppler Current Profiler (ADCP) was deployed in the vicinity of the proposed amendment zone from 7 September 2016 to 31 October 2016 at the position shown in the map in Figure 27 below. The raw current data was also used as background data for the DEPOMOD modelling of the accumulation of organic carbon underneath the pens in the Yellow Bluff zone (Section 6.1.2.2).

The ADCP was set to measure current velocity and direction throughout the water column every 15 minutes, with this data grouped into two metre depth bins. The deployment lasted for 7-8 weeks.
The current and velocity data for the deployment is summarised for average flow, minimum flow, maximum flow, percentage of flows less than 3 cms\(^{-1}\), percentage of flow less than 5 cms\(^{-1}\), and percentage of flow greater than 10 cms\(^{-1}\) for each depth bin in Table 15 below. Polar plots providing frequency data on current velocity and direction are provided in Figure 28 and Figure 29 below.
### Table 15 - Summarised current velocity data for the site from 7th September to 31st October 2016

<table>
<thead>
<tr>
<th>Depth ranges (m)</th>
<th>23-25</th>
<th>21-23</th>
<th>19-21</th>
<th>17-19</th>
<th>15-17</th>
<th>13-15</th>
<th>11-13</th>
<th>9-11</th>
<th>7-9</th>
<th>5-7</th>
<th>3-5</th>
<th>1-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>0.0494</td>
<td>0.0548</td>
<td>0.0586</td>
<td>0.0614</td>
<td>0.0619</td>
<td>0.0653</td>
<td>0.0723</td>
<td>0.0762</td>
<td>0.0831</td>
<td>0.0941</td>
<td>0.1220</td>
<td>0.2522</td>
</tr>
<tr>
<td><strong>Max</strong></td>
<td>0.2290</td>
<td>0.2950</td>
<td>0.3320</td>
<td>0.4370</td>
<td>0.3060</td>
<td>0.4470</td>
<td>0.5250</td>
<td>0.5400</td>
<td>0.3960</td>
<td>0.4800</td>
<td>0.5350</td>
<td>0.8370</td>
</tr>
<tr>
<td><strong>Min</strong></td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.0000</td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.0000</td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.0030</td>
</tr>
<tr>
<td>%flow &lt; 3cm/s</td>
<td>26.8</td>
<td>23.6</td>
<td>21.1</td>
<td>20.1</td>
<td>19.6</td>
<td>15.8</td>
<td>15.2</td>
<td>12.3</td>
<td>9.6</td>
<td>6.4</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>%flow &lt; 5cm/s</td>
<td>56.8</td>
<td>50.4</td>
<td>46.5</td>
<td>43.6</td>
<td>45.8</td>
<td>43.2</td>
<td>35.8</td>
<td>34.2</td>
<td>30.0</td>
<td>25.5</td>
<td>17.2</td>
<td>3.9</td>
</tr>
<tr>
<td>%flow &gt; 10cm/s</td>
<td>5.6</td>
<td>8.8</td>
<td>11.5</td>
<td>13.8</td>
<td>15.9</td>
<td>18.5</td>
<td>22.4</td>
<td>25.5</td>
<td>29.5</td>
<td>37.0</td>
<td>52.7</td>
<td>86.1</td>
</tr>
</tbody>
</table>
Figure 28 - Polar plots of current velocity and direction – 1-13m Depth
The data shows that the flow velocities measured around the proposed zones appear to be comparable to those measured at Huon’s SB4 lease area during March 2014 (Trumpeter EIS, 2015). These flows are generally higher than those previously measured within the Huon River Estuary. This indicates that the proposed zones should provide at least equivalent seafloor recovery conditions to those fish farm leases in the D’Entrecasteaux Channel. Predominant flow direction over the range of depth bins for the survey period differed from southerly near the surface (depths 1-7m) through to northerly for the deeper layers (17-25m depth).

The current data has been provided to Huon Aquaculture’s mooring consultants, Aquastructures A/S, Norway, for incorporation into the design of the 240m pen moorings to be established at the proposed zone.
5.1.4 Water Quality

The source for all data in the following section is Crawford et al., (2011) except where stated, and updated data/information contained in Appendix L (FRDC Project 2014/031) is included in the commentary. In addition, the Nutrient Dispersion Modelling for Proposed Finfish Farming Zones in Storm Bay (Appendix M) will be discussed in Section 6.1.1.

Further Crawford’s data has been used (by DPIPWE, Table 16) to derive the expected 20th, Median and 80th percentiles that might then be employed as a guide to the potential trigger levels for the overall Storm Bay region. The data also provides for a comparison with other percentile data available for the Huon River and Port Esperance and D’Entrecasteaux Channel MFDP areas, derived from data provided by the Broadscale Environmental Monitoring Program (BEMP) for those Plan areas (for position of sites refer to Figure 30 below).

A synopsis of this data specifically targeting the comparison between the Yellow Bluff/SB 1-4 zones area (Site 6) and the following sites is provided in Table 16 below:

1) the offshore site in Storm Bay (Site 3),

2) the control site in Recherche Bay from the Huon and Port Esperance and D’Entrecasteaux Channel BEMP, and,

3) a site located in the lower D’Entrecasteaux Channel which is located between a number of fish farms in that area but is at least 500m from the nearest farm, within the Huon and Port Esperance and D’Entrecasteaux Channel BEMP.

Observations relating to this percentile data (referred to as DPIPWE percentile data) are also included for pertinent water quality sub-sections below.
Figure 30 - Map showing the position of the sites used in the percentile data comparison

Table 16 - Synopsis of water quality variables percentile data provided by DPIWPE, comparing sites in Storm Bay and the Huon/Channel MFDP’s.

<table>
<thead>
<tr>
<th>SITE_ID</th>
<th>SITE_NAME</th>
<th>Chlor a (ug/L)</th>
<th>Ammonia (ug/L)</th>
<th>DIN (ug/L)</th>
<th>Nitrte (ug/L)</th>
<th>DO (mg/L)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>80 %ile Median</td>
<td>80 %ile Median</td>
<td>80 %ile Median</td>
<td>80 %ile Median</td>
<td>20 %ile Median</td>
<td></td>
</tr>
<tr>
<td>M 15</td>
<td>Recherche</td>
<td>1.20</td>
<td>0.90</td>
<td>8.0</td>
<td>5.0</td>
<td>39.0</td>
<td>15.0</td>
</tr>
<tr>
<td>M 6</td>
<td>Central Mid Channel</td>
<td>1.90</td>
<td>1.10</td>
<td>10.0</td>
<td>9.0</td>
<td>49.0</td>
<td>20.0</td>
</tr>
<tr>
<td>SB 3</td>
<td>Storm Bay 3</td>
<td>0.86</td>
<td>0.54</td>
<td>14.6</td>
<td>7.0</td>
<td>57.3</td>
<td>34.3</td>
</tr>
<tr>
<td>SB 6</td>
<td>Storm Bay 6</td>
<td>1.21</td>
<td>0.66</td>
<td>11.5</td>
<td>6.9</td>
<td>49.2</td>
<td>17.0</td>
</tr>
</tbody>
</table>

Temperature and salinity

Surface temperature and salinity observations for the Storm Bay region are shown in Figure 31 and for site 6 in Figure 32. Site 6 corresponds most closely with the location of the proposed amended zones.
Figure 31 - Salinity (a) and temperature (b) values at 0.5 – 1 m water depth at sampling sites in Storm Bay. (source: Crawford et al., 2011)
Figure 32 - Temperature and salinity data for site 6 (source: Appendix L - FRDC 2014/031)
Figure 33 - Monthly temperature profiles at the five sites for 13 months (Crawford et al., 2011)
Figure 34 - Monthly salinity profiles at the five sites for 13 months (Crawford et al., 2011)
As stated in Crawford et al., (2011):

‘Water circulation in Storm Bay predominately has marine waters flowing north into the bay on the western side and the freshwater outflow from the Derwent River and the northern end of the D’Entrecasteaux Channel flowing south along the eastern side of the bay. This circulation pattern suggests that the freshwater flow would influence sites 1 and 5 the most while the marine flow would influence sites 3 and 6 the most. Site 2 could be influenced by either source depending on which source was the more dominant. In August the high rainfall caused a large pulse of freshwater to enter Storm Bay which flooded into the surface waters of site 2, but not as far south as site 3. This is reflected in the salinity and temperature values recorded for the surface waters at each site.

Monthly temperature and salinity profiles with depth also generally reflect this circulation pattern (Figure 32 and Figure 33). At the commencement of sampling in December 2009 the temperature was warmest at site 5 with a thermocline at approximately 20 m depth, and lowest at site 3. In January 2010 there was a progressive decline in temperature with increasing distance into Storm Bay. Water temperatures were warmest and more similar at all sites in February and March, followed by a major change in April when site 3 was over 1°C warmer than the other sites. Temperatures decreased at all sites in May and again in June and July, especially at the inner sites and close to shore. Site 3 had the warmest water across the entire water column at this time. By early October the inner sites were similar to site 3 and by late October they were warmer. Temperatures at all sites in November had increased, with site 5 the warmest and a thermocline at 20m. Water temperatures in December 2010 showed a similar pattern to that observed in December 2009.

Salinity was highest at site 3 in all months except February and May and generally lowest at site 1, reflecting the freshwater flow from the Derwent. In most months the salinity at site 5 was lowest from about 5 m depth and a halocline was present at 20+ m. This unusual stratification of temperature and salinity could be influenced by a 80 m deep hole that was encountered due to drifting while sampling in 32-33 m depth at site 5.

Results from the two sites close to shore, sites 5 and 6, which have been identified by industry as potential sites for expansion of salmon aquaculture, indicate that site 6 is largely marine influenced whereas site 5 showed greater influence of freshwater flow from the Derwent River.’

As previously stated in the MFDP for Storm Bay off Trumpeter Bay North Bruny Island (1998), the temperature range of 11-18.5°C and the broadly fully marine salinity profiles are ideal for farming Tasmanian salmon.

**Dissolved oxygen**

Clementson et al. (1989) provide data on oxygen content at a depth of 10m averaged through the mid region of Storm Bay. The levels were described as typical for temperate waters showing seasonal variation with winter peaks around 270-280uM (approximately 8.8mg/l) and lows during summer of 240-250uM (7.85mg/l) with a
minima of 220\mu M or approximately 7.04mg/l. Data provided by in Appendix L (FRDC project 2014/031) suggest that the mimina may be slightly less (Figure 35).

In such a well-mixed and high-energy water body with constant oceanic influences there is low to negligible risk of low or stressful oxygen levels.

![Dissolved oxygen levels at site 6](source: Appendix L - FRDC 2014/031)

**Figure 35 - Dissolved oxygen levels at site 6 (source: Appendix L - FRDC 2014/031)**

The DPIPWE percentile data presented in Table 16 shows that annual and summer dissolved oxygen levels are basically the same between the Yellow Bluff/SB Zones 1-4 area and the offshore site 3 sampled by IMAS (Appendix L). These levels tend to be lower than the Recherche Bay site both on an annual basis and for summer and are marginally lower than the central mid channel BEMP site on an annual basis but very similar to this site during summer.

**Biogeochemical modelling**

CSIRO have developed some capacity for longer term biogeochemical modelling of the SE Tasmania region including Storm Bay. Initial work in this area by Wild-Allen, K. and Skerratt, J. is described in Crawford et al., (2011). In brief, the progress to that point is described as follows:

‘With the support of the Storm Bay sampling program the open boundary of the SETAS biogeochemical model has been constrained sufficient to allow a hindcast simulation of 14 months and an ongoing pilot near real time simulation. In the coming year these simulations will be validated against in situ data to confirm that the model captures the essential seasonal
dynamics of southeast Tasmanian coastal waters. We look forward to using the Storm Bay sampling data to assist in this model validation exercise and thereby support the further application of these models to address science questions and management issues.’

It is accepted that the open boundary of Storm Bay is complex in nature and that any future potential for modelling is dependent on gathering more data along this boundary. As such, any environmental monitoring programme will necessarily include open boundary monitoring in order to further develop an effective and reliable biogeochemical model for the region.

The development of the biogeochemical model itself is an acknowledged part of the future sustainable management of fish farming in the region and will help define future trigger limits to be measured against within the monitoring programme. Huon Aquaculture is therefore committed to supporting the development of the biogeochemical model and any associated developmental monitoring programme such as the indicative programme provided in Appendix P.

**Dissolved nutrients**

*Nitrogen*

Nitrogen is the most important parameter for evaluating and managing the potential impact of salmonid farming on the environment. Nitrogen enters the water column and sediments through waste food and fish excreta. Nitrogen inputs from salmonid farming add to inputs from other sources (rivers, wastewater treatment plants, industrial plants and the ocean) and the management of salmonid farming is aimed at ensuring that its nitrogen contributions do not compromise the health of the bay.

Under Tasmanian conditions, it typically takes 1.35kg of dry feed to produce 1kg of fish; this is referred to as a Food Conversion Ratio (FCR) of 1.35. Approximately 5% of the total feed given to fish is lost as nitrogen to the environment through uneaten food or fish excretory products. Of this 5%, approximately 85% is in the form of dissolved nitrogen and approximately 15% is in the form of particulate nitrogen.

Crawford et al., (2011):

‘Nitrate concentrations at both the surface and 10m showed a pattern of low values over spring, summer and autumn (generally < 1 µM) and increased over winter-early spring to up to 4 µM, although there was some variation between sites. Site 5 generally had the lowest concentrations over winter. Bottom water nitrate concentrations were more variable although a general increase over winter was apparent. The deepest site 3 at approximately 90m depth had the highest nitrate concentrations in most months of the year, and these were particularly high in February and March, up to ~8 µM. Site 2 at 45m depth also had relatively high values in most months of the year.

Ammonium concentrations were consistently low at the surface and <1 µM (Figure 37). They were similar across sites at 10m depth, except for higher values at site 3 in February, March
and November 2010. Bottom water ammonium concentrations were markedly higher in January at the two outermost sites and also relatively high at these sites in March and November, similar to concentrations at 10m depth. Site 5 ammonium concentrations in bottom water, although generally within ANZECC guidelines (1.07µm for marine waters, ANZECC 2000), were the highest of all sites in winter and December, and relatively high in February and March.’

Figure 36 - Nitrate and nitrite levels at site 6 (source: Appendix L - FRDC 2014/031)

Figure 37 - Ammonium levels at site 6 (source: Appendix L - FRDC 2014/031)
Site 6 shows a pattern of elevated nitrate levels up to 4μM through May to October (5-6 months of the year), with values <1μM for the rest of the year. Both nitrate and ammonium values were generally greatest in the bottom waters (Figure 38). It is interesting to note that the highest values for nitrate and phosphate (Appendix L) were generally found at site 3, the most offshore site included in the study.

The DPIPWE percentile data presented in Table 16 shows that annual and summer nitrate levels are lowest for the BEMP control site at Recherche Bay and highest at the offshore S3 site, with the central mid channel BEMP site and Yellow Bluff/SB zones 1-4 site being somewhat similar. It is noteworthy that the offshore S3 site is 3-4 times the concentration for both the median and the 80th percentile than all other sites. For ammonia and dissolved inorganic nitrogen (DIN), the trends are somewhat similar, with the one notable difference being that the ammonia/DIN levels for the Yellow Bluff/SB zones 1-4 site appear to be somewhat higher during summer than the levels in the central mid channel site. This might be regarded as surprising given that the data represents a period during which there were no fish farms at the Yellow Bluff/SB zones 1-4 site whereas there were numerous fish farm leases in operation at the mouth of the Huon river and through the lower D'Entrecasteaux Channel (i.e., surrounding the BEMP mid central site, M6). Please note that when comparing ammonia levels between the two regions datasets (Crawford’s Storm Bay data and BEMP data), that the two datasets were analysed by different laboratories (CSIRO and Analytical Services Tasmania, DPIPWE). Therefore, to make a valid comparison a statistically rigorous correction factor (peer reviewed) was applied to the CSIRO data (DPIPWE pers. Comm.).
Figure 38 - Nitrate and ammonium concentrations at 3 depths in 2009-2010. Note truncated scale for ammonium. (Crawford et al. 2011)
Phosphorus

In marine waters, phosphorus is usually not a limiting nutrient and is therefore not a significant concern. Phosphorus inputs from salmonid farming are therefore not routinely measured or estimated.

For Storm Bay, phosphate concentrations are generally low and show little variation between sites at the different depths over time (Figure 40). The exception was at site 3 in February and March when clear peaks in concentrations, much higher than ANZECC guidelines for marine waters, were evident.

At site 6, levels were generally lower in summer, and more consistently higher in bottom waters for most of the year (Figure 39).

![Phosphate levels at site 6](source: Appendix L - FRDC 2014/031)
Figure 40 - Phosphate and silicate concentrations at 3 depths in 2009-2010. Note truncated scale for phosphate. (source: Crawford et al., 2011)
Silicate

Silicate concentrations were variable and tended to follow rainfall patterns, with highest values in surface waters over much of the year and especially at site 1, which peaked in winter and early summer (Figure 40 and Figure 41). Bottom water values were generally the lowest in each month.

Figure 41 - Silicate levels at site 6 (source: Appendix L - FRDC 2014/031)

Spatial variation in nutrient levels

From Crawford et al., (2011); ‘A comparison of nutrient concentrations at each site over the sampling period and presented as box and whisker plots (Figure 41) and Appendix L; ‘Box and whisker plots of the median values for nutrients at each site over the five-year period show that NOX (nitrate plus nitrite) values in surface waters were highest at site 3 and lowest at site 5. Bottom water NOx values were highest at the deepest, outer site 3 and least at the inshore shallow sites 1 and 9. Surface water phosphate concentrations were low at all sites and highest in bottom waters at site 3. These results suggest that nitrates and phosphates are imported into Storm Bay from offshore waters. Ammonium concentrations were relatively consistent across sites and silicates were highest in surface waters at the entrance to Storm Bay.’
Figure 42 - Box and whisker plots of nutrients concentrations at each site over the sampling period (Crawford et al. 2011)
Chlorophyll a

‘Phytoplankton biomass, as indicated by Chlorophyll a concentration, for the five sites sampled is shown in Figure 43 and Figure 44. Statistically, a single factor ANOVA (p < 0.05) showed there was a significant difference between mean Chlorophyll a concentrations at the five sites. In general the biomass was lowest at site 6 and highest at site 1. On two occasions (21 April and 05 October 2010) the highest biomass was recorded at site 2. Biomass tended to increase at all sites except site 3 from around April/May until late in 2010. Increased biomass was recorded at site 3 from 5th October 2010. Chlorophyll a shows seasonal peaks in spring and autumn but the timing and size of these peaks varies from year to year.’

Figure 43 - Surface Chlorophyll a concentration in samples collected from five sites in Storm Bay. Note the different scales for Chlorophyll a at each site. (source: Crawford et al., 2011)
Figure 44 - Surface Chlorophyll a l-a concentration in samples collected from five sites in Storm Bay. (source: Crawford et al. 2011)

Figure 45 - Chlorophyll a levels at site 6 (source: Appendix L - FRDC 2014/031)
The extended data set for site 6 as provided by IMAS, Appendix L shows that Chlorophyll levels at that site have increased or at least have registered higher peak values since 2010 (Figure 45), reaching peaks of nearly 4mg/L in both surface and bottom waters. These peaks coincide with peaks of similar or higher values at other sites in the study.

From Crawford et al., 2011: ‘Pigment analysis is used to estimate algal community composition and concentration. Pigments which relate specifically to an algal class are termed marker or diagnostic pigments (Jeffrey and Vesk, 1997; Jeffrey and Wright, 2006). The presence or absence of these diagnostic pigments can provide a simple guide to the composition of a phytoplankton community, including identifying classes of small flagellates that cannot be determined by light microscopy techniques.

The pigment composition for the 1m water samples from the five sites is shown in Figure 46. There is a general similarity in pigment composition between all sites with a presence of diatoms (as indicated by fucoxanthin), haptophytes (hex-fucoxanthin), prasinophytes (prasinoxanthan), cryptophytes (alloxanthan), cyanophytes (zeaxanthan) and green algae (chl-b) in nearly all monthly samples at all sites. The green algae could be in the form of euglenophytes or prasinophytes; the absence of the pigment lutein in all samples indicates that chlorophytes are not present in Storm Bay, at least at the sites sampled.’

The DPIPWE percentile data presented in Table 16 suggest that median Chlorophyll a levels are lower (approximately half) in the Storm Bay region in general than in the Huon River and D’Entrecasteaux Channel area.
Figure 46 - The composition of marker pigments for surface water samples collected from five sites in Storm Bay.

Key:

<table>
<thead>
<tr>
<th>Pigment name</th>
<th>Abbreviation</th>
<th>Algal group</th>
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<tr>
<td>Peridinin</td>
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<td>Dinoflagellates</td>
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<tr>
<td>15'-butanoyl-fucosterin</td>
<td>But-fuco</td>
<td>Chrysophytes</td>
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<tr>
<td>Fucosterin</td>
<td>Fuco</td>
<td>Diatoms</td>
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<td>15'-hexanoyl-fucosterin</td>
<td>Hex-fuco</td>
<td>Haptophytes</td>
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<td>Prasistroxin</td>
<td>Pras</td>
<td>Prasinophytes</td>
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<td>Aloxanthin</td>
<td>Alox</td>
<td>Cryptophytes</td>
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<td>Zeaxanthin</td>
<td>Zea</td>
<td>Cyanophytes</td>
</tr>
<tr>
<td>Chlorophyll b</td>
<td>Chl b</td>
<td>Green algal groups</td>
</tr>
<tr>
<td>Divinyl chlorophyll a</td>
<td>DV chl a</td>
<td>Prochlorophytes</td>
</tr>
</tbody>
</table>
Phytoplankton biomass

Crawford et al., 2011: ‘Data from November to July for all sites (except site 4 which was dropped after sampling in November and December 2009) were pooled to examine ‘annual’ spatial patterns (Figure 47). The nearshore sites tended to have greater densities of phytoplankton. Diatoms were the dominant phytoplankton type at site 1, 5 and 6; that is the nearshore stations. Noctiluca was most abundant at site 1 followed by site 5 and rarely present at the other sites. Other dinoflagellates were less abundant overall than the other groups but showed similar patterns of abundance, declining with distance from shore. ‘

Figure 47 - Averaged biomass of phytoplankton types at 6 sites in Storm Bay. (source Crawford et al. 2011)
Crawford et al., 2011: ‘Temporal trends in phytoplankton abundance were estimated for the entire study by averaging across all sites. If there was a spring bloom we did not observe it when sampling in November 2009 (Figure 48). There was a substantial bloom of diatoms in January. At the same time the heterotrophic dinoflagellate Noctiluca also peaked, probably supported by the diatom bloom. There was another peak in diatoms in April and a subsequent peak in Noctiluca in May.’

![Figure 48 - Temporal patterns of phytoplankton in Storm Bay. (source Crawford et al. 2011)](image)

More recent work by Buchanan et al., (2014) showed that; ‘an intensifying EAC created a greater subtropical influence, leading to changes in the physical and biological oceanography of the region. In this cool temperate setting seven species of dinoflagellates, all in the genus Ceratium, which are more typically associated with warm waters of eastern Australia, were observed. Chlorophyll a concentrations revealed a distinct spring bloom event and an extended, productive summer, typical of temperate and subantarctic systems, respectively. This suggests the region is a transitional state between classic seasonal primary production cycles for temperate and subantarctic waters.’
Comparison to historical data - CSIRO studies 1985-89

Harris et al., (1991) undertook weekly observations at a sampling station in Storm Bay (43°10'S, 147°32'E) over a period of 4 years from March 1985 to March 1989.

They provided strong evidence for the very dynamic nature and variability of the waters in Storm Bay and the strong influence of wind events in the productivity of the system:

- Sea surface temperature (SST) could warm by 2.5°C from the cool, windy summer of 1986-87 to 1989.
- Warm years were characterized by an increased north-easterly, subtropical influence and cool years by an increased south-westerly, subantarctic influence.
- Intrusions of subtropical water could be detected by increased salinities and very low dissolved inorganic phosphorus
- Phosphate concentrations in Storm Bay in the summer of 1988-89 were one-half of the concentrations measured in 1985. Winter nitrate concentrations in 1988 were also one-half of average.
- Total nitrogen (range 2-20uM), phosphorus and dissolved organic carbon (range 60-200uM) concentrations in surface waters (10m depth) fell steadily throughout the sampling period. Pulses of algal growth (measured as Chlorophyll) followed peaks in the 40-day wind oscillation and resulted from the re-suspension of nutrients regenerated by decomposition in bottom waters.
- Surface nitrate concentration ranged from 0-4.5uM and bottom nitrate was always higher with a maximum of 8uM, surface phosphate ranged from 0-0.8uM, and Chlorophyll ranged from 0.5-8ug/l.
- Windy periods (such as the summer of 1986-87) were marked by high nitrate and dissolved organic nitrogen concentrations in surface waters. Episodes of 'new' production therefore followed periods of increased westerly wind stress. There was thus a strong interaction between the time scales of wind events, nutrient uptake, phytoplankton growth, grazing, sedimentation, decomposition and re-suspension.
- Particle size data and data on the size fractionation of the zooplankton biomass indicated a strong trend towards more oligotrophic conditions in surface waters during the warm, calm period after 1987
- The phytoplankton community was dominated by small flagellates, indicative of regenerated production rather than the large diatoms characteristic of new production in the cool, windy years.
- The very oligotrophic conditions of the summer of 1988-89 led to small copepods dominating, and the elimination of all large zooplankters.
The entire chain of events appears to have been associated with the major La Nina 'Cold Event' of 1988.

Crawford et al., (2011): ‘A comparison of the preliminary environmental data collected in 2010 with data collected by CSIRO at the same site in Storm Bay in 1985-89 indicates that salinities tended to be higher in 2010 in autumn and early winter compared with over two decades ago and temperatures are now tending towards the higher values of 1985-89. Phosphate are clearly lower for most of the year in 2010, whereas nitrates are generally similar although indicate a pattern of higher winter values over an extended winter period. Chlorophyll a values in 2010 were mostly lower than in the 1980’s, implying lower productivity. These preliminary data indicate changes are occurring and if the indications of lower productivity are correct then a reduction in fishery output can be expected. However additional monthly data are required to determine whether change is long term or merely interannual variability, and to provide the replication necessary for statistical analysis.

When comparing results over time there is a concern that the techniques and analytical equipment used will have changed so the results may not be directly comparable. However, one of the co-investigators in the current project, Lesley Clementson, conducted the nutrient analyses of the data from 1985-89. The flow injection technique she used was relatively new at the time and is still used today. The auto analyser type system that was used for the analyses in 2009-10 is probably capable of lower detection limits compared to those of the 1980’s, but the levels recorded in Storm Bay are unlikely to show any difference. Chlorophyll a results, however, should be viewed with caution because both the extraction and analytical techniques differed between the two sampling periods.’

5.1.5 Sediments

Sediment chemistry

Refer to the Initial Environmental Assessment (Appendix H).

The Geophysical survey and mapping report provided by CSIRO showed the sediments to be highly uniform across the whole survey area and similar to the sediments found at the south of Trumpeter Bay (SB)1-4 sites in the previous 2014 survey for Amendment 1. The sediments were described as fine to medium sands with some silt in places.

From the ROV survey the majority of sites shared the common features of fine to medium-grained rippled sands, with varying amounts of shells and shell grit or gravel. Shells and shell grit appeared more prevalent towards the northern and more shallow end of the survey area and were especially prevalent at sites R1 and R8.

The results for the sediment grab samples mirror the film footage in that all sites were composed of fine to medium rippled sands, yellow-brown in colour. Again, the two
exceptions were sites 1 and 8 where larger shell debris dominated the samples. Dark grey/black silt was also present beneath the surface at several sites across the survey area.

The fine to medium grained sands dominating the whole survey area are broadly indicative of a sedimentary environment with moderate agitation of seabed sediments. These patterns are considered typical of sediments in exposed locations. The overall similarity in particle size distribution between sites implies similar depositional environments.

Extract from the Marine Farming Development Plan for Storm Bay off Trumpeter Bay North Bruny Island (1998):

‘Aquahealth et al (1996) assessed sediment and biological quality at two sites within the exploratory lease (100m apart) and two control sites off the lease site (1.4km apart), prior to placement of the exploratory fish cage.

The bottom was found to be typically sand with minor corrugations. Across all four sites the sediment profile was typically yellow sand to a depth of 3-4 cm, and then becoming a yellow-brown sand at further depths. The sediments had a clayey nature and gritty content (mainly due to fine shell fragments). Rocks and boulders were not observed.

The pH values of sediments ranged between 7.79 and 8.18, reflecting the marine conditions. Temperature values ranged between 9.8°C and 12.5°C, reflecting the winter sampling period. The Eh values ranged between 303 and 310 mV and this indicated that the water column was well oxygenated at the surface, with the Eh value decreasing with increasing sediment depth. The % Loss-On-Ignition values ranged between 2.6% and 3.7%, indicating a low to moderate level of organic enrichment.’

Benthic infauna

The Benthic Infauna observed in the latest survey work is broadly consistent with all previous survey work in the Storm Bay off Trumpeter Bay North Bruny Island, MFDP. The Initial Environmental Assessment for this proposed zone is included in Appendix H. It notes that larger infauna found in multiple grab samples across the survey area included heart urchins, Screw shells, bivalves and gastropods, with the occasional hermit crab.’ In addition, ‘There appeared to be numerous Anthozoa (suspected Edwardsiidae) at most sites.’

Extracts from the original Trumpeter Bay lease (approximately 3.5-4kms to the south of the proposed Yellow Bluff zone) Environmental Baseline surveys can be found at Appendix A:

In the original Trumpeter Bay 30ha lease survey (Dec 2014), it was noted that ‘Benthic infaunal analysis revealed high faunal diversity, with a total of 543 individuals from 68 species identified across the 12 samples. Faunal communities were dominated by crustaceans, accounting for 48.8% of individuals and 41.2 % of species identified. The
remaining fauna was mainly comprised of bivalves and polychaetes, which were comparable in terms of abundance and diversity. Other fauna, including echinoderms, nemerteanas, nematodes and ascidians, were recorded in low numbers. The most common families recorded included Euphilomedidae (ostracod), Veneridae (bivalve mollusc), Phoxocephalidae (amphipod) and Spionidae (polychaete).

Observed faunal patterns were within the range expected for an unimpacted ecosystem, with relatively diverse communities and low levels of single species dominance. Based on the benthic faunal patterns present, any future benthic impacts should be readily observable.'

During the subsequent Trumpeter Bay lease 70ha baseline survey (Sept 2016) Benthic infaunal analysis revealed high faunal diversity, with a total of 2390 individuals from 109 taxa identified across the 12 samples. Faunal communities were dominated by crustaceans, accounting for 36.5% of individuals and 41.3% of species identified. The remaining fauna was mainly comprised of polychaetes, anthozoans and molluscs. Other fauna (including ascidians, echinoderms, nemerteans, nematodes, phoronids, platyhelminths and sipunculids) were recorded in low numbers.

The most common family recorded during the survey was the anthozoan family Edwardsiidae. Overall, this taxa accounted for 22.5% of all animals counted. While this group is occasionally recorded from benthic samples in Tasmanian coastal waters, the densities recorded during the current survey were unusually high. In past surveys of the Trumpeter Bay area, anthozoans were either absent or present in low densities. It appears that a significant recruitment event has occurred for this particular taxa.'

An extract from the Marine Farming Development Plan for Storm Bay off Trumpeter Bay North Bruny Island (1998): stated that ‘The density of invertebrates (average density of 1340 individuals per m2) was within the range for those found in other South East Tasmanian sites (eg. Nubeena, South Roaring Beach and Great Taylors Bay). However, the average richness of the Trumpeter Bay site was lower than these other South East Tasmanian sites. The number of individuals and taxa were also much lower than those recorded for shallow inshore habitats by Moverley and Jordon (1996).

Crustaceans accounted for 50% of the 55 taxa identified at the sites. The dominant biomass was the New Zealand screwshells. Small pipis and hermit crabs were occasionally present at all the sites.'

5.1.6 Geoconservation Sites

A search of the Tasmanian geoconservation database3 identified a number of geoconservation sites within 5 km of the new lease areas.

One site, the Variety Bay Coastal Karst, is within approximately 2 km of the closest zone. As the name suggests, this is located along the coast of Variety Bay. The site has local significance.

Another locally significant site is the Cape Queen Elizabeth Erosional Surface, which is approximately 3 km to the south of the southernmost lease area.

There are an additional three geoconservation sites listed on the western side of Bruny Island in Great Bay. However, these are approximately 5 km away from the proposed zones at their closest point and on the opposite side of Bruny Island.

5.1.7 Wind and Wave Conditions

Extract from the Marine Farming Development Plan for Trumpeter Bay (1998):

‘The site is reasonably well protected from the southwest - northwest winds, although strong northwest gales can provide choppy wave conditions. The site is more exposed to southeast winds and seas, but these are typically uncommon during summer periods. However, a strong southeast gale can be expected every 2-3 years. Strong northeast winds would typically generate up to 3m waves at the site.

The most extreme wave conditions are from southerly seas. The CSIRO (1996) undertook a prediction of wave conditions at Trumpeter Bay based on an assessment of an eight-year
program of wave observations at Wedge Island. Wedge Island is located some 20 kms to the east of Trumpeter Bay within Storm Bay and both sites are similarly exposed to southerly seas. The Wedge Island site is more exposed to westerly winds than the Trumpeter Bay site, but not so exposed to easterly winds. Trumpeter Bay has 30m depth of water compared with 40 m at Wedge Island, but the latter is closer to the shelf edge and it is likely to experience slightly rougher conditions than Trumpeter Bay.

The prediction of extreme wave conditions over a ten-year period was for a wave height of 9.64 m with a mean event duration of 20 minutes. It was stressed that the prediction is only a tentative estimate, until such time as more detailed wave measurements can be taken. The maximum wave height observed at the site during the exploratory lease period was 6m. Discussions with local people indicated that swells were normally less than 2m and any waves greater than 4m were infrequent conditions.’

Data provided by BoM for the nearest BoM station (Figure 50) shows that the predominant winds in the morning tend towards north and westerly and that in the afternoon these change to more south and westerly. However, as expected westerlies are predominant for the region.

Modelled wave and wind hindcasts for a point 1.8km south-east of the Initial Environmental Survey area, and 2.8km to the south-east of the proposed lease area are presented in Figure 51. The wind data essentially reflects that provided for the nearest BoM station. The modelled wave heights show a very strong predominance for waves to come from the south with a maximum significant wave height of 4.3m, noting that the significant wave height rarely exceeds 2.5m.

Figure 50 - Wind roses for the nearest BoM station (Cape Bruny Lighthouse) (source: Bureau of Meteorology)
Figure 51 - Wind and significant wave height hindcast plots for the east of Yellow Bluff zone 1979-2010
Wave exposure (Figure 52) is rated as high for the SB 1-4 zones. The proposed Yellow Bluff site is rated medium wave exposure.

Figure 52 - Wave exposure in the Bruny Island and Huon-Channel region (source: Parsons 2012 after Barrett et al 2001)
The surface residual flows for the area as provided by Herzfeld (2008) suggest that the predominant surface wind induced waves and currents will also be westerly (Figure 53).

Figure 2.1. Surface residual flow
(a) Autumn  (b) Winter

Figure 53 - Seasonal surface currents (source: Herzfeld 2008)
5.2 Flora and Fauna

The proposal has no impact on any land areas, with only changes to the marine farming zone and hence the potential for impact on marine species which are covered in the sections below. There will be no impacts on terrestrial flora or fauna.

5.2.1 Marine Vegetation

The Initial Environmental Assessment (Appendix H) found no real significant presence of marine vegetation in any part of the survey area. The only algae’s detected were green and red drift algae, which are common to Storm Bay in general at least around the north of Bruny island, and very occasional small reds attached to larger shells and shell debris at those sites where larger shells naturally seem to collect. There were no reefs or unconformities of any kind observed that might suggest possible substrate for macroalgae (Appendix H).

5.2.2 Benthic Fauna

Extract from the Initial Environmental Assessment (Appendix H):

‘The fauna was depauperate consisting generally of ascidians and Screw shells (found at most sites), and Japanese seastars, Hermit crabs and Ribbon worms (at a few sites only). However, there appeared to be numerous Anthozoa (suspected Edwardsiidae) at most sites. Two introduced species were identified from the survey footage, the Japanese seastar (A. amurensis) and the Screw shell (M. roseus).’

Extract from the original Trumpeter Bay lease (4kms to the south of the proposed Yellow Bluff zone) Environmental Baseline surveys (Appendix A):

Trumpeter Bay 70ha survey (Sept 2016)

‘Consistent with the previous Trumpeter Baseline survey undertaken during August 2014, all sites shared the common features of rippled sand, shell grit and old shells. The fauna was generally depauperate consisting of Maoricolpus shells (live and old), with occasional sycozoan stalks at some sites and hermit crabs. There was also an occasional ribbon worm. Maoricolpus appeared to decrease in number with depth (or possibly towards the east and southeast), and certainly the great majority of the live shells were observed in the shallower areas of the lease. The only introduced species identified during the survey was the New Zealand screw shell Maoricolpus roseus.’

5.2.3 Fish

The occasional flounder, flathead and stingray were identified in the Initial Environmental Assessment (Appendix H), and juvenile flathead, sea moth or flounder
were observed in the Environmental Baseline surveys from the original Trumpeter Bay lease 4kms to the south of the proposed Yellow Bluff zone (Appendix A).

Various recreational fishing sources (e.g. Tasfish, DPIPWE, 2010, information sheets) describe a number of fish species could be expected to pass by the zones, and some will frequent the shallower waters/reefs of the eastern shores of Bruny Island. The most common of these species and certainly those of interest to anglers include Australian Salmon (especially around headlands), Barracouta, Gummy and School Sharks, calamari and Arrow Squid (these species are widespread and prevalent in Storm Bay during the warmer months). Morwong, Striped Morwong and Striped Trumpeter can be found at times in the region. Flathead are common, and Gurnards are encountered over sand and reef areas. Cod are prolific on the inshore reefs where Bastard Trumpeter and Bluethroat Wrasse can also be found.

In consultation with commercial abalone divers there is also some suggestion that the eastern side of North Bruny is likely to have a Great White Shark population. However, in Huon Aquaculture’s experience if properly managed through the prompt removal of any dead fish on the bottom of the net then salmon farming activities should not lead to an increase in the presence of sharks in and around farm sites. Sharks that have on occasion been sighted in and around fish farms included seven gill sharks and schooling sharks in the Huon River/D’Entrecasteaux Channel areas.

In addition, Huon’s new “Fortress Pens” provide a significant barrier between all native inhabitants of the waterway and the farmed salmon, and have fish mortality removal systems incorporated into their design (Lift-up systems) that remove any dead fish from the bottom of the pens on a regular and frequent (potentially numerous times daily) basis. As a result, it is unlikely that sharks will be able to feed off the salmon mortalities (morts). In addition, seal numbers will be managed by preventing access to the salmon or their being able to use the pen as a “haul-out”. Huon Aquaculture will keep a log of shark interactions at the amended zones.

### 5.2.4 Birds

Storm Bay contains nesting, feeding and roosting habitat for a range of bird species including waders, waterfowl, seabirds, woodland birds and raptors. Two approaches were used by Birdlife Tasmania to identify the bird species that were potentially at risk in their report ‘Bird species at potential risk, proposed Huon Aquaculture lease alterations assessment’ (Appendix J).

The first approach identified birds recorded in Trumpeter Bay from the BirdLife Tasmania database (Table 17) 16 January 2013.
Table 17 - Bird species identified in Trumpeter Bay

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<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status</th>
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<td>Acanthiza pusilla</td>
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</tr>
<tr>
<td>Halieaeetus leucogaster</td>
<td>White-bellied Sea-Eagle</td>
<td>T</td>
</tr>
<tr>
<td>Hirundo neoxena</td>
<td>Welcome Swallow</td>
<td></td>
</tr>
<tr>
<td>Hirundo nigricans</td>
<td>Tree Martin</td>
<td></td>
</tr>
<tr>
<td>Larus dominicanus</td>
<td>Kelp Gull</td>
<td></td>
</tr>
<tr>
<td>Larus pacificus</td>
<td>Pacific Gull</td>
<td>C</td>
</tr>
<tr>
<td>Lichenostomus flavicollis</td>
<td>Yellow-throated Honeyeater</td>
<td>E</td>
</tr>
<tr>
<td>Malurus cyaneus</td>
<td>Superb Fairy-wren</td>
<td></td>
</tr>
<tr>
<td>Melithreptus affinis</td>
<td>Black-headed Honeyeater</td>
<td>E</td>
</tr>
<tr>
<td>Morus serrator</td>
<td>Australasian Gannet</td>
<td>C</td>
</tr>
<tr>
<td>Pardalotus striatus</td>
<td>Striated Pardalote</td>
<td></td>
</tr>
</tbody>
</table>
The second approach lists bird species that have been recorded within 5 km of the centroids for each of the proposed and amended lease areas (Table 18).

**Table 18 - Species with elevated conservation status listed under the Tasmanian TSPA 1995 and/or the Federal EPBC Act 1999 recorded within 5km of the new current meter mooring.**

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Date</th>
<th>Lat Lon</th>
<th>TSPA</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aquila audax</em></td>
<td>Wedge-tailed Eagle</td>
<td>4-Mar-06</td>
<td>43.0800 147.4100</td>
<td>X</td>
</tr>
<tr>
<td><em>Haliaeetus leucogaster</em></td>
<td>White-bellied Sea-Eagle</td>
<td>4-Mar-06</td>
<td>43.0800 147.4100</td>
<td>X</td>
</tr>
<tr>
<td><em>Pardalotus quadragintus</em></td>
<td>Forty-spotted Pardalote</td>
<td>4-Mar-06</td>
<td>43.0800 147.4100</td>
<td>X</td>
</tr>
<tr>
<td><em>Thalassarche chlororhynchos</em></td>
<td>Yellow-nosed Albatross</td>
<td>17-Feb-96</td>
<td>43.0830 147.4120</td>
<td></td>
</tr>
</tbody>
</table>

**5.2.5 Marine Mammals**

The Natural Values Atlas lists only two records of two threatened marine mammal species within a 5km radius of the proposed zone and amended zones:
• Southern Right Whale (*Eubalaena australis*), which is listed as endangered under both the Tasmanian Threatened Species Protection Act 1995 (TSPA) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBCA)

• Humpback Whale (*Megaptera novaeangliae*), which is listed as endangered under the Tasmanian Threatened Species Protection Act 1995 (TSPA) and vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBCA).

Although no other records of marine mammals have been recorded on the Natural Values Atlas within 5 km from the sites, other (non-threatened) marine mammals that have been recorded within 10 km of the sites and which are likely to occur within a 5 km area of the project include:

• Common Dolphin (Delphinus delphis)

• Australian Fur Seal (*Arctocephalus pusillus subsp. doriferus*)

• Minke Whale (*Balaenoptera acutorstrata*).

Guidance about what might be expected for some of these species can be drawn from the experience at Huon Aquaculture’s existing sites in Storm Bay (refer to Section 5.2.5).

### 5.2.6 Threatened Species

#### Threatened Marine Species

Table 19 - Listed threatened fauna species that may occur in the area lists threatened marine species recorded in the Natural Values Atlas (source: theList) as occurring or likely to occur in the area surrounding the proposed lease. Additional information with regard to marine mammals is provided in Section 5.2.5 above.

Table 19 - Listed threatened fauna species that may occur in the area

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>TSPA listing</th>
<th>EPBCA listing</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Thymichthys politus</em></td>
<td>Red Handfish</td>
<td>Endangered</td>
<td>Critically Endangered</td>
</tr>
</tbody>
</table>

4 Species listed in the Tasmanian Threatened Species Protection Act 1994

5 Species listed in the Environment Protection and Biodiversity Conservation Act 1999
<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Conservation Status</th>
<th>Habitat Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Brachionichthys hirsutus</em></td>
<td>Spotted Handfish, Endangered Critically Endangered</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Parvulastra vivipara</em></td>
<td>Tasmanian Live-bearing Seastar Vulnerable Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Gazameda gunni</em></td>
<td>Gunn’s Screw Shell Vulnerable NL</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Carcharodon carcharias</em></td>
<td>Great White Shark Vulnerable Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Mirounga leonina</em></td>
<td>Southern Elephant Seal Endangered Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Arctocephalus tropicalis</em></td>
<td>Sub-Antarctic Fur Seal Endangered Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Balaenoptera borealis</em></td>
<td>Sei Whale NL Vulnerable</td>
<td></td>
<td>Marine</td>
</tr>
<tr>
<td><em>Arctocephalus forsteri</em></td>
<td>Long-nosed Fur-Sea Rare NL</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Balaenoptera acutorostrata</em></td>
<td>Dwarf Minke Whale NL Marine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Balaenoptera bonaerensis</em></td>
<td>Antarctic Minke Whale NL Marine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Delphinus delphis</em></td>
<td>Common Dolphin NL Marine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Grampus griseus</em></td>
<td>Risso’s Dolphin NL Marine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Tursiops truncatus</em></td>
<td>Bottlenose Dolphin NL Marine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Caperea marginata</em></td>
<td>Pygmy Right Whale NL Migratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lagenorhynchus obscurus</em></td>
<td>Dusky Dolphin NL Migratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Orcinus orca</em></td>
<td>Killer Whale NL Migratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Megaptera novaeangliae</em></td>
<td>Humpback Whale Endangered Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Balaenoptera musculus</em></td>
<td>Blue Whale Endangered Endangered</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All the marine species listed in Table 19 are transient animals, except for the Red Handfish, the Spotted Handfish, the Tasmanian Live-bearing Seastar and the Gunn’s Screw Shell. According to the Natural Values Atlas, none of these species have been recorded within 4km of the proposed lease area.

**Gunn’s Screw Shell (Gazameda gunnii)**

Huon Aquaculture commissioned Marine Solutions Tasmania Pty Ltd to undertake a survey for the Gunn’s Screw Shell in and around the south of Trumpeter Bay (SB 1-4) zones during February 2014 (refer to Appendix A). The company then further commissioned Aquaculture, Management and Development Pty Ltd to undertake a survey for the Gunn’s Screw Shell at east of Yellow Bluff during October 2016 (refer to Appendix H). Both surveys were undertaken using the specifications provided by DPIPWE.

The survey reports are provided in Appendices A and H.

No evidence was found for the presence of Gunn’s Screw Shell during either survey at any of the proposed zones. However, empty (old) Gunn’s Screw Shell shells have been found in the original Trumpeter Bay lease baseline surveys provided in Appendix A.

**Spotted Handfish (Brachionichthys hirsutus)**

According to the Natural Values Atlas, there have been no recordings of the Spotted Handfish within 4km of the proposed zone areas. However, should the species be detected within the proposed zone during any environmental surveys, a targeted Spotted Handfish survey can be conducted.

**Threatened Bird Species**

Table 20 lists threatened bird species recorded in the Natural Values Atlas (source: theList) as occurring or likely to occur in the area surrounding the proposed zones. Additional information with regard to birds is provided in Section 5.2.4 above.
Table 20 - Listed threatened bird species that may occur in the area

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>TSPA listing</th>
<th>EPBCA listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haliaeetus leucogaster</td>
<td>White-bellied Sea-eagle</td>
<td>Vulnerable</td>
<td>NL</td>
</tr>
<tr>
<td>Aquila audax fleayi</td>
<td>Wedge-tailed Eagle</td>
<td>Endangered</td>
<td>Endangered</td>
</tr>
<tr>
<td>Pachyptila turtur subantarctica</td>
<td>Southern Fairy Prion</td>
<td>Endangered</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Ardenna tenuirostris</td>
<td>Short-tailed Shearwater</td>
<td>NL</td>
<td>Marine/migratory</td>
</tr>
<tr>
<td>Catharacta skua</td>
<td>Great Skua</td>
<td>NL</td>
<td>Marine</td>
</tr>
<tr>
<td>Diomedea epomophora epomophora</td>
<td>Southern Royal Albatross</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Diomedea exulans antipodensis</td>
<td>Antipodean Albatross</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Diomedea exulans gibsoni</td>
<td>Gibson's Albatross</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Diomedea exulans</td>
<td>Wandering Albatross</td>
<td>Endangered</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Fregetta grallaria grallaria</td>
<td>White-bellied Storm-Petrel (Tasman Sea)</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Halobaena caerulea</td>
<td>Blue Petrel</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Macronectes halli</td>
<td>Northern Giant-Petrel</td>
<td>Vulnerable</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Pterodroma mollis</td>
<td>Soft-plumaged Petrel</td>
<td>Rare</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Sternula nereis nereis</td>
<td>Australian Fairy Tern</td>
<td>Endangered</td>
<td>Vulnerable</td>
</tr>
</tbody>
</table>

6 Species listed in the Tasmanian Threatened Species Protection Act 1994
7 Species listed in the Environment Protection and Biodiversity Conservation Act 1999
<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Vulnerability</th>
<th>Endangered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thalassarche bulleri</td>
<td>Buller's Albatross</td>
<td>Vulnerable</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Thalassarche cauta</td>
<td>Shy Albatross, Tasmanian Shy Albatross</td>
<td>Vulnerable</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Thalassarche salvini</td>
<td>Salvin's Albatross</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Thalassarche cauta steadi</td>
<td>White-capped Albatross</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Thalassarche melanophris</td>
<td>Black-browed Albatross</td>
<td>Endangered</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Thalassarche impavida</td>
<td>Campbell Albatross</td>
<td>NL</td>
<td>Vulnerable</td>
</tr>
<tr>
<td>Diomedea epomophora sanford</td>
<td>Northern Royal Albatross</td>
<td>NL</td>
<td>Endangered</td>
</tr>
<tr>
<td>Macronectes giganteus</td>
<td>Southern Giant-Petrel</td>
<td>Vulnerable</td>
<td>Endangered</td>
</tr>
<tr>
<td>Thalassarche chrysostoma</td>
<td>Grey-headed Albatross</td>
<td>Endangered</td>
<td>Endangered</td>
</tr>
</tbody>
</table>

All of the bird species are oceanic seabirds which generally travel great distances except for the White-bellied Sea Eagle, the Wedge-tailed Eagle and the Australian Fairy Tern.

There were four records listed on the Natural Values Atlas for the Wedge-tailed Eagle however, they were all in the one location, 2.5km to the north east of the zone area. This record was out to sea in Storm Bay and therefore does not reference a likely nesting location.

There are three records listed on the Natural Values Atlas for the White-bellied Sea Eagle approximately 2.5km to the south west of the zone area. It is possible that this location has been used as a nesting site for this species.

There are 331 records of the Australian Fairy Tern listed on the Natural Values Atlas, only two of which occur on Bruny Island. Both of these recordings are at the Neck Beach, a minimum of 10kms away from the proposed zone area.
**Threatened flora**

Two threatened plant species, the Forest Germander (*Teucrium corymbosum*) and the Shale Pellitory (*Parietaria debilis*), both listed as rare under the TSPA, have been recorded approximately 15km south from the lease area in Variety Bay.

### 5.3 Reservations

Reservations in the general region surrounding the marine farming zone are shown in Figure 54 below.

![Reservations in the region](image)

*Figure 54 - Reservations in the region (source: theList) 2017. (Zone outlines indicate approximate position only)*

**5.3.1 World Heritage Areas**

There are no World Heritage Areas within or in the proximity of the proposed zone.

**5.3.2 Ramsar sites**

There are no Ramsar sites within or in the proximity of the proposed zone.
5.3.3 **Marine Reserves**

There are no marine reserves within 5km of the proposed zone. The closest marine conservation area is Tinderbox Marine Nature Reserve, which is over 9km away as the crow flies to the northwest of the proposed lease area.

5.3.4 **National Parks**

There are no national parks within the proximity of the zone. The closest, the South Bruny National Park, is located over 25km to the south of the area.

5.3.5 **Other Conservation Areas**

Other conservation areas are shown in Figure 54 above.

There are two Land Conservation Areas listed under the *Nature Conservation Act 2002* on the eastern side of North Bruny, albeit that after a thorough search of online documents their actual conservation purpose does not appear to be listed:

- **The Cape de la Sortie Conservation Area** which occupies the eastern side of Dennes Point. The conservation area is approximately 100m wide and 5km to the northwest of the Yellow Bluff zone at its closest point and >10 km from the amended SB zones 1-4 at their closest point.

- **The Red Reef Conservation Area** which follows the coast from Variety Bay to approximately 1.5km north of Red Reef. The conservation area is approximately 150m wide and 6km to the south of the Yellow Bluff zone at its closest point and 2km from the amended SB zones 1-4 at their closest point.

Additional land reserves within 5km of the zone include the Dennes Hill Nature Reserve, which is approximately 5km northwest of the Yellow Bluff zone, and Marks Point Conservation Area, which is 4.5km to the west of the Yellow Bluff zone at Barnes Bay.

5.4 **Land Planning Aspects**

5.4.1 **Land Tenure**

Land tenure in the region surrounding the proposed zones is shown in Figure 55.
Figure 55 - Land tenure in the region surrounding the proposed new and amended zones (source: theList). Zone outlines indicate approximate position only.
The main land tenure adjacent to the proposed zones is private freehold land with a small strip of conservation covenant at One Tree Point. There are no land tenures that conflict with marine farming.

5.4.2 Land Zoning

Land zoning in the region surrounding the Trumpeter Bay zone is shown in Figure 56. Bruny Island falls within the Kingborough Council Municipal Area and is zoned under the Kingborough Council Interim Planning Scheme 2015. There are two land zonings adjacent to the lease area; the Environmental Management and Rural Resource zones. None of the surrounding land zoning conflicts with the proposed marine farm zone amendments.
Figure 56 - Land zoning in the region surrounding the proposed new and amended zones (source: theList). Zone outlines indicate approximate position only.
5.4.3 Land Use
There are no sensitive land use areas in the vicinity of the land adjacent to the proposed zones. The adjacent land is rural.

5.5 Maritime Aspects
The far south of Tasmania is renowned for the quality of its commercial and recreational fishing, yachting, and coastal landscapes.

A study undertaken by the Institute of Marine and Antarctic Studies (IMAS) (Ogier and McLeod (2013)) states that “for resource planning and management to be effective, it is important to understand all the various values held by different communities and users (of) this marine environment.”

5.5.1 Commercial shipping
TasPorts have advised that the proposed amendment location was not currently regarded as an issue for commercial shipping. Specifically, TasPorts provided guidance on the amount of sea-room that was required for safe commercial shipping in the region and this is shown in Figure 93.

Should TasPorts and MAST require any changes to lease marking and lighting for the proposed new and amended zones then Huon Aquaculture will fully comply with all requirements.

5.5.2 Recreational boating
Tasmania has the highest level of recreational boat ownership in Australia with one boat for every 17 Tasmanians. The eastern shore of North Bruny Island is utilised by a range of recreational boaters. In good weather conditions, the area is frequented by sailors, fishermen and divers, originating from the Hobart area and visiting from other regions. During inclement weather, boaters may track along the eastern side of Bruny Island to avoid adverse and/or dangerous weather conditions.

In addition, the Royal Yacht Club of Tasmania typically conducts one overnight race and two to three daylight races in the Bruny Island area. The routes of these races are summarized below:

The annual Veolia Bruny Island Race starts on Regatta Day Saturday (10 February 2018) and usually travels south through the D’Entrecasteaux Channel, rounding The Friars and making its way back into the river via the eastern side of Bruny Island. Most of the boats travel up the eastern shore of Bruny Island late in the evening and on into the early hours of Sunday morning.
Day-races ‘outside’ Bruny Island are conducted by the Royal Yacht Club of Tasmania and other senior clubs. Their turning marks are in Bull Bay, Trumpeter Bay and rarely, further south in Variety Bay. These races start at 10am and are sailed entirely in daylight hours. Anchorages on the eastern side of Bruny Island are listed in Figure 58.

In addition to the locally run yachting races, the Royal Yacht Club of Tasmania in conjunction with the Cruising Yacht Club of Australia, run the Sydney to Hobart Yacht Race. Whilst the race typically tends to utilise the eastern side of Storm Bay, there have been occasions when participants have used the western side as a result of severe weather or vessel damage/equipment failure. A map of the route is provided below in Figure 57.

![Sydney to Hobart Yacht Race Route](image)

**Figure 57 - Sydney to Hobart Yacht Race Route showing transit through storm bay**

### Anchorages

The nearest anchorages to the proposed Yellow Bluff lease and amended SB zones 1-4 are shown in Figure 58. There are clear sight lines (created by MAST) and access
routes to all anchorages shown on the map in Figure 93. The minimum distance from shore of 1.6km to the proposed east of Yellow Bluff lease and amended SB zones 1-4 allows for sufficient “sea-room” to readily access local anchorages.

Figure 58 - Anchorages (indicated by yellow labels) off the eastern shoreline of North Bruny Island (source: South East Tasmanian Boating Guide MAST)
5.5.3 Commercial fishing

Commercial fishing is predominantly abalone and stock levels were stated as “very low, and many (divers) were concerned about the future of this part of the fishery.” (Tarbath 2012). According to the Tasmanian Rock lobster Association, rock lobster fishing is undertaken by a relatively small number of commercial fishers in the region covered by the Draft Amendment (Sansom, pers comm.). However, the western side of Storm Bay can be used as a transit way to fishing grounds further south.

Limited commercial seine fishing in undertaken in Storm Bay, two seine fishers are known to operate in Storm Bay. Initial indications from the commercial operators indicate that fishing activity in the area directly covered by this Draft Amendment is limited.

5.5.4 Recreational fishing

Recreational fishing is a well-recognised cultural pastime in Tasmania. South-east Tasmania has the highest recreational fishing participation of any region in Tasmania at 27% (Lyle, 2014). Participation in fishing has fallen around 5% between 2000 and 2013 state-wide (Lyle 2014). Key species caught in the south-east include Sand and Tiger flathead, scallops and Rock Lobster (Department of Primary Industries, Parks, Water and Environment (DPIPWE), 2010). Additionally, other known target species also includes; Australian salmon, calamari, Gould’s squid, barracouta, wrasse, flounder, gurnard, striped trumpeter, morwong, cod, mullet, school and gummy shark (outside the Shark Refuge Area).

Access to a wide range of popular recreational species such as flathead, Australian Salmon, abalone, Rock Lobster and scallops using a variety of fishing gear including rod and line, nets and pots and diving is available in the area around the proposed amended zones.

A survey of recreational fishers (Lyle, 2014) identified “relaxing in the outdoors with family and friends” as the most important reason for going fishing for over two-thirds of recreational fishers surveyed.

Consuming and catching fish were less important with only around a quarter of fishers saying that this was their primary motivation for fishing.

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The vast majority of fishers surveyed indicated that they preferred to retain enough fish for ‘a feed’ rather than catching bag limits.

Figure 59 below shows known recreational fishing hotspots around Bruny Island. The nearest spots to the proposed Yellow Bluff lease are at Dennes Point to the north and Adventure Bay to the south. Both are at significant distance from the site of the proposed Yellow Bluff lease.

There is no change as a result of the amendments to the SB1-4 leases.

Figure 59 - Known recreational fishing "hot-spots" around Bruny Island

10 ibid
5.5.5 Recreational activities

Sea-based
Recreational activities that take place in vicinity of the leases (excluding recreational fishing and boating) include diving, kayaking and marine wildlife viewing.

Land-based
The coastline adjacent to the proposed zone is privately owned and forms part of Murrayfield Station (a working sheep farm), owned and managed by weetapoona Aboriginal Corporation (wAC). Visitors to the farm are welcome with prior notice. Public access is limited and the coastline is characterised by steep cliffs.

North of the proposed zone are two privately held sheep farming properties, Waterview and Oceanview, which are likely to have visual impacts from the proposed amendment. One Landholder has expressed an intention to have a guided walk through the property as a commercial tourism venture.

5.6 Heritage

5.6.1 Aboriginal Heritage
A search by Aboriginal Heritage Tasmania (AHT) of the Tasmanian Aboriginal Site Index (TASI) found no Aboriginal heritage sites recorded within or close to the proposed development. AHT has advised that there is no requirement for an Aboriginal heritage investigation and that the AHT have no objection to the project proceeding.

In addition, the weetapoona Aboriginal Corporation (wAC) have indicated that the area in and around Trumpeter Bay is utilised to teach and maintain sea-based cultural practices.

5.6.2 European and Other Heritage
Places on North Bruny listed on the Tasmanian Heritage Register\textsuperscript{11}:

- (7078) Variety Bay Historic Site, 150 Trumpeter Road, North Bruny 7150
- *(7148) Pilot Station and Brick Kiln (part of Variety Bay Historic Site), 150 Trumpeter Road, North Bruny 7150
- (8219) Bruny Island Quarantine Station, 816 Killora Road, North Bruny 7150

\textsuperscript{11} Register last updated 16 December 2016.
- (8764) Kelly and Lucas' Bull Bay Whaling Station, 585 Bruny Island Main Road, North Bruny 7150
- (8763) Roberts Salt and Soap Factory Site, Lennon Road, North Bruny 7150
- (10696) Former Elizabeth Farm (Kelly’s Farm) Bruny Island Main Road, North Bruny 7150
- (10898) Woodcutters Point former Aboriginal Ration Station, 33 Grays Road, North Bruny 7150
- (10911) Woodlands, 35 Bruny Island Main Road, North Bruny 7150
- (10990) Waterview, 585 Bruny Island Road, North Bruny 7150.

Figure 60 - Locations of places on the Tasmanian Heritage Register on North Bruny (source: theList, accessed 20 January 2017)
Local government planning scheme heritage schedules

The Kingborough Council’s Planning Scheme establishes a Heritage Code with the intent of protecting items and places of heritage significance in the Kingborough Council’s municipal area. There are no places within or adjacent to the proposed development area, with the closest site (“Waterview”, 585 Bruny Island Road, North Bruny 7150.) approximately 2 km west of the proposed Yellow Bluff zone.

Other places of heritage significance

There are no places of heritage significance listed on the Register of National Estate, World Heritage List or National Heritage List within or in proximity to the proposed development.

5.7 Social and Economic Description

5.7.1 Population

Population data from the Australian Bureau of Statistics (ABS) has been accessed to describe the population of Bruny Island. Bruny Island has a total population of around 620 and the island is deceptively large, being almost 100km long.12 The Bruny Island/Kettering area (Figure 61) has a total population of 2,95813.


13 Regional Profile: Bruny Island - Kettering (Statistical Area Level 2), Australian Bureau of Statistics, 2014
Persons aged between 15 and 34 years are significantly under-represented in the Bruny Island – Kettering region when compared with the demographic data of both Tasmania and Australia as a whole (Table 21). This might point to a lack of perceived employment opportunities (the unemployment rate was 0.2% higher in the region when compared with a state-wide rate of 6.4% and 1% higher than the national average of 5.6%), other factors may include a lack of services (e.g. education and health) and the complicated transport (use of ferry) required to work “off-island”.

Persons aged between 55 and 74 are over-represented when compared with both Tasmanian and Australian demographic data. However, persons aged 75 years and older are under-represented when compared with Tasmanian demographic data and this might point to the need to move away from the region to access vital health services and aged care.

Figure 61 - Bruny Island statistical local area

Bruny Island-Kettering age data (2014)\textsuperscript{14}

Table 21 - Demographic structure of the Bruny Island - Kettering region

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>Tasmania</th>
<th>Diff +/-</th>
<th>Australia</th>
<th>Diff +/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 14 years</td>
<td>17.2</td>
<td>17.2</td>
<td>16.9</td>
<td>17</td>
<td>16.5</td>
<td>18.7</td>
<td>-2.2</td>
<td>18.9</td>
<td>-2.4</td>
</tr>
<tr>
<td>15 to 24 years</td>
<td>7.7</td>
<td>7.5</td>
<td>7.3</td>
<td>7.1</td>
<td>7.2</td>
<td>13</td>
<td>-5.8</td>
<td>13.7</td>
<td>-6.5</td>
</tr>
<tr>
<td>25 to 34 years</td>
<td>7.5</td>
<td>7</td>
<td>6.6</td>
<td>5.9</td>
<td>5.9</td>
<td>11.5</td>
<td>-5.6</td>
<td>14.3</td>
<td>-8.4</td>
</tr>
<tr>
<td>35 to 44 years</td>
<td>13.6</td>
<td>13.5</td>
<td>13.6</td>
<td>13.4</td>
<td>12.9</td>
<td>13</td>
<td>-0.1</td>
<td>14.1</td>
<td>-1.2</td>
</tr>
<tr>
<td>45 to 54 years</td>
<td>17.8</td>
<td>17.4</td>
<td>16.9</td>
<td>16.8</td>
<td>17</td>
<td>14.4</td>
<td>2.6</td>
<td>13.6</td>
<td>3.4</td>
</tr>
<tr>
<td>55 to 64 years</td>
<td>20.3</td>
<td>20.8</td>
<td>20.7</td>
<td>20.6</td>
<td>20.2</td>
<td>13.4</td>
<td>6.8</td>
<td>11.5</td>
<td>8.7</td>
</tr>
<tr>
<td>65 to 74 years</td>
<td>11.1</td>
<td>11.5</td>
<td>12.5</td>
<td>13.7</td>
<td>14.7</td>
<td>8.9</td>
<td>5.8</td>
<td>7.5</td>
<td>7.2</td>
</tr>
<tr>
<td>75 years and over</td>
<td>4.1</td>
<td>4.3</td>
<td>4.6</td>
<td>4.3</td>
<td>4.4</td>
<td>5.1</td>
<td>-0.7</td>
<td>4.5</td>
<td>-0.2</td>
</tr>
</tbody>
</table>

**Aboriginal and Torres Strait Islanders**

The percentage of total residents identifying as Aboriginal or Torres Strait Islander in the Bruny-Kettering region is 3.8% of the total population or 112 individuals (Table 22). This is slightly higher than within Australia (2.6%).

Table 22 - Aboriginal and Torres Strait Islander proportions in the Huon Valley region

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of total population %</td>
<td>3.8</td>
<td>4</td>
<td>-0.24</td>
<td>2.6</td>
<td>+1.2</td>
</tr>
</tbody>
</table>

**Movement**

On Census night in 2011, 69% of the Bruny Island-Kettering region population was still at the same address as five years ago.

**Labour force participation, unemployment and educational attainment**

In 2011, the Bruny Island-Kettering region reported 62.4% of the population to have post-school qualifications. This is significantly higher than the national average of 55.9%.

The unemployment rate in the Bruny Island – Kettering region was 6.1% representing 74 individuals compared to the Tasmanian unemployment rate of 6.4%. The participation rate in the labour force on census night in 2011 was 52.3% for the Bruny Island-Kettering region.
5.7.2 Economic

5.7.2.1. Tourism
Tourism Tasmania’s *Tasmanian Tourism Snapshot* reported that, for the year ending September 2016, the total number of visitors to Tasmania was 1.19 million, with 572,900 of those visitors holidaying in Tasmania. During the period October 2015 to September 2016, a total of 138,621 people visited Bruny Island, an increase of 32.2% from the previous year. 132,248 people visited Kettering, an increase of 15.2% from the previous year.

Land Based

Accommodation
A search for hotels in the Bruny Island-Kettering region returned 24 hotels and at least 44 private holiday rentals on Airbnb. There are also numerous camping and caravan facilities within both regions. Many hotel-style accommodation providers provide some form of food and beverage offering, with the typical type of offering being within the ‘pub meal/value for money’ price bracket.

Restaurants, Cafes, Bars and Other Food Outlets
There are a number of boutique cafes, restaurants and cellar door providers in the Bruny Island-Kettering region. Attractions such as Bruny Island Cheese, Bruny Island Berry Farm, Get Shucked Oyster Farm, the Bruny Island House of Whiskey and other small boutique producers bolster the food and beverage offering of the region, have created an opportunity for visitors to extend their stay because of a perceived wealth of places to eat. The *Made on Bruny Island Gourmet Trail* provides information on local growers and producers.

Cultural Heritage
Bruny Island was inhabited by Indigenous people until European arrival and there is still a large community of people who identify as Aboriginal. Abel Tasman attempted to land in the vicinity of Adventure Bay in November 1642. In 1773, Tobias Furneaux was the first recorded European to land on the island at Adventure Bay (named after his ship). Four years later, on 26 January 1777 James Cook's two ships, the *Resolution* and *Discovery* stayed in the bay area for two days.

The island itself was named after the French explorer Antonie Bruni d'Entrecasteaux, who explored the Channel region and found it to be an island in 1792. It was known as Bruni Island until 1918, when the spelling was changed to Bruny.
In 1829, the Van Diemen’s Land Government commissioned George Augustus Robinson to set up an Aboriginal mission on Bruny Island. While the exact whereabouts of the mission is unknown, it was somewhere on the site of present-day Murrayfield. The majority of the Tasmanian Aboriginal population was removed to the mission on the island, however they rapidly contracted European diseases for which they had no immunity. The mission was subsequently abandoned after 9 months and the buildings fell quickly into decay. Murrayfield is now owned and managed by the weetapoona Aboriginal Corporation (wAC)\(^\text{15}\).

The island was opened up to European settlement in 1856 when the Tasmanian timber industry expanded rapidly. Almost all settlements on South Bruny were originally opened as timber ports owned by the different timber companies operating on the island. Lunawanna (former Daniels Bay), Alonnah (former Mills Reef) and Adventure Bay/Cooktown were some of the largest ports operating on the island. Most settlements of South Bruny now serve as shack towns or holiday locations. Since European settlement, a State maritime quarantine station was established in 1884. During World War I, the island was used for the internment of German nationals and to quarantine soldiers during the Influenza Pandemic of 1919. It was proclaimed a State Reserve in 2003.

Since the 1920s, the island has become known as a holiday location with surfing beaches, National Parks and historical sites. In more recent history, Bruny Island was the site of a land transfer by the state Government to local Aboriginal people.\(^\text{16}\)

**Lookouts**

The narrow isthmus joining the two parts of the island is called "The Neck". This is home to the Truganini Lookout - a timber stepped boardwalk that takes you to some of the most spectacular 360° panoramic views of the Bruny Island coastline.

South Bruny is the site of the Bruny island Lighthouse; a significant drawcard for visitors on the island.

**Walks and Treks**

The Bruny Island Kettering region has a number of walks ranging in length and difficulty\(^\text{17}\), and includes Truganini Lookout, Mavista Nature Walk, Grass Point, Luggaboine Circuit, Mt. Mangana, Fluted Cape, Cape Queen Elizabeth, East Cloudy


Head, Labillardiere Peninsula, Slide Track, Alonnah Sheepwash Track, and Nebraska Beach to Bligh Point.

**Marine Based**

*Boat tours*

The major marine based tourism operator in the region is the highly acclaimed Pennicott Wilderness Journeys. There are also numerous recreational yacht and boat clubs in the area that offer private charter opportunities for leisurely cruises and fishing charters.

### 5.7.2.2 Industry

In 2011, 8.4% of the Bruny Island-Kettering population worked in the agriculture, forestry and fishing industries. A further 11% were working in health care and social assistance and an additional 10.8% working in education and training. The other major industries in the area are construction (9.9%) and public administration and safety (9.6%).

In 2016, the region’s aquaculture industry was reported as having an approximate value of approximately $526 million based on the region producing 73% of the state’s salmon production (the state-wide industry was worth a reported $721 million).

The median weekly personal reported income in 2011 was $441, and the median weekly family reported income $1,058.
6 POTENTIAL EFFECTS AND THEIR MANAGEMENT

6.1 Impacts on the Natural Environment

Huon Aquaculture mitigates its impacts on the environment through a comprehensive risk assessment program. This program includes the development of process flow diagrams for all freshwater and marine operations. At each step in these processes, all potential hazards that are reasonably expected to occur are identified and recorded, and management plans are prepared and implemented to mitigate these risks. Risk assessments and management plans cover:

1. food safety
2. environment and biodiversity
3. animal health and welfare
4. hygiene
5. food defence
6. water quality
7. biosecurity
8. mortality
9. waste.

Environmental management plans are central to the sustainable management of Huon Aquaculture’s marine farming leases. Their purpose is to describe the principles and procedures used by the company to maintain its obligations and commitments to responsible and sustainable environmental and biodiversity management of its fish farming operations in Tasmania. Below is a description of Huon Aquaculture’s systematic approach to environmental management, through its overarching Environmental Management Plan (EMP). Specific risks and mitigation measures are described in more detail under Section 6 sub-headings below.

Background

The basis for the sustainable management of Huon Aquaculture’s farming operations is provided by rigorous monitoring, firstly for broadscale effects, and secondly for between and within lease effects. The results obtained from monitoring have been, and will continue to be, the basis for ongoing adaptive management of farming
operations on both system-wide and fish farm scales, and enable best practice management of environmental and biodiversity values to be demonstrated.

Huon Aquaculture has an EMP and a Fish Health and Welfare Program, including a Veterinary Health Plan (VHP). These underpin the responsible and sustainable production of salmon and rainbow trout. Transparency and communication are key principles of the programs and are critical success factors.

All operations are managed by adaptive management principles through the EMP and the VHP.

Management procedures also take into account the impact on wildlife that live in the environment surrounding fish farming operations. This includes protocols for the management of marine animals (seals) and birdlife.

**Responsibilities**

The assessment of operational risks to environment and biodiversity will be the responsibility of the site’s General Manager, in this case the General Manager Marine Operations. The EMP is the management control that addresses identified operational risk areas.

The management of the EMP will be the responsibility of the General Managers. The General Managers meet monthly and retain a record of meetings and actions. The Environmental Management Plan will be reviewed annually by internal audit and revised accordingly. Recommendations raised from the annual audit will be presented to the General Managers for their revision of the proposed changes.

The General Management group is comprised of Huon Aquaculture Management which has a wide range of Aquaculture management expertise.

The General Managers and monthly meeting members are listed below:

- Managing Director (Peter Bender)
- Deputy Chief Executive Officer (Philip Wiese)
- General Manager Sales, Marketing and Processing (Philip Wiese)
- General Manager Freshwater Operations (David Mitchell)
- General Manager Marine Operations (David Morehead)
- General Manager Fish Performance (Steve Percival)
- General Manager Commercial and Planning (Charles Hughes)

As part of the development of the EMP, there have been risk assessments completed for each hatchery and marine farm operation.
Issues from the Risk Assessments are then built into the Site Environmental Management Plans.

- Huon Aquaculture Environmental Management Plan - Bridport Hatchery
- Huon Aquaculture Environmental Management Plan - Lonnavale Hatchery
- Huon Aquaculture Environmental Management Plan - Millybrook Hatchery
- Huon Aquaculture Environmental Management Plan - Springfield Hatchery
- Huon Aquaculture Environmental Management Plan – Meadowbank Hatchery
- Huon Aquaculture Environmental Management Plan – Forest Home Hatchery
- Huon Aquaculture Environmental Management Plan – Hideaway Bay
- Huon Aquaculture Environmental Management Plan – Trumpeter Bay

Area Management Agreement Schedule 3: Macquarie Harbour Environmental Management Plan

**Ecological based management**

Comprehensive regulatory and management controls have been imposed by the Tasmanian Government to ensure sustainable development. The EMP is designed to support an ecological based management approach underpinned by adaptive management principles.

**Existing regulatory environmental monitoring program**

Marine salmonid farming operations in Tasmania are primarily managed under the provisions of the Marine Farming Planning Act 1995 (MFPA) and the Living Marine Resources Management Act 1995 (LMRMA). The MFPA sets out processes to plan for marine farming development and to determine the allocation of marine farming leases in State waters. The Minister for Primary Industries and Water and the Secretary of the Department of Primary Industries, Parks, Water and Environment (DPIPWE) have essential roles, as the decision maker and the planning authority.
respectively, under the MFPA. Individual marine farms are authorised by a licence under the LMRMA which specifies what species may be farmed within a lease area and under what conditions.

In Tasmania, marine salmonid farming operations also rely on the supply of juvenile Atlantic salmon and rainbow trout from freshwater hatcheries for on-growing at sea. Freshwater salmonid farming operations are regulated by Inland Fisheries Service through the Inland Fisheries Act 1995 (IFA). Each farm is authorised by a fish farm licence under the IFA.

The Government is currently separating the ongoing environmental regulation of the salmonid farming industry from the development and planning regulatory functions. A key component of the new framework has already been achieved by transferring environmental regulation to the Environment Protection Authority (EPA). This step integrates the regulation of all salmonid inland and marine farms, including hatcheries, and will improve overall consistency of process. Placing environmental regulation of salmonid aquaculture under the responsibility of the EPA will also bring it into line with other large industry sectors such as mining and food processing.

The proposed legislative changes will introduce a new Environmental licence for salmonid aquaculture to enable the EPA to consolidate all environmental conditions into one instrument and ensure they are being met by operators. Marine farming operations will still require a Marine Farming licence in order to comply with other non-environmental conditions, such as the requirement to provide navigational markers. To formally bring environmental regulatory changes into effect, amendments to a number of pieces of legislation are needed.

The overall planning and development framework for marine salmonid farming will remain largely unchanged, with primary decision making regarding the areas for development resting with the Minister under the MFPA. Additional powers will be provided to the Director of the EPA, which will enable the Director to require specific environmental matters to be addressed during the planning process and to ensure the EPA is notified of key decisions.

Research outputs from research service providers (such as IMAS) are critical to the regulatory environmental assessment and management process, and will continue to assist in the ongoing refinement of management strategies.

At present, prior to commencing marine farming operations on lease areas, Huon Aquaculture collects baseline environmental data on sediment biology, chemistry, current flow and habitat characteristics for broadscale (i.e. Storm Bay region) and near field (i.e. in and around leases).
Management controls within the relevant Marine Farming Development Plan (MFDP) require all marine farming leaseholders to comply with an environmental monitoring program as prescribed in marine farming licence conditions.

Marine farming licences are issued to lease holders on an annual basis. Licence conditions specify environmental standards, and recording and reporting requirements that depend on the species being licensed. For finfish licence holders, production data must either be reported or made available for audit on request. Production data includes information on feed, fish inputs, production planning and food conversion ratios, and this is used in conjunction with other environmental monitoring data to assist in site specific or regional management of sustainability issues across the MFDP area.

In addition to production related reporting, licence holders must also undertake underwater video surveys to assess sediment health either annually or in accordance with their stocking and fallowing regimes (determined in consultation with the EPA). It must be stressed also that Huon proactively manages the condition of the sediments under its pens through undertaking monthly under-pen video surveys, where every pen on the farm is assessed for waste feed pellets and the condition of the sediments underneath the pen.

Farms have been required to participate in this benthic monitoring program since 1997 in order to monitor compliance against licence conditions and management controls specific to benthic impacts.

The program has led to the compilation of a comprehensive, area-specific dataset, providing information on environmental conditions within marine farming lease areas and at 35m compliance sites and control sites. This information has been used to assist in the adaptive management of regulatory monitoring.

The results of monitoring in finfish lease areas around the State have confirmed that pen positioning, stocking duration and intensity are the major factors affecting detectable impacts on the benthos. Current flow is typically low and survey assessments have revealed that visible benthic impacts are localised, with solid particulate waste settlement forming distinct footprint zones directly under pens.

Unacceptable impacts, when detected through monitoring in the south-east, can be broken down into two main categories: any visible farm derived impact at a compliance site 35m outside the lease boundary, or any significant visual impact within the lease area.

These impacts are largely due to either, or both, of the following occurring on a lease:

- Detectable impact at a 35m compliance point - poor pen positioning leading to the presence of a pen footprint at a compliance point.
- Significant impact within the lease area - the cumulative impact of overfeeding stock and or stocking a single pen bay for an extended period of time. This leads to excessive feed and faecal deposition, deterioration of sediment health and eventual spontaneous gas bubbling from sediments.

In cases where a breach of licence conditions is detected as a result of these surveys, immediate action is taken to ascertain the level and extent of the breach and the cause of the specific problem. The EPA can then require changes to the management of the lease and, where relevant, stipulate an increased frequency and intensity of monitoring to assess the rate of recovery of an impacted site. This program employs adaptive management principles, enabling performance-based monitoring for individual lease areas, with the frequency and intensity of monitoring surveys being adjusted according to the level of compliance and monitoring history of individual farm sites.

**Environmental Monitoring**

Fish farms also undertake environmental monitoring around all leases. In the main, the information is used to assess feeding rates, and as background information aiding in the assessment of fish behaviour, fish health and mortality rates. This information also provides a very significant part of the background data to adaptive management on a broader scale. This information is also a critical part of the dataset required by the VHP.

The list of variables includes:

**Marine Farm Sites**

- dissolved oxygen - measured either at specific times each day or with continuous recording probes at some sites
- temperature - as for dissolved oxygen
- salinity - as for dissolved oxygen
- phytoplankton - both events driven (e.g. fish mortalities, water discoloration), and through a regular sampling program, the frequency of which is determined by season (e.g. weekly in summer)
- meteorological data – accessed daily through websites to determine operations for the day
- net fouling - divers provide a score every dive during spring and summer on which net cleaning is based
- excess feeding - video monitoring under pens to assess build-up of organic matter
- seal interactions – e.g. ongoing recording of seal interactions around the leases, counts of seals, general counts of seals entering pens.

**Hatchery Sites**
- dissolved oxygen - measured either at specific times each day or with continuous recording probes at some sites
- temperature - as for dissolved oxygen
- water chemistry - events driven (e.g. fish mortalities, water discoloration)
- rainfall and flooding.

**Environmental Management Systems**
Huon Aquaculture has documented procedures for the installation and maintenance of marine farming systems and freshwater hatchery systems, as well as documented procedures for the day-to-day running of all marine farming lease areas. All employees and contractors working on aquaculture leases are fully trained and inducted.

As a family run ‘local’ company, Huon Aquaculture bases its environmental responsibilities both on sustainable expansion of its operations and working closely with the local community to promote understanding and awareness of environmental issues associated with the fish farming industry. Environmental management is undertaken primarily on a site by site basis and is directed through the AMT for farming operations, and by Huon Aquaculture’s General Manager – Processing for fish processing operations. Huon Aquaculture contracts much of the design of the land operations waste facilities to independent consultants but takes on the management of those systems through its own trained personnel.

**The Adaptive Management process**
Adaptive management is a structured, iterative process of optimal decision making, using the best science available, with an aim to further improve our knowledge of the system over time using comprehensive monitoring. In this way, decision making simultaneously maximises one or more resource objectives and, either passively or actively, accrues information (e.g. by monitoring and modelling through fluctuating system conditions) needed to improve future management. Through adaptive
management, rigorous control can be applied that assures sustainable operation and development.

Adaptive management is a tool which should be used not only to change a system, but also to learn about the system (Figure 62). Because adaptive management is based on a learning process, it improves long-run management outcomes. The challenge in using the adaptive management approach lies in finding the correct balance between achieving the best short-term outcome based on current knowledge, and gaining knowledge to improve management in the future.

The achievement of adaptive management objectives requires an open management process which seeks to include past, present and future stakeholders. Adaptive management needs to at least maintain political openness, but usually aims to create it. Adaptive management must therefore be a scientific and social process.

![Figure 62 - Example of an Adaptive Management Cycle as provided by CSIRO (reference http://www.cmar.csiro.au/research/mse/)](image)

At the core of the adaptive management process is a detailed and targeted environmental monitoring program and a whole-of-environment predictive model. Huon Aquaculture would favour an industry driven environmental monitoring strategy aimed at incorporating both company-specific and statutory monitoring requirements being developed in order to optimise future production management and sustainability assessment within our leases.
These environmental management processes focus on addressing the main risks to the wider aquatic environment and farmed fish (fish health). The ultimate aim of the adaptive management program is to monitor production over time and increase knowledge in relation to the sustainability and feasibility of our operations. Monitoring any potential adverse environmental effects will be associated with the application of relevant mitigation measures based on the severity of the observed impacts.

Adaptive management, by its nature, provides for flexibility. For example:

- sampling frequency can be targeted to high risk periods
- some parameters may be replaced by others, and/or new ones added
- some parameters may be removed if they no longer reflect an element of risk
- the relevance of survey sites may also change with time and some may need to be created, replaced or moved.

As a general rule, monitoring is carried out not simply to accumulate a wealth of data, but rather to identify and tackle specific risks and uncertainties.

The prioritised risks are identified through consultation with regulators, relevant experts and community stakeholders. Risks are managed by the adaptive management process with continued long-term stakeholder involvement. The following risks have been identified by Huon Aquaculture and the industry in general:

**Company wide**

- The company’s farms have a significant effect outside their lease area. Examples include but are not restricted to; broadscale eutrophication, and, the particular requirements of Marine Reserves, Tasmanian Wilderness World Heritage Areas and endangered/threatened species.

- The social licence to operate is jeopardised by not maintaining the water quality and general ecology of the waters we farm, thus negatively impacting the local community and other industries in the region.

**Fish farms**

- That eutrophication of the overall water body will affect water quality on the farms.

- Environmental conditions may have a synergistic effect on, or may precipitate a fish health event.
That neighbouring leases will affect the quality of the water flowing through adjacent farming lease areas. These risks drive both the strategies (modelling/limits) and implementation plans (environmental monitoring program) of the adaptive management process.

Modelling
The further refinement of models when needed will provide ongoing support to manage the company’s farms, improving the understanding of the hydrodynamic and ecological processes.

Environmental monitoring program
The EMP monitoring requirements will, as required, be adapted to meet the risks/issues identified in the assessment process.

Broadscale water quality and sediment monitoring
Huon Aquaculture’s marine farm areas (southern and western) are monitored on a broadscale basis. The datasets from the broadscale monitoring captures seasonal trends as well as assessing inter annual variability. Three multi-company regional programs cover the Huon Aquaculture marine operations:

• The Huon River and Port Esperance and D’Entrecasteaux Channel MFDP fish farms are covered by the Broadscale Environmental Monitoring Plan (BEMP).

• Western sites are covered by the Macquarie Harbour Fish Farm Environmental Monitoring Plan (FFEMP), and a wide range of formal research projects designed to aid in understanding the sustainable biomass capacity for the harbour.

• For Storm Bay including the Storm Bay off Trumpeter Bay North Bruny Island MFDP, baseline monitoring has been provided through formal research such as FRDC research project 2014/031. It is Huon Aquaculture’s intention to comply with the Environmental Management programs, including monitoring and modelling of the Storm Bay area that are currently being drafted by the EPA, and an Indicative program for the area as provided by the EPA is presented in Appendix P.
Farm or lease based monitoring.

In-pen monitoring
This is undertaken to inform the Fish Health Management Plan and includes dissolved oxygen, temperature and salinity. Phytoplankton assessment taken as part of the general lease based monitoring (described below) is also made. Other parameters may be nominated (e.g. light levels, CO₂) through the risk assessment process and these are included in the full list of information required under the VHP.

Lease-based monitoring
This informs the individual lease or farm of changes occurring in and around the farm, and may include sentinel sites upstream and downstream of the fish farming area within the region. Many of these sites will also provide information back to the regional water quality assessments.

Mitigation
The basis for the sustainable management of aquaculture is provided through rigorous monitoring, firstly for system-wide effects, and secondly for between and within fish farm effects. This acknowledges that there will be a variation in overall production in Huon Aquaculture’s sites. The results obtained from monitoring continue to be the basis for modelling the effects of farming operations on both system-wide and fish farm scales, and support the implementation of future “trigger levels” where pertinent, which in turn are based on the best possible science available at the time.

Risk mitigation is driven by an adaptive management process, as overseen by the AMT. Evaluation and assessment of results from both farm-based and regulatory monitoring, along with the outputs of modelling and relevant research conducted into ecological processes, drives AMT decision making in relation to sustainable production.

Regulatory Controls
Significant regulatory controls/instruments are included in both Marine Farming licences and Marine Farm Development Plans. An overview of these instruments is provided in Appendix E of this document, including the Marine Farming Licence for Marine Farm #261, and the Management Controls included in Amendment No 1 of the Storm Bay off Trumpeter Bay North Bruny Island Marine Farm Development Plan.
6.1.1 Water Quality

6.1.1.1 Recognised effects of farming emissions on water quality

There are a number of formal comprehensive scientific and independent reviews of the effects of fish farming on water quality. The GESAMP (1991) report on, ‘Reducing Environmental impacts of coastal aquaculture’, provides a brief but concise review of the effects on water quality and covers all the issues that are still of most significance today.

More recent information relating to water quality effects is provided by:

1. The Ministry of Primary Industry, New Zealand (MPINZ) has released a series of reports/papers under the collective title; ‘Literature Review of Ecological Effects of Aquaculture (2013a)’, that includes ‘feed added’ aquaculture systems/species. Chapter 2 entitled, ‘Pelagic Effects’ provides an excellent review of water quality effects.

2. IMAS Submission — Senate Environment and Communications References Committee Inquiry into Fin-fish Aquaculture in Tasmania - June 2015. This submission provides (amongst other information) an overview of both: the adequacy and availability of data on waterway health, and, the impact on waterway health, including to threatened and endangered species.

The description of the recognised effects of farming emissions on water quality provided below is taken directly from the MPINZ chapter which also forms a template for the section. The additional Tasmanian industry-specific information, referenced and italicised to distinguish it from the MPINZ information throughout the remainder of 6.1.1.1, is provided in the main through the IMAS submission.

Main factors affecting the extent of pelagic effects

The magnitude and spatial extent of pelagic effects from finfish farms are a function of a number of inter-related factors, that can be broadly considered as farm attributes and physical environment attributes.
Farm attributes

Farm attributes (husbandry, management and farm design) that can affect the amount of dissolved nutrients and solid waste entering the water column include the following.

- **Farm density**: Density of farms in a unit volume of water.
- **Stocking density**: Salmon have a seasonal production cycle dictated mainly by ambient temperature, which means the amount of feed per fish varies during the year. Stocking density varies and this in turn will also influence the magnitude of waste loading to the water column.
- **Feed conversion ratio (FCR)**: FCR is a measure of the efficiency of growth relative to feed used, specifically the weight of feed used divided by the amount of weight gained. The most efficient ratio is 1, all feed is converted to fish biomass, but in reality the global range is 1.1 to 1.7 on average (Reid 2007). The use of FCRs in assessing the impact of faeces and DIN on the environment is complex and the reader is referred to Section 5.1 of Reid (2007) for a full discussion.
- **Cage design and orientation**: Cage design and orientation to prevailing current direction impact the drag on passing water masses, flushing of cages and settlement of biofouling organisms.

Physical site attributes

The physical attributes of a finfish culture site that most influence its pelagic impact are temperature, the depth of water and current speed. The latter two dictate the magnitude and spatial extent to which dissolved and solid farm waste are dispersed through near-field water column. Secondary benefits from a well-placed site are increased oxygen delivery to the water column and benthos and maintenance of healthy benthic–pelagic coupling.

Overview of pelagic effects

The significant effects of finfish waste on the integrity and functioning of the near-field pelagic system are addressed in this section. The potential pelagic effects from finfish farming can be categorised as:

- dissolved nutrients;
- solid waste;
- depletion of dissolved oxygen (DO).
Descriptions of main effects and their significance

Dissolved nutrients

Summary
Dissolved inorganic nutrients are released into the pelagic environment from finfish cages either directly, as fish excretory products (e.g. ammonium and urea), or indirectly as a result of remineralisation of particulate organic waste (Navarro et al. 2008). Nitrogen is often a limiting nutrient for phytoplankton production, and the introduction of inorganic nutrients has the potential to enhance the growth of phytoplankton (Wu et al. 1994) and at high concentrations can cause harmful algal blooms (Sorokin et al. 1996). Internationally, there have been experiences of blooms of species that produce biotoxins, some of which can be directly toxic to fish, and others which can accumulate in shellfish and affect consumers.

Symptoms of eutrophication or nutrient enrichment include the formation of algal blooms that can potentially reduce water clarity (and consequently sunlight availability to other phytoplankton in the water column) and strip oxygen from the water column once the blooms decay (Wetzel 1983). Since nitrogen and phosphorus are waste products from finfish farming, there is the potential to promote eutrophic conditions either by supplying a readily available nutrient source directly to phytoplankton or through oxygen removal via the bacterial decomposition of waste solids.

Nutrient enrichment may also lead to changes in phytoplankton species composition via altered nutrient ratios with, for example, an increased N:Si ratio favouring the growth of flagellates rather than diatoms (Officer & Ryther 1980). Dissolved organic nutrients are released from fish farms indirectly via dissolution of particulate organic waste and are likely, due to the high nutritional content of waste food and faeces, to represent a highly labile source of nutrients for heterotrophic bacteria.

As reported in the IMAS submission (IMAS, 2015), the Tasmanian experience covering more than 30 years research and monitoring data (more recently through the BEMP programme) for the relatively sheltered Huon River and D’Entrecasteaux Channel farming regions (MFDP’s) is;

‘Despite the changes in ammonium and oxygen concentrations in the Huon Estuary, there is no clear evidence of a concomitant change in water column productivity (i.e. phytoplankton biomass). There is some indication that phytoplankton composition may have changed in the Huon Estuary and D’Entrecasteaux Channel; however, more data and further analyses (i.e. inclusion of count data) are required before concluding an unambiguous change in composition through time and/or direct links to any single source.’
Table 23 - Pelagic effects associated with dissolved nutrients from feed-added aquaculture operations. (MPINZ, 2013a)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved nutrients (mainly ammonia) are released as finfish excretory products. Nutrient enrichment of the water column above natural levels (i.e. eutrophication) can potentially lead to enhanced phytoplankton growth, including harmful algal blooms (HABs) and changes in phytoplankton species composition. Bloom decay (and increased microbial activity) can lead to reduced DO levels.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spatial scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised. Effects are most evident inside a farm and in the primary pelagic footprint with a strong gradient of decreasing impact with increasing distance. The intensity and spatial extent of enrichment is highly site specific, with high flow, deep sites producing larger but more “diluted” footprints.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable between grow-out periods when fish stocking densities change.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be partially controlled through:</td>
</tr>
<tr>
<td>- careful site selection;</td>
</tr>
<tr>
<td>- maintaining appropriate stock densities/feeding rates and matching farm placement and design to the site;</td>
</tr>
<tr>
<td>- monitoring and ongoing adaptive management. Impacts are reversible upon removal of farm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline dissolved nutrient concentrations in areas suitable for finfish farm development.</td>
</tr>
<tr>
<td>New studies are required to determine changes in water column variables in areas of intensive finfish aquaculture.</td>
</tr>
<tr>
<td>Enrichment effects on bacterioplankton.</td>
</tr>
<tr>
<td>Hydrodynamic and biophysical model development to predict impacts and field data to validate models.</td>
</tr>
</tbody>
</table>

Rapid water exchange in coastal waters may also disperse phytoplankton, and in this respect it is significant that macrophyte growth has been shown to be stimulated by fish farm effluents (Neori et al. 2004). Hydrographic conditions are clearly important in dictating the degree of impact of fish farm inputs on pelagic ecosystems. Further information in relation to effects on macrophytes in the Tasmanian context are described in Section 6.1.3.

The response of the heterotrophic planktonic microbial community to fish farm inputs has received even less attention than that of the autotrophic community (Navarro et al. 2008). Of the few, mostly seasonal studies published, some have recorded enhanced bacterioplankton abundance near fish farms (La Rosa et al. 2002; Sakami et al. 2003; Pitta et al. 2006; Navarro et al. 2008) while others have not (Alongi et al. 2003; Maldonado et al. 2005). Navarro et al. (2008) suggest that the heterotrophic bacteria play a significant part is processing organic particulates released from farms. Indeed recent Tasmanian studies investigating the dissolved oxygen drawdown in Macquarie Harbour have identified possible significant roles for autotrophic communities at least in very poorly
flushed water bodies (Ross et al., 2016b).

In the past few years, computing resources and numerical modelling systems have advanced considerably. This has enabled the evolution of models and integrated model suites that can mimic physical forcing and biogeochemical processes in marine systems and model the systems response to stressors. The main goals of applying a modelling approach to aquaculture include acquiring information on potential environmental impacts, designing of monitoring strategies and understanding the processes of a particular system (Silvert & Cromey 2001). Models should be used early on in the process of aquaculture development since they can not only identify potential problem areas with regard to environmental effects, but also can help in determining carrying capacities and setting sustainable feed levels for finfish.

A selection of models applicable to a range of environments and conditions is available (Magill et al. 2006; Stigebrandt et al. 2004; Tett et al. 2003). Existing models can provide crucial information and decision support when needed, however, they are limited by lack of ecosystem integration, a limited number of species interactions and their scale. Considering that fish farming impact is introduced into the system through the lower trophic levels where phytoplankton and bacteria are key players, it is important that any model used must incorporate a detailed description of the system in terms of both organisms and processes.

Planned expansion of finfish culture in New Zealand has prompted the use of models to predict the potential impact of proposed finfish farms on the water column in a number of bays (Zeldis 2008; Zeldis et al. 2010, 2011a). The most important finding from these client reports was that local hydrodynamics, water depth and ambient oxygen levels were the most critical factors for determining the sustainability of planned expansion of finfish farming.

The industry in Tasmania has been supported through all phases of growth through the parallel development of models, both biogeochemical and hydrodynamic, that have played a pivotal role in the future planning and subsequent management of the industry in the state. Outlines of modelling projects pertinent to the development of the industry in the south-east of Tasmania are included in Section 6.1.1.4 (Mitigation measures) below.
Table 24 - Pelagic effects associated with oxygen depletion due to feed-added aquaculture operations (MPINZ, 2013a)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
<th>The primary cause of oxygen depletion inside salmon cages is through respiration of cultured fish. Decay of organic farm waste and/or phytoplankton blooms through heterotrophic bacterial activity can contribute to stripping oxygen from the water column. Oxygen depletion can cause the stress or death of culture fish and other pelagic organisms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial scale</td>
<td>Localised.</td>
</tr>
<tr>
<td>Duration</td>
<td>Variable – Depending on stocking density, water temperature and flushing rates.</td>
</tr>
<tr>
<td>Probability</td>
<td>Unlikely to likely – Depending on seasonal fish stocking densities, temperature and water stratification.</td>
</tr>
</tbody>
</table>
| Management options                                                                      | Can be partially controlled through:  
- careful site selection; altering feed capacities (and farm production/intensity) and matching farm placement and design to site;  
- monitoring and ongoing adaptive management. Impacts reversible upon removal of farm.                                                                                              |
| Knowledge gaps                                                                          | Integration of hydrodynamic models with environmental oxygen saturation levels to predict the spatial and temporal scale of the impacts of finfish aquaculture.                                                                 |

**Solid waste**

*Summary*

Solid waste is made up of uneaten feed pellets and faecal material. The physical properties and chemical composition of the solid waste will in part dictate the potential for environmental effect (Reid 2007). It has been well documented in the literature that solid waste settling out of the water column onto the seabed can have significant impacts on the biogeochemical properties of benthic habitats (also refer to Section 6.1.2). Pelagic effects are less well understood or quantified.

Faecal and feed material that remains suspended (or is resuspended from the seafloor into the water column) is fragmented by turbulence and the grazing activity of pelagic organisms such zooplankton and bacterioplankton (Olsen 2007). As with the fibrous indigestible portion of feed, faeces also have traces of micronutrients, such as dietary copper and zinc that, depending on feed concentrations and farming methodologies, is of environmental concern to pelagic food webs (Reid 2007). If a salmon farm is proximal to a mussel farm, as advocated in Integrated Multi-trophic Aquaculture (IMTA) (Chopin et al. 2008), a portion of small particles will be filtered out by the mussels. Filtering biofouling organisms on the cages, such as ascidians and blue mussels, will also remove some of the suspended faecal particulates. Most of this material, however, will settle on the seabed.

Through bacterial digestion, dissolved organic nitrogen and carbon (DON and DOC)
are released from particulate waste into the water column. DOC is comprised of both labile (digestible) and non-labile components, the latter having relatively long turnover times in seawater (Olsen 2007). Labile DOC is readily and rapidly utilised further by bacterial heterotrophs while the fate of non-labile DOC is not well understood in the pelagic system.

**Oxygen depletion**

**Summary**

One component of water quality, DO, is particularly critical for the survival and good performance of farmed salmon. As a result, most farms regularly measure DO levels (in mg/l), which fluctuate naturally in the environment due to temperature shifts, time of day and upwelling of oxygen-poor waters from deep in the ocean. However, the primary mechanism for DO depletion is uptake by the fish themselves through respiration. This can result in significant depletion (below 50 to 60 percent oxygen saturation, Reid 2007) within and potentially down current from the cages. The problem is only likely to occur where flushing rates are insufficient (on scales of many days to weeks).

DO provides a useful overall proxy for a water body’s ability to support healthy biodiversity and supplements the benthic indicators that will also pick up excessive nutrient loading.

Salmon ideally need a level of dissolved oxygen over 5 mg/l to avoid oxygen stress, although they are able to live under lower oxygen concentrations, particularly if it is only for short periods of time (SCSAD 2010).

There are a number of processes that can deplete oxygen around a finfish farm. Since DIN is often a limiting nutrient for phytoplankton growth in the marine environment, an outside source of DIN above ambient levels can cause large algal blooms (MacKenzie et al. 2011). During subsequent decay of these blooms, oxygen can potentially be stripped from the water column. Microbial degradation of suspended organic particulate waste can also cause oxygen depletion as can the respiratory activities of the cultured finfish. However, episodes of oxygen depletion would be seasonal depending on fish stocking densities and water column temperature and stratification.

Excessive oxygen depletion in the water column could potentially stress or kill the fish and other animals, with sediment DO depletion resulting in the release of toxic by-products (e.g. hydrogen sulphide) into the water, which can also have adverse effects on fish and other organisms. (Forrest et al. 2007). Significant depletion of water column concentrations of DO at finfish farms overseas has usually only been observed when cages are heavily stocked or where they are located in shallow sites with weak flushing (La Rosa et al. 2002).
Table 25 - Pelagic effects associated with oxygen depletion due to feed-added aquaculture operations (MPINZ, 2013a)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
<th>The primary cause of oxygen depletion inside salmon cages is through respiration of cultured fish. Decay of organic farm waste and/or phytoplankton blooms through heterotrophic bacterial activity can contribute to stripping oxygen from the water column. Oxygen depletion can cause the stress or death of culture fish and other pelagic organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial scale</td>
<td>Localised.</td>
</tr>
<tr>
<td>Duration</td>
<td>Variable – Depending on stocking density, water temperature and flushing rates.</td>
</tr>
<tr>
<td>Probability</td>
<td>Unlikely to likely – Depending on seasonal fish stocking densities, temperature and water stratification.</td>
</tr>
<tr>
<td>Management options</td>
<td>Can be partially controlled through: • careful site selection; altering feed capacities (and farm production/intensity) and matching farm placement and design to site; • monitoring and ongoing adaptive management. Impacts reversible upon removal of farm.</td>
</tr>
<tr>
<td>Knowledge gaps</td>
<td>Integration of hydrodynamic models with environmental oxygen saturation levels to predict the spatial and temporal scale of the impacts of finfish aquaculture.</td>
</tr>
</tbody>
</table>

In New Zealand, monitoring data from existing salmon aquaculture operations reveal that water column DO concentrations do not become significantly depleted and are managed well at individual farms (Forrest et al. 2007). Maintenance of adequate DO levels is critical to the survival of the farmed stock. In relation to future development in New Zealand, DO depletion is an issue that may need to be considered if, for example, multiple farms in close proximity are proposed. In such instances, there is the potential for DO to become increasingly depleted as water currents pass through sequential farms (Roper et al. 1998). It is generally considered that the greatest potential for adverse effects in the water column will occur in areas subject to poor flushing and a high stocking density (Wu et al. 1994; La Rosa et al. 2002).

In Tasmania where fish are farmed in the full exposure range of marine sites, i.e., enclosed (Macquarie Harbour), sheltered (Huon River and D’Entrecasteaux Channel) and exposed (Storm Bay) waters, the industry is all too familiar with the effects of stocking density and poor flushing. In general the sheltered and exposed waters have been managed successfully. Where potential sinks for oxygen have been identified through modelling and subsequent monitoring (BEMP - Ross and MacLeod, 2013; IMAS, 2015) in the sheltered sites of the Huon River, then the industry has taken steps to either limit its production at sites nearby or indeed move leases to better mixed waters.

However, the industry is also all too familiar with the potential for oxygen levels to be significantly depleted in the almost enclosed conditions in Macquarie Harbour, where flushing...
rates for mid and deeper waters can be counted in hundreds of days. Discussion between government and industry and researchers are ongoing in an effort to find a sustainable stocking density for the Harbour.
6.1.1.2 Expected levels of farming emissions

Current levels of soluble nutrient emissions from stock/feed/faeces

Huon Aquaculture currently operates one lease in Storm Bay which is presently divided into four zones, SB 1-4 zones. The original Trumpeter Bay lease site, continues to be farmed under the authority of a permit issued pursuant to the Living Marine Resources Management Act 1995, as the company reorganises its operations to further develop the south of Trumpeter Bay (SB) 1-4 zones. The SB1 lease is fully stocked, with the SB2 lease to come on stream in the next year. Feed fed figures and calculated soluble (dissolved Nitrogen) and solid emission waste loadings for these operations between 1 October 2015 and 30 September 2016 are provided below (Table 26).
Table 26 - Monthly feed inputs, solid (Feed loss, Nitrogen, Carbon, Faeces) and dissolved waste emissions (Tonnes of N) for Huon Aquaculture operations in Storm Bay from Oct 15 to Sep 16

<table>
<thead>
<tr>
<th>old Trumpeter Bay</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Fed (T)</td>
<td>435</td>
<td>346</td>
<td>198</td>
<td>207</td>
<td>150</td>
<td>145</td>
<td>198</td>
<td>172</td>
<td>67</td>
<td>141</td>
<td>216</td>
<td>291</td>
<td>2567</td>
</tr>
<tr>
<td>Feed loss</td>
<td>13.1</td>
<td>10.4</td>
<td>5.9</td>
<td>6.2</td>
<td>4.5</td>
<td>4.4</td>
<td>5.9</td>
<td>5.2</td>
<td>2.0</td>
<td>4.2</td>
<td>6.5</td>
<td>8.7</td>
<td>77</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>3.1</td>
<td>2.5</td>
<td>1.4</td>
<td>1.5</td>
<td>1.1</td>
<td>1.0</td>
<td>1.4</td>
<td>1.2</td>
<td>0.5</td>
<td>1.0</td>
<td>1.6</td>
<td>2.1</td>
<td>18.5</td>
</tr>
<tr>
<td>Carbon</td>
<td>20</td>
<td>16</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>116.4</td>
</tr>
<tr>
<td>Faeces</td>
<td>66</td>
<td>52</td>
<td>30</td>
<td>31</td>
<td>23</td>
<td>22</td>
<td>30</td>
<td>26</td>
<td>10</td>
<td>21</td>
<td>33</td>
<td>44</td>
<td>388.14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SB1</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Fed (T)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>72</td>
<td>139</td>
<td>248</td>
<td>432</td>
<td>668</td>
<td>528</td>
<td>601</td>
<td>476</td>
</tr>
<tr>
<td>Feed loss</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>13</td>
<td>20</td>
<td>16</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.5</td>
<td>1.0</td>
<td>1.8</td>
<td>3.1</td>
<td>4.8</td>
<td>3.8</td>
<td>4.3</td>
<td>3.4</td>
<td>22.8</td>
</tr>
<tr>
<td>Carbon</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.4</td>
<td>3.3</td>
<td>6.3</td>
<td>11.3</td>
<td>19.6</td>
<td>30.3</td>
<td>24.0</td>
<td>27.3</td>
<td>21.6</td>
<td>144</td>
</tr>
<tr>
<td>Faeces</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>21</td>
<td>38</td>
<td>65</td>
<td>101</td>
<td>80</td>
<td>91</td>
<td>72</td>
<td>480</td>
</tr>
</tbody>
</table>

Total dissolved N outputs

<table>
<thead>
<tr>
<th>old Trumpeter Bay</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes</td>
<td>16</td>
<td>13</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>11</td>
<td>94</td>
</tr>
<tr>
<td>Monthly %</td>
<td>17.0</td>
<td>13.5</td>
<td>7.7</td>
<td>8.1</td>
<td>5.9</td>
<td>5.7</td>
<td>7.7</td>
<td>6.7</td>
<td>2.6</td>
<td>5.5</td>
<td>8.4</td>
<td>11.3</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SB1</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>16</td>
<td>25</td>
<td>19</td>
<td>22</td>
<td>18</td>
<td>116.815</td>
</tr>
<tr>
<td>Monthly %</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>2.3</td>
<td>4.4</td>
<td>7.8</td>
<td>13.6</td>
<td>21.1</td>
<td>16.7</td>
<td>18.9</td>
<td>15.0</td>
<td>100</td>
</tr>
</tbody>
</table>
Expected levels of soluble nutrient emissions from stock/feed/faeces

There is a proposed limit of 1147.5T of total dissolved nitrogen output (TPDNO) for Huon Aquaculture farms in Storm Bay. The projected feed inputs for the Huon Aquaculture latest production forecast and nutrient emissions provided in Table 27 comply with the proposed TPDNO.

Huon Aquaculture latest forecast suggests that the proposed TPDNO limit will be reached by May 2019 (refer to Figure 4).
Table 27 - Monthly feed inputs, solid (Feed loss, Nitrogen, Carbon, Faeces) and dissolved waste emissions (Tonnes of N) for Huon Aquaculture farms at the TPDNO limit of 1147.5T in Storm Bay

<table>
<thead>
<tr>
<th>East of Yellow Bluff</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Fed (T)</td>
<td>153</td>
<td>-</td>
<td>-</td>
<td>42</td>
<td>273</td>
<td>440</td>
<td>675</td>
<td>852</td>
<td>1,254</td>
<td>1,565</td>
<td>709</td>
<td>133</td>
<td>6,095</td>
</tr>
<tr>
<td>Feed Loss</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>8</td>
<td>13</td>
<td>20</td>
<td>26</td>
<td>38</td>
<td>47</td>
<td>21</td>
<td>4</td>
<td>183</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Carbon</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>12</td>
<td>20</td>
<td>30</td>
<td>38</td>
<td>56</td>
<td>70</td>
<td>32</td>
<td>6</td>
<td>274</td>
</tr>
<tr>
<td>Faeces</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>41</td>
<td>66</td>
<td>101</td>
<td>128</td>
<td>188</td>
<td>235</td>
<td>106</td>
<td>20</td>
<td>914</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storm Bay 1-4</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Fed (T)</td>
<td>1,665</td>
<td>1,413</td>
<td>1,472</td>
<td>1,529</td>
<td>1,954</td>
<td>2,171</td>
<td>2,278</td>
<td>2,049</td>
<td>1,571</td>
<td>1,077</td>
<td>1,377</td>
<td>1,853</td>
<td>20,410</td>
</tr>
<tr>
<td>Feed Loss</td>
<td>50</td>
<td>42</td>
<td>44</td>
<td>46</td>
<td>59</td>
<td>65</td>
<td>68</td>
<td>61</td>
<td>47</td>
<td>32</td>
<td>41</td>
<td>56</td>
<td>612</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>14</td>
<td>11</td>
<td>8</td>
<td>10</td>
<td>13</td>
<td>143</td>
</tr>
<tr>
<td>Carbon</td>
<td>75</td>
<td>64</td>
<td>66</td>
<td>69</td>
<td>88</td>
<td>98</td>
<td>103</td>
<td>92</td>
<td>71</td>
<td>48</td>
<td>62</td>
<td>83</td>
<td>918</td>
</tr>
<tr>
<td>Faeces</td>
<td>250</td>
<td>212</td>
<td>221</td>
<td>229</td>
<td>293</td>
<td>326</td>
<td>342</td>
<td>307</td>
<td>236</td>
<td>162</td>
<td>207</td>
<td>278</td>
<td>3,062</td>
</tr>
</tbody>
</table>

Total dissolved N outputs

<table>
<thead>
<tr>
<th>East of Yellow Bluff</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>19</td>
<td>29</td>
<td>36</td>
<td>53</td>
<td>66</td>
<td>30</td>
<td>6</td>
<td>259</td>
</tr>
<tr>
<td>Monthly %</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>0.7</td>
<td>4.5</td>
<td>7.2</td>
<td>11.1</td>
<td>14.0</td>
<td>20.6</td>
<td>25.7</td>
<td>11.6</td>
<td>2.2</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storm Bay 1-4</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes</td>
<td>71</td>
<td>60</td>
<td>63</td>
<td>65</td>
<td>83</td>
<td>92</td>
<td>97</td>
<td>87</td>
<td>67</td>
<td>46</td>
<td>59</td>
<td>79</td>
<td>867</td>
</tr>
<tr>
<td>Monthly %</td>
<td>8.2</td>
<td>6.9</td>
<td>7.2</td>
<td>7.5</td>
<td>9.6</td>
<td>10.6</td>
<td>11.2</td>
<td>10.0</td>
<td>7.7</td>
<td>5.3</td>
<td>6.7</td>
<td>9.1</td>
<td>100</td>
</tr>
</tbody>
</table>
Soluble effluent stream from *in situ* net cleaning

In 2011-12, Huon Aquaculture, together with Tassal Ltd, undertook a study entitled “Improving water quality in cage finfish aquaculture: managing net biofouling”, supported through funding from Caring for Our Country (CfOC). A primary aim of the study was to describe the general characteristics of the effluents from the *in situ* cleaning process. The study primarily focussed on suction cleaning, but also provided data for water blast cleaning, which will be the primary method of cleaning on the proposed zones.

Given the cessation of use of anti-fouling paints, the soluble fraction components of *in situ* cleaning effluent (as identified through consultation with DPITPWE prior to the study) are the nutrients nitrogen (including NH$_4$ and NO$_X$) and phosphorus.

Results are provided below from the CfOC study, “Improving water quality in cage finfish aquaculture: managing net biofouling”.

Table 28 shows the nutrients loads/outputs to the water for *in situ* cleaning using the combined suction/blasting methodology with the MIC type of cleaner.

Note that these figures assume that the nets will be cleaned approximately 8-10 times over one pen position per year. The data are derived from sampling events from two different nets, and both nets would have had significantly higher levels of fouling than that allowed by Huon Aquaculture’s Standard Operating Procedures (SOP’s) under the current regime of net maintenance.

**Table 28 - Estimated nutrient loads from blasting or suction in situ net cleaning (per pen/cage and per lease over a year)**

<table>
<thead>
<tr>
<th>Analyte (blasting)</th>
<th>Analyte (Suction)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean loading per cage soluble (g)</td>
</tr>
<tr>
<td>N mg/L</td>
<td>139.45</td>
</tr>
<tr>
<td>P mg/L</td>
<td>16.54</td>
</tr>
<tr>
<td>Cu mg/kg</td>
<td>0.37</td>
</tr>
<tr>
<td>Zn mg/kg</td>
<td>0.27</td>
</tr>
<tr>
<td>NO$_X$ mg/L</td>
<td>13.37</td>
</tr>
<tr>
<td>NH$_4$ mg/L</td>
<td>9.58</td>
</tr>
</tbody>
</table>

In relation to the south of Trumpeter Bay, SB 1-4 zones, the CfOC figures in are based on washing nets at 5-10m depth on 120m circumference pens whose total area of stock net is
approximately a quarter that of 240m pens. Further, we might assume that the larger mesh predator nets are equivalent at least to the same area of stock netting again, remembering that predator nets have much larger apertures (80mm) than the stock nets (12mm-40mm). Therefore, the total area of netting and potential nutrient loading could be conservatively estimated at 5x that provided in the table above. This is, though, an over estimation as it does not take into account the fact that the vast majority of the fouling grows in the top 6m. The 240m nets are 28-30m deep, compared to 18m in the 120m pens, which would greatly reduce the proportion of net fouling on the new 240m pens compared to the 120m pens.

Using the 5x multiplication factor, the amount of soluble N from in situ cleaning \((105.15 \times 4 \text{ leases} = 420.6 \text{ kg})\) compared to the total feed derived N output for the SB 1-4 leases \((682 \text{T/annum})\) demonstrates that the total emissions from net cleaning exercises are insignificant in this regard, at approximately 0.06% of any total emission from the fish in the pens.

At the proposed east of Yellow Bluff lease, the area of netting in 168m pens would be half that of the SB 240m pens, and given that the N output is estimated at 465T/annum (more than half of the SB 1-4 leases output) the total emission from the nets will be again less than 0.06% of the fish themselves.

### 6.1.1.3 Evaluation of potential effects

The proposed annual limit of 1147.5T TPDNO equates to an increase of 534.5T above that predicted (613T) for growing marine pre-smolts at the 4 SB 1-4 zones alone (Trumpeter Bay off Storm Bay MFDP Amendment No. 1). For the current proposed amendment it is estimated that annually 682T of the TPDNO quota will be split between the 4 SB 1-4 zones, and 465T will be used at the proposed east of Yellow Bluff zone.

The proposed zone amendment is part of an integrated production growth strategy for Huon Aquaculture, which is designed to increase the production of the company to match growing market demand. At the core of the expansion strategy is an expansion of farming effort from the Huon River/D’Entrecasteaux Channel into the deeper, better mixed, more exposed (termed offshore) leases in Storm Bay. As outlined in Section 5.1.7, the prevailing mass flow at the zones coupled with the overall high energy environment will reduce the potential impacts of nutrient inputs through far greater dilution/dissipation in an open water, more oceanic environment. In support of this assertion, Holmer (2010) in a review of offshore case studies also concludes that both benthic and water quality impacts are reduced by moving farming activity offshore (see Table 29 below).
Table 29 - Environmental impact predicted effects of Offshore locations from Holmer, 2010, note reference to nutrients under Other Issues at the bottom of the table.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Observed change in ecosystem services coastal/off-coast</th>
<th>Categorization of impact</th>
<th>Offshore production</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual impact and ecological footprint</td>
<td>Conflicts with coastal users, loss of property value</td>
<td>Severe</td>
<td>Lower</td>
<td>Ersan (2005)</td>
</tr>
<tr>
<td>Use of fish as feed</td>
<td>Pressure on wild fish stocks to produce feed for mostly carnivore aquaculture species</td>
<td>Severe</td>
<td>No change</td>
<td>Nayler et al. (2009)</td>
</tr>
<tr>
<td>Seed collection</td>
<td>Pressure on wild fish stocks</td>
<td>Severe</td>
<td>No change</td>
<td>Nayler et al. (2009)</td>
</tr>
<tr>
<td>Benthic impact</td>
<td>Loss of seagrass habitat, impact on mount</td>
<td>Severe</td>
<td>Lower</td>
<td>Holmer et al. (2003), Holm &amp; Kristensen (1992)</td>
</tr>
<tr>
<td>Enrichment of sediments</td>
<td>Accumulation of organic matter</td>
<td>Medium</td>
<td>Lower</td>
<td>Hargrave et al. (2008)</td>
</tr>
<tr>
<td>Sediment microbial activity</td>
<td>Increased sulfide production leading to poor sediment conditions</td>
<td>Medium</td>
<td>Lower</td>
<td>Dom &amp; Ganju (2014)</td>
</tr>
<tr>
<td>Benthic fauna</td>
<td>Increase in productivity and diversity under oligotrophic conditions, loss of productivity and diversity under eutrophic conditions</td>
<td>Medium</td>
<td>Lower/no change/higher</td>
<td>Kutti et al. (2007, 2008), Holm &amp; Kristensen (1992)</td>
</tr>
<tr>
<td>Wild fish and fisheries</td>
<td>Escapesees (incl. spawn) interact with wild fish, affecting (inter alia) and competing for habitat</td>
<td>Severe</td>
<td>Lower/no change</td>
<td>Jerstad et al. (2008), Toledo-Guzman &amp; Turner (2009)</td>
</tr>
<tr>
<td>Wild fish (disease)</td>
<td>Spreading of disease between cultured and wild fish</td>
<td>Medium</td>
<td>Lower/no change</td>
<td>Vike et al. (2009)</td>
</tr>
<tr>
<td>Invasion of exotic species</td>
<td>Introduction of species into new habitats</td>
<td>Medium</td>
<td>Lower</td>
<td>Williams &amp; Smith (2007)</td>
</tr>
<tr>
<td>Wild fish (attraction)</td>
<td>Wild fish are attracted to cages due to food availability</td>
<td>Medium</td>
<td>Lower/no change</td>
<td>Dempster et al. (2002)</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Conflicts for space, increased landings</td>
<td>Medium</td>
<td>Lower/no change</td>
<td>Machias et al. (2005)</td>
</tr>
<tr>
<td>Other issues</td>
<td>Seed collection</td>
<td>Pressure on wild fish stocks</td>
<td>Severe</td>
<td>No change</td>
</tr>
<tr>
<td>Use of antifoulants/chemicals</td>
<td>Accumulation of hazardous compounds</td>
<td>Medium</td>
<td>Higher</td>
<td>Samuelsen et al. (1992)</td>
</tr>
</tbody>
</table>

The primary influence for decreasing the impact of soluble waste (nutrients) at offshore sites is the greater capacity for flushing those nutrients out of the surrounding water body. Defne and Ganju (2014) state in reference to coastal estuarine regions, ‘That a primary physical control on eutrophication is estuarine flushing and ultimately residence time which was defined as the time elapsed until a water parcel leaves a water body through one of its outlets. Estuaries with poor flushing and long residence times tend to retain nutrients within the system leading to high primary productivity rates. Conversely, well-flushed estuaries are more resilient to nutrient loading due to reduced residence time and greater exchange with less impacted coast waters.’

IMAS, at the request of DPIFWE, have provided a report on nutrient dispersion modelling in Storm Bay, which includes modelling of all present industry Amendment Proposals for Storm Bay, and, provides the outputs for each company separately. The assumptions made and set up parameters used in the model are detailed in Appendix M, and include the proposed regional TPDNO limit equivalent to approximately 40,000T fish production. This currently equates to a proposed apportioned TPDNO limit of 1147.5T of Nitrogen for Huon Aquaculture’s proposed and amended zones. The modelled outputs for the Huon Aquaculture TPDNO demonstrate the direction of flow of the modelled particle from source, in this case, the proposed and amended zones themselves. Care must be taken when attempting to estimate concentrations at distance from the source as biological processes are
not included in the dispersal model. Therefore, the concentration gradients derived from the model output are likely to be an over-estimation.

When there is an extended dispersal time and decay rate relative to the hydrodynamic flows and the extent of the target region, then there is a tendency for the lowest nutrient concentrations to fill most of the region thereby obscuring the predominant direction of spread of the nutrient. Therefore, in order to most easily interpret the direction of dispersion in the plots in Figure 63, it is probably most helpful to examine the innermost contours which represent the estimated 1% and 0.5% proportions of total dissolved nitrogen released.

From these patterns of dispersion for the Huon zones (provided in Appendix M and included below in Figure 63 and Figure 64), Huon Aquaculture concludes that:

1. The prevalent flow direction for most of the year is towards the east and south with dispersal therefore directed out into the open ocean. This may be different in the bottom waters where the flow is reduced, and therefore the dissolved nutrients may not be dispersed as quickly.

2. In the surface layer there is a far greater spread of dissolved nutrient from the farm itself as may be expected. Given the stronger flows in general at the surface, and given the fact that the fish spend the majority of their time in this layer, then the greater mass of dissolved nutrients will be transported in the surface layer.

3. The only time of year when we might expect nutrients from the farm to have any influence on the Derwent or Channel is in summer, however even at those times the modelled increase in dissolved Nitrogen is generally less than 0.25% of farm derived nutrients (refer also to Figure 64c).

4. It would appear that at these concentrations very little, if any, of the dissolved nutrient will generally reach the North Bruny Island eastern shoreline, and where the contours do approach the shore then the modelled increase is again less than 0.25% of farm derived nutrients.
Figure 63 - Model representation of the dispersion of dissolved nitrogen released from the proposed Huon Aquaculture Group farms in Storm Bay integrated over the 0-15m depth range (see parameterisation in Table 1). Results are shown as the proportion of the total dissolved nitrogen released (with contours shown for 0.1%, 0.25%, 0.5% and 1.0%) over the periods: 1st – 14th July 2014, 1st – 14th October 2014, 1st – 14th January 2015, 1st – 14th April 2015 and an average of the previous 4 results which produces the annual result. and 1.0%) over the periods: a) 1st – 14th July 2014, b) 1st – 14th October 2014, c) 1st – 14th January 2015, and d) 1st – 14th April 2015.
Figure 64 - Model representation of the dispersion of dissolved nitrogen released from the proposed Huon Aquaculture Group farms in Storm Bay integrated over the 15-28m depth range (see parameterisation in Table 1). Results are shown as the proportion of the total dissolved nitrogen released (with contours shown for 0.05%, 0.1% and 0.2%) over the periods: 1st – 14th July 2014, 1st – 14th October 2014, 1st – 14th January 2015, 1st – 14th April 2015 and an average of the previous 4 results which produces the annual result.
The surface nutrient dispersion model runs combining all potential future farms in Storm Bay (refer to Appendix M) suggest that there is the potential for an overlap of nutrient concentrations at the lowest concentrations presented. However, it could be argued that this level of nutrient is well below any levels that we might reasonably expect to detect. Furthermore, the overlapping regions are located in the central and/or eastern side of Storm Bay, where the surface currents as presented in Figure 53 are predominantly to the southeast which would result in the nutrients being flushed out of the Bay. The establishment of a Biogeochemical model will define the concentration gradients for Storm Bay and in the meantime the best evidence of the potential for nutrient increase/accumulation from the combined fish farms comes from the Huon River and D’Entrecasteaux Channel. For that region the BEMP data and analysis at 81% of the TPDNO for that region (40,000 tonnes of production equivalent to the Storm Bay TPDNO) suggests that the nutrients or phytoplankton concentrations are not showing any significant, unpredicted signs of broadscale harm to the environment (Ross and MacLeod, 2013). Huon Aquaculture would therefore suggest that the surface directional flow combined with the degree of exposure, greater intrusion of oceanic water, larger significant wave heights, and fetch of Storm Bay compared to the Huon & Channel would strongly suggest that there is less risk of any significant eutrophication of Storm Bay on a broad scale basis at the proposed TPDNO level.

In terms of near-field effects, such as macroalgal growth/diversity, given that the proposed east of Yellow Bluff and SB I-4 zones are located at least 1.5km from the rocky shoreline and 1km to offshore reef outcrops (shore distances to zones provided in Figure 10) then there should be minimal risk that the farm derived nutrients will affect those areas. From Oh’s (2009) work undertaken in the more sheltered waters of the D’Entrecasteaux Channel and Nubeena (refer to Section 6.1.3.1 below), this distance is well outside that where any significant effect might be expected, especially as the predominant mass flows from the proposed and amended zones have been shown to be northerly for bottom waters and south-easterly for surface waters (Herzfeld, 2008, also Appendix M), allowing for the export of the ammonia in particular out to the ocean rather than inshore. These flow patterns and dispersal characteristics also strongly suggest that there is not likely to be any measurable (let alone significant) nutrient loads exported to the south of the farm and into Adventure Bay.

6.1.1.4 Mitigation measures

Monitoring and management response

Huon Aquaculture will continue to manage its operations in accordance with best practice principles. The transfer of farming effort towards a higher energy (generally more offshore) farming environment will reduce potential environmental impacts because of the greater depth, current flow and dissipation of nutrients and organic carbon in the proposed new and amended zones.

With the termination of the broadscale nutrient and phytoplankton survey study undertaken by IMAS (Appendix L), there is the need to establish a broadscale regulatory monitoring
system as has served the industry well in the Huon River and D’Entrecasteaux Channel. Huon Aquaculture is committed to working with DPIW/EPA, research providers, and the rest of industry to formulate a risk-based monitoring plan suitable for assessing the potential impact of farming fish in more exposed conditions such as Storm Bay. An Indicative Monitoring Program as drafted by the regulatory authorities is provided in Appendix P. The foundations of such a plan are already provided through the baseline monitoring programme completed through FRDC research projects 2009/067 and 2014/03 and through the various hydrodynamic models (in terms of boundary and scales) provided by CSIRO. In addition, the IMAS Nutrient Dispersion Modelling for Proposed Marine Finfish Farming Zones in Storm Bay (Appendix M) and the contemporary FRDC Research project 2015/024 will also inform future monitoring and management strategies. Specifically, the FRDC Project 2015/024, has been assessing the extent, nature and risk associated with environmental impacts from fish farms at exposed sites, as well as methodologies to best evaluate these impacts. Much of this work has centred on Huon Aquaculture’s lease MF261 in Storm Bay and is therefore providing additional baseline data including rocky reef ecology and monitoring criteria; sediment chemistry and biology; and water column nutrients.

Huon Aquaculture believes there is negligible risk to the shoreline adjacent to the proposed and amended zones due to prevailing flows, dissipation and the distance of the lease to shore. This assertion will be tested fully as Huon Aquaculture has already obtained baseline surveys for sub-tidal sites along the eastern shore of North Bruny Island (Valentine et al., 2016.) and of the offshore reefs closest to the SBI zone (https://auv.aodn.org.au/auv/ - site Tasmania201502, 02 Trumpeter Bay Broad North). Huon Aquaculture is also committed to extending the collection of data along the Northern Bruny Island eastern shoreline into the future.

Further, the company will use the resulting framework from the FRDC-funded study ‘Informd 2: Risk based tools supporting consultation, planning and adaptive management for aquaculture and other multiple uses of the coastal waters of southern Tasmania’ for evaluating spatial risk management strategies, to better inform and improve the sustainability of future stocking strategies across the south-east region.

The tools from the Informd 2 study have been used in the present EIS through the Connie 3 derived nutrient dispersal modelling provided in Appendix M.

**Statutory Environmental Monitoring and Management Program**

Marine farming in Tasmania is managed under an adaptive monitoring and management regime. Adaptive management is a structured, iterative process of optimal decision making using the best science available with an aim to further improve our knowledge of the system over time using comprehensive monitoring. Through this adaptive process rigorous control can be

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applied that assures sustainable operation and development, with monitoring and management decisions continually updated to reflect latest knowledge.

An effective ongoing adaptive management process requires clearly defined objectives, the selection of appropriate indicators and performance measures and a monitoring program that has the ability to detect any adverse effects associated with marine farming operations. The outcomes of this monitoring then inform decision making around the implementation of mitigation measures designed to reduce environmental effects.

An indicative monitoring program (Appendix P) has been developed by the PA that presents an approach for monitoring stressor levels and potential biological responses of key receptors at varying spatial and temporal scales. This program involves proposal-specific monitoring of water quality and sediment condition geared to production cycles and ongoing broadscale monitoring to assess water quality, sediment condition and reef community structure at intermediate and far-field scales.

Following the completion of the planning process, responsibility for the establishment, implementation and ongoing management of the environmental monitoring program for proposed salmonid marine farming operations will rest with the EPA. A range of management controls contained within the Storm Bay off Trumpeter Bay North Bruny Island MFDP area provide for the implementation of environmental monitoring requirements and specific measures to mitigate environmental effects.

In relation to the management of potential environmental effects on water quality, substrates and fauna and marine vegetation, it is the planning authority’s intent that in accordance with the provisions of relevant management controls:

1. The initial maximum biomass load across the region will not exceed 40,000 tonnes and that this will be managed through a TPDNO that will be determined by the Director EPA pursuant to management controls.

2. The EPA will incorporate a staged approach into environmental controls for biomass development within Storm Bay, with an initial limit on feed input equivalent to approximately 30,000 tonnes of production.

3. An ongoing monitoring program to assess the environmental condition of the Storm Bay region at varying spatial scales will be established and mandated by the Director EPA in marine farming licences. This program will be reviewed and improved in accordance with Adaptive Management principles.

4. Guideline limit levels be established in marine farming licences for relevant water quality and biological indicators by the Director EPA and that where relevant these be used as performance measures in future sustainability assessment and review of the TPDNO.

**Biogeochemical model**

Models have long been in use in SE Tasmania as described in the IMAS submission (IMAS, 2015);
‘With continued expansion in existing growing areas because of a shortage of new sites in the southeast, government and industry became increasingly concerned about broadscale cumulative effects, particularly due to increased nutrient inputs from dissolved salmon farm wastes in the Huon Estuary where most salmon were grown.

This triggered an intensive investigation of environmental quality by CSIRO (CSIRO Huon Estuary Study Team, 2000). This included examination of the physics, cycling of nutrients, and phytoplankton dynamics culminating in the development of hydrodynamic and water quality models of the Estuary. The modelling predicted that the Estuary could assimilate a doubling of production. Investigation of system wide environmental issues for sustainable salmonid aquaculture in southeast Tasmania then became the focus of a major seven year collaborative (IMAS & CSIRO) R&D program under the Aquafin CRC. With expansion into the nearby D’Entrecasteaux Channel, hydrodynamic and water quality models were developed for the whole Huon Estuary/ D’Entrecasteaux Channel region to evaluate the effects of current and projected farming loads to the system in addition to detailed investigation of water column nutrients, phytoplankton and zooplankton dynamics, and benthic biogeochemistry (Volkman et al., 2009). The study provided an extensive set of environmental data for the region, and demonstrated good environmental conditions with occasional localised periods of high phytoplankton abundance and low DO. The data were used to calibrate and validate sophisticated 3D hydrodynamic and biogeochemical models utilized to evaluate the environmental impacts of the salmonid fish farms in the region, contrasting the environmental footprint based on 2002 farm inputs with projected 2009 farm inputs. Informed by the modelled predictions of likely effects on phytoplankton populations based on projections of salmon farming in 2009, the Marine Farming Planning Review Panel and the Secretary of DPIPWE imposed a limit (via a nitrogen feed cap) of the salmonid industry in the Huon/D’Entrecasteaux region.’

And more recently through the INFORMD project (IMAS, 2015):

‘The first funded INFORMD project sought to specifically support integrated planning, management and development of the marine and coastal ecosystems of south east Tasmania by developing and demonstrating practical and science-based methods for predicting, assessing, and monitoring environmental condition in the Derwent, Huon Estuary and Bruny Bioregion. This region represents a microcosm of the issues facing coastal development and management throughout Australia. A range of remote sensing and modelling tools were developed and tested in this region with a view to developing practical approaches to coastal planning that can be used both by individual industries and for the region as a whole. Several of the methods, models, and management approaches developed through INFORMD are now being applied elsewhere in Australia.

INFORMD2 was funded by FRDC in 2012 and sought to build on the work done in the previous study by developing a new computer model, based on and linked to the existing hydrodynamic and biogeochemical models, but simplified, to enable communities and aquaculture industries to more easily assess the potential for environmental and human impacts in south east Tasmania. The project focuses on the estuarine and marine environments of the Huon River, D’Entrecasteaux Channel, and around Bruny Island, and is particularly relevant to the management of salmonid farms. The computer-based tool will in essence be a simulator, which allows management ideas to
be tested before implementation. The project will help industry, regulators, and local communities to better understand how changes in farming practices or spatial deployment, the expansion of other industries, or coastal urbanisation might impact key aspects of the marine and estuarine environments (i.e. those aspects critical to ecosystem function and or which are most valued by the community).’

This modelling capacity together with the baseline hydrodynamic and chemical and biological data already provided for the region (described in Section 5) and the EPA Environmental Monitoring Program (Indicative Program provided in Appendix P) can now form the basis for the relatively short term development of a biogeochemical model for the region.

**In situ net cleaning protocols**

Huon Aquaculture uses the same basic net cleaning protocols described in *The Environmental Practices Guideline for cleaning of Salmon pens using Marine Inspector Best Management in situ Net Cleaner MIC*. These guidelines are equally applicable to the RONC ROV style *in situ* cleaners used by Huon Aquaculture.

Huon Aquaculture has further designed SOPs that are targeted towards minimising the growth of biofouling on all nets and ensuring good flow through all pens to maximise oxygen availability to the fish. As a core part of this strategy (already underway), all nets are cleaned once a week in summer and every 2-3 weeks in winter. This also greatly reduces the loadings from net washes during any single cleaning event and prevents the growth (final settlement) of higher biomass fouling organisms such as mussels and squirts.

**Regulatory controls**

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedules 3, 3V

MC – 3.1, 3.2, 3.3, 3.4

**6.1.1.5 Overall effect following implementation of mitigation measures**

There should be no long-term net effect on water quality as:

- Storm Bay is an offshore site strongly influenced by oceanic currents, winds and waves that provide thorough mixing of the water body and dissipation of nutrients.

• The prevailing south-easterly flows in the Bay will tend to export nutrients out to the open ocean rather than to inshore areas.

• Given that the Storm Bay region is proposed to be restricted to a TPDNO level equivalent to that of the Huon and Channel MFDP’s, and that those areas have demonstrably poorer mixing and dissipating characteristics suggests that the risk to water quality in the area is therefore low to negligible.

• Management and ultimately stocking of fish farming in the region will be subject to a rigorous monitoring programme informed through hydrodynamic and biogeochemical modelling.
6.1.2 Substrates and Fauna

6.1.2.1 Recognised effects of farming emissions on substrates and benthic fauna

As for Section 6.1.1.1, the description of the recognised effects of farming emissions on water quality provided below is taken directly from the relevant MPINZ chapter which also forms a template for the section. The additional Tasmanian industry-specific information, referenced and italicised to distinguish it from the MPINZ information throughout the remainder of 6.1.2.1, is provided in the main through the IMAS submission.

1. The Ministry of Primary Industry, New Zealand (MPINZ) has released a series of reports/papers under the collective title; ‘Literature Review of Ecological Effects of Aquaculture (2013b)’, that includes ‘feed added’ aquaculture systems/species. Chapter 3 entitled, ‘Benthic Effects’ provides an excellent review of water quality effects.

2. IMAS Submission — Senate Environment and Communications References Committee Inquiry into Fin-fish Aquaculture in Tasmania - June 2015. This submission provides (amongst other information) an overview of both: the adequacy and availability of data on waterway health, and, the impact on waterway health, including to threatened and endangered species.

Overview of seabed effects

Note: The following MPINZ summary draws heavily on a review that was conducted by Forrest et al. (2007) and references contained therein. At times, information has been condensed and source references have been omitted for the sake of brevity and readability, however, they can be found in that document. Additions and amendments have been made based on new understanding or information.

Fish farms are almost invariably sited above soft-sediment habitats (as opposed to rocky habitats) and therefore the information on seabed effects relates primarily to physico-chemical and ecological changes in such areas. Most of the literature describes the effects of salmon farming, but studies for other finfish species (e.g. yellowtail kingfish, European sea bass, red sea bream) reveal that seabed impacts are similar (e.g. Karakassis et al. 1999; Rajendran et al. 1999; Mazzola et al. 2000; Yokoyama 2003). The dominant effect on the seabed arises from the deposition of faeces and uneaten feed, which leads to over-enrichment of the seabed due to the high organic content of the deposited particles. Hence, there is considered to be a high degree of transferability between the effects that have been described for salmon and those that are likely to occur for lesser known fish species, as long as the feed type and farming methods (e.g. feeding mechanisms, stocking densities) are comparable.
The seabed effects that result from finfish farming have been described according to the scale of the resulting effects (i.e. localised and within the primary footprint or far-field wider ecosystem) as listed below. The most dominant and well-described effects concern localised seabed enrichment from biodeposits and this appropriately comprises the bulk of the discussion. Other related effects include those of biofouling drop-off and shading by structures. It should also be noted that finfish farms produce significant quantities of dissolved nutrients and, therefore, the potential exists for waterborne enrichment of the benthos.

Descriptions of main effects and their significance

**Organic enrichment and smothering**

| Description of effect(s) | Feed and faecal deposition from finfish farms can change well-aerated and species-rich soft sediments in the vicinity of farm cages into anoxic (oxygen-depleted) zones that can be azoic (devoid of life) in extreme cases. Microbial decay of the waste material can dramatically alter the chemistry and ecology of the seafloor. Benthic communities can become highly enriched, infaunal diversity will be significantly reduced and extreme abundances of common opportunistic taxa may occur. Organic accumulation is less at highly dispersive sites, but the sediment chemistry and general composition will be significantly altered. Beneath finfish farms, enrichment effects are usually inseparable from those of farm-derived contaminants (e.g. copper and zinc), which is likely to be a compounding factor. |
| Spatial scale | **Local to bay-wide scale** – Effects most evident directly beneath the cages and exhibit a strong gradient of decreasing impact with increasing distance. The intensity and spatial extent of enrichment is highly site specific, with high flow, deep sites producing larger but more diffuse footprints. Mild enrichment can be detected out to about 100 to 1000m away from the farm, dependent on the site’s dispersive properties. |
| Duration | **Short to long term** – Significant recovery is short term, occurring within the first few months (approximately three to 12 months) of cessation of deposition. The benthos is mostly recovered in the medium to long term, within the timeframe of months to years (estimated 5–10 years for low flow sites in Tasmania (IMAS, 2015, MacLeod et al., 2014) & New Zealand). However, if trace metals accumulate in the sediments then they may continue to retard recolonisation after the organic material is gone, in which case full recovery may take longer. |
| Management options | Can be partially controlled through:  
  • careful site selection;  
  • altering feed capacities, optimising feed management (and farm production and/or intensity) and matching farm placement and design to site;  
  • monitoring and ongoing adaptive management. Impacts reversible upon removal of farm. |
| Knowledge gaps | Enrichment effects on reef biota.  
Comparative recovery rates at high flow sites. |
Table 31 - Smothering of benthic organisms by biodeposits from feed-added aquaculture operations (MPINZ, 2013b)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smothering effects are closely related to enrichment effects as both are caused by elevated levels of biodeposition and, in many cases, occur concurrently and are, therefore, difficult to separate. The distinction is made because the resuspension processes that dominate highly dispersive sites tend to preclude smothering effects from accumulative deposition; however, the effects of enrichment are usually still evident. Conversely, at low flow sites, &quot;inundation&quot; and smothering by biodeposits are likely to contribute significantly to the effects.</td>
</tr>
</tbody>
</table>

| Spatial scale                                                                 |
| Local scale (tens to hundreds of metres from farm) – Smothering effects tend to be more localised than enrichment effects because they tend to occur at low flow, depositional sites, where biodeposits will not spread as far, compared to sites where enrichment effects are more prevalent. |

<table>
<thead>
<tr>
<th>Management options</th>
<th>Site selection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge gaps</td>
<td>None identified.</td>
</tr>
</tbody>
</table>

Localised biodeposition

The microbial decay of organic waste material (predominantly feed and faeces) can dramatically alter the chemistry and ecology of the seafloor (Forrest et al. 2007 and references therein).

More than 20 years of research and investigation within Tasmania, and overseas has consistently shown that feed and faecal deposition from finfish farms can change well-aerated and species-rich soft sediments in the vicinity of farm cages into anoxic (oxygen-depleted) zones that can be azoic (devoid of life) in extreme cases, or dominated by only a few sediment-dwelling species tolerant of the degraded conditions.

The depositional “footprint” of a typical finfish farm extends tens to hundreds of metres from the point of discharge (Brown et al. 1987; Karakassis et al. 2000; Schendel et al. 2004; Chagué-Goff & Brown 2005), often in an elliptical pattern that is skewed in the direction of prevailing currents. Effects tend to be most evident directly beneath the cage, and exhibit a strong gradient of decreasing impact with increasing distance, which is consistent with other organic enrichment gradients (see review by Pearson & Rosenberg 1978). Farm-derived particulates may disperse further than the footprint of measurable effects, as shown by a recent overseas study detecting farm wastes up to 1 km from the source (Sara et al. 2004). Such findings highlight that the seabed environment beyond the effects footprint may be exposed to farm-derived materials, but at a rate that is able to be assimilated without exhibiting any measurable ecological changes.

Excessive levels of organic enrichment directly beneath finfish farms are typically identified using a suite of different “indicators”. Anoxic conditions within the sediment are evident as a strong “rotten egg” smell of hydrogen sulphide from sediment samples and a black colour throughout the sediment profile. Such conditions will typically be accompanied by visible white or cream coloured patches across the seafloor, which indicate the presence of mat-forming filamentous bacteria such as Beggiatoa sp.. Under extreme conditions, sediment out-gassing
also occurs, which will be evident as gas bubbles emerging from the sediment surface (Iwama 1991; Hopkins et al. 2004). This gas predominantly comprises hydrogen sulphide and methane, which is formed through the process of sulphate reduction and methanogenesis in the presence of anaerobic conditions (Gowen & Bradbury 1987; Hargrave et al. 2008); The hydrogen sulphide component of the out-gassing can adversely affect the health of fish and other fauna (Gowen & Bradbury 1987; Black et al. 1996). Under such conditions, levels of sediment organic matter and nutrients (e.g. organic carbon, nitrogen and phosphorus) are usually significantly elevated in comparison to natural sediments (Karakassis et al. 2000; Gao et al. 2005). The sediment can also be enriched with trace contaminants (e.g. zinc, copper) sourced from feed or antifouling agents. The specific effects of copper and zinc are discussed in more detail in Sneddon et al., (2012), but it is also relevant to note here that there are common additional stressors that occur in association with organic enrichment beneath salmon farms. As such, the ecological effects of copper and zinc are also part of, and encompassed by, assessments of benthic effects.

Enrichment leading to seabed sediments devoid of infauna (animals that inhabit the sediment matrix) has been detected in the past for salmon farms in Tasmania. However, significant effects extending to 35m compliance sites outside of the lease are rare and have generally been due to incorrect positioning of pens close to or on the lease boundary. IMAS in their submission (IMAS, 2015), describe the current status of research and knowledge of enrichment in Tasmania as:

‘After farming has commenced, routine monitoring of the lease areas is required and the marine farming development plan management controls stipulate “there must be no unacceptable impacts 35 m outside the boundary of the marine farming lease area’

The 35 m point from the boundary was based on studies from Europe where particulate farm wastes were generally found to be concentrated within 35 m of the edge of the cage, and preliminary research conducted in Tasmania (Ye et al. 1990). There has since been extensive research in Tasmania documenting the extent of benthic affects associated with particulate farm waste (e.g., McGhie et al., 2000; Crawford et al., 2002; MacLeod et al., 2004b; Edgar et al., 2005) which confirm a distinct gradient of impact: from significant signs of enrichment immediately adjacent to cages to minor farm effects evident at sites 35 m from the lease boundary. Research conducted at IMAS also established scientifically credible and cost effective environmental variables and techniques for monitoring the effects of particulate organic waste from fish farms that have been incorporated into regulatory requirements (e.g. Crawford et al., 2002). Subsequent work developed novel approaches for farm based monitoring of environmental condition which have since been used to improve farm management protocols and to maximize sustainable usage of the lease area (MacLeod & Forbes 2004).’

More recently the expansion of fish farming into the exposed Storm Bay region and concerns related to infauna beneath pens in Macquarie Harbour have indicated that the enrichment gradients differ significantly in these regions to the previous work, and IMAS have now expanded both the documentation of the effects and are providing region based gradients of impact to aid management and ensure sustainability in these areas through FRDC Project 2015-024, ‘An evaluation of the options
for expansion of salmonid aquaculture in Tasmanian Waters’, and other targeted research projects such as Ross et al., (2016a).

The rapid reduction in the severity of physico-chemical effects with increasing distance from the farm leads to an associated reduction in ecological effects. Most studies characterise ecological changes using infaunal communities (and other complementary techniques); the presence or absence, abundance and diversity of organisms that inhabit the sediments are well-recognised indicators of seabed health and enrichment status (Pearson & Rosenberg 1978; Brown et al. 1987; Keeley et al. 2012a, b).

New Zealand and overseas research to date has typically described ecological effects on the seabed based on infaunal communities as indicators. However, another important component of the seafloor community is the assemblage of animals and plants that live on the sediment surface, which are commonly referred to as “epibiota”. Depositional enrichment effects on epibiota from finfish farms in New Zealand are not well documented, although Forrest (1996) provides one example where epibiota were observed beneath salmon cages in a well-flushed environment. Similarly, organisms such as sea cucumbers, cushion stars and snake stars have been observed aggregating under conditions of mild enrichment at New Zealand salmon farming sites (Govier & Bennett 2007), sometimes in association with bacterial mats. These fauna tend to be displaced in situations of high enrichment, in which case they can be absent directly beneath the cages but aggregated around the perimeter where the enrichment is less intense.

However, in Tasmania it has long been the practice to use regular ROV surveys as the primary tool to detect significant effects both under pens and at 35 m compliance points. Therefore there is a wealth of both data and understanding of the effects both on, and of, these organisms at all sites. Further through IMAS there is a form of ongoing calibration between ROV footage and infaunal observations gained through FRDC Project 2015-024, ‘An evaluation of the options for expansion of salmonid aquaculture in Tasmanian Waters’, and other targeted research projects such as Ross et al., (2016a). Similar to New Zealand, capitellids (dorvilleids in Macquarie harbour), fanworms, small swarming crustaceans, Nudibranches, decapod crabs, fish, starfish, urchins, brittle stars and squat lobsters can be prevalent depending on the particular region and extent of the bacterial mats.

Epibiota may also respond to salmon farm effects other than direct deposition. For example, they may scavenge fouling biota that have fallen (or been defouled) from the farm structures. In Tasmania crabs and starfish are the main epibiotic scavengers.

Widespread biodeposition

Wider ecological effects from farm-derived biodeposits are possible due to resuspension processes that can transport organic particles beyond the primary footprint. However, the dilution and dispersion factors are such that distant ecological effects are usually minimal and/or difficult to detect over and above natural temporal and spatial variability. This is because much of the suspended particulate organic matter will be sufficiently diffuse that it can be naturally assimilated in the water column and/or on the seabed.

The extent to which resuspension spreads the waste material is determined by a site’s, physical
properties (i.e. depth and current speeds). At low flow sites very little resuspension occurs and effects are largely constrained to the local environment (Forrest et al. 2007). At high flow sites, however, the majority of the biodeposits are resuspended and exported, which promotes dilution and assimilation by the environment, and a portion may eventually be deposited in a diffuse form in neighbouring low flow areas (e.g. in blind bays). If depositional inputs are sufficiently elevated then there is potential for far-field benthic enrichment. In which case, although the magnitude of change would be very small the spatial extent could be very large.

Therefore, habitats outside of the primary footprint (e.g. ecologically important inshore communities, downstream reefs) may be affected by elevated suspended particulate loads (biodeposits) when resuspension occurs. This has the potential to negatively impact some species by creating an environment that is too turbid, blocking light (in the case of photosynthetic taxa) and potentially impeding larval settlement (e.g. Rodriguez et al. 1993; Walker 2007). Conversely, some taxa may benefit from the increased availability of organic particulates and dissolved nutrients (e.g. suspension-feeding bivalves, Teaioro 1999; Keeley 2001). This issue is particularly pertinent at high flow sites, because they tend to coincide with the physical requirements of reef communities, which often contain “potentially sensitive” or “ecologically valuable” taxa, in particular, large sessile filter feeders (e.g. hydroids, sponges) and macroalgae (e.g. kelp). However, by their very nature, high flow sites are well flushed and non-depositional and, therefore, inherently resilient to the effects of biodeposition and smothering. Direct observations of reef communities adjacent to New Zealand King Salmon farms operating in high flow areas for up to five years are yet to detect any obvious negative effects from resuspended farm-generated wastes (Dunmore & Keeley 2013).

This has generally also been the case in Tasmania (refer to Section 6.1.3).

Table 32 - Organic enrichment due to biodeposition from feed-added aquaculture operations – widespread effects (MPI NZ, 2013b)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
<th>Regional – Potentially large scale, i.e. that is, tens to hundreds of hectares. Cumulative across farms in the area.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial scale</td>
<td>Regional – Potentially large scale, i.e. that is, tens to hundreds of hectares. Cumulative across farms in the area.</td>
</tr>
<tr>
<td>Duration</td>
<td>Short term – Any low level enrichment is likely to be reversible within a relative short timeframe.</td>
</tr>
<tr>
<td>Management options</td>
<td>Site selection, system wide hydrodynamic modelling to identify potential hotspots.</td>
</tr>
<tr>
<td>Knowledge gaps</td>
<td>None identified.</td>
</tr>
</tbody>
</table>
Biofouling drop-off and debris

Table 33 - Biofouling drop-off and debris from feed-added aquaculture operations leading to organic enrichment and changes to physical composition of sediments (MPINZ, 2013b)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop-off of biofouling is most obvious around the farm perimeters beneath net sides. This can occur naturally (sloughing and natural drop-off) and unnaturally (net cleaning and dropping of litter). It is thought to contribute substantially to organic enrichment in those areas. Shell material and debris can also alter the physical and chemical composition of the seabed and can affect the benthic fauna; infaunal composition can be altered and diversity enhanced by providing substrate for sessile organisms.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spatial scale</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local scale – Limited to the areas directly beneath the nets and up to a few metres away. However, dispersal range will increase at deep and/or very high velocity sites, but this is still likely to be in the order of tens of metres from the cages.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Short to long term – Associated enrichment is reversible within a similar timeframe to enrichment from feed and faeces. Shell material will take longer to breakdown and revert to natural conditions. Inorganic debris (e.g. rope, cable ties) are unlikely to break down in the foreseeable future.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural drop-off can be partially manageable by controlling net rotations, antifouling methods, cage design and so on. Drop-off from cleaning is highly manageable by preventing in situ cleaning. Littering is manageable through industry best management practices.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge gaps</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of information pertaining to how much fouling drop-off contributes to benthic enrichment over and above feed and faeces deposition. Lack of information quantifying the contribution of different farm practices (e.g. in situ net cleaning) to drop-off.</td>
<td></td>
</tr>
</tbody>
</table>

Table 34 - Biofouling drop-off and biodeposition from feed-added aquaculture operations leading to aggregations of predators and scavengers (MPINZ, 2013b)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biofouling drop-off and elevated biodeposition can lead to aggregations of scavenging and/or predatory organisms, such as sea cucumbers, sea stars, crabs and lice. These fauna tend to be displaced under highly enriched conditions, in which case they may aggregate around the perimeter of the farm.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spatial scale</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local scale – Limited to the areas directly beneath the nets and up to about 50m away.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>For the duration of the farm – however this effect is reversible as mobile predators are likely to move away or starve once the food source is removed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of attractant (or food source) partially controllable through composition of farm structures and net cleaning practices.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge gaps</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Very limited information regarding any possible ecological effects of predator aggregations. What happens when a farm is removed and the organisms disperse?</td>
<td></td>
</tr>
</tbody>
</table>
Summary

Deposition of fouling biota may also contribute to seabed enrichment. One example arises in situations where fouling organisms reach high densities on farm structures and fall to the seabed either naturally or because of deliberate defouling by farm operators. Shell material and debris can alter the physical and chemical composition of the seabed and can affect the benthic fauna (Keeley et al. 2009); infaunal composition can be altered and diversity enhanced by providing substrate for sessile organisms.

In Tasmania in the past, the fouling biomass has intermittently been a substantial component of the organic material deposited on the seafloor, as was the case when blue mussels and/or sea squirts were removed from nets on salmon farms in the SE regions. In such situations, the deposited fouling biomass exacerbated enrichment effects (at least in the short term) associated with other processes, and led to increases of crabs, sometimes sea-stars and fish. This fauna tends to be displaced under highly enriched conditions, in which case it may aggregate around the perimeter of the pens with some individuals extending out towards the lease boundary. However, net cleaning operations and management have been modified significantly in recent years with very regular in situ cleaning greatly reducing the size and therefore the instantaneous loading to the seafloor.

Seabed shading by structures

Direct effects on the seabed can arise via processes other than deposition alone. For example, shading from farm structures can reduce the amount of natural light (photosynthetically active radiation, PAR) reaching the seafloor. This in turn could reduce the productivity of ecologically important primary producers such as benthic microalgae, or beds of macroalgae or eelgrass, with a range of associated ecological effects (e.g. Huxham et al. 2006). This issue could arise if farms are located in environments of relatively high water clarity, especially in well-flushed locations where deposition effects were low. Although identified as a potential effect, no studies exist that separate the effects of shading from that of benthic enrichment; presumably because they occur concurrently and the latter is thought to be the dominant stressor. Hence, this is a site-specific issue and one that can be at least partially mitigated by site selection.

Table 35 - Shading of seabed by structures on feed-added aquaculture farms (MPINZ, 2013b)

<table>
<thead>
<tr>
<th>Description of effect(s)</th>
<th>The presence of farm structures could reduce the amount of natural light (PAR) reaching the seabed, thereby reducing algae productivity. Changes would be most evident when situated in naturally clear water.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial scale</td>
<td><strong>Local</strong> scale – Roughly equate to two to three times the area of the structures.</td>
</tr>
<tr>
<td>Duration</td>
<td>For the duration of the farm – Microalgae productivity responds quickly to changes in ambient conditions, hence it would be expected that the benthic microflora would rapidly re-establish if the farm was removed.</td>
</tr>
<tr>
<td>Management options</td>
<td>Site selection, fine scale positioning of cages, matching feed levels to a sites physical properties and staged adaptive management.</td>
</tr>
<tr>
<td>Knowledge gaps</td>
<td>None identified.</td>
</tr>
</tbody>
</table>
Factors relating to all benthic impacts

Main factors affecting the extent of seabed effects
The magnitude and spatial extent of seabed effects from finfish farms are a function of a number of inter-related factors that can be broadly considered as farm attributes and physical environment attributes.

Farm attributes
Farm attributes that can affect the mass load of organic material deposited to the seabed include fish stocking density and the settling velocities of fish faeces. The latter appears to vary considerably among fish species from about 0.4–6.0 cm s⁻¹; Magill et al. 2006), and hence may influence relative deposition levels.

Other farm attributes include the types of feed and feeding systems, the feeding efficiency of the fish stock and the settling velocities of waste feed pellets. Depositional rates can also be influenced by farm waste consumption by wild fish assemblages. Clearly, it is in the interests of the fish farmer to minimise feed wastage. As well as the economic costs associated with waste feed, excessive food loss can organically enrich the seabed to a point where water column effects occur (e.g. hydrogen sulphide production) and fish health may be compromised.

The type of cage structure may also influence depositional effects through differences in fish holding capacity, which affects feed loadings and may affect feeding efficiencies.

The arrangement of the cages will also obviously affect the distribution of the seabed effects. Tightly clustered steel cages will have a localised and intense footprint in comparison to a more widely distributed cluster of individual plastic circular cages. Furthermore, cage design and position may affect depositional patterns through altering the way water currents move around a farm site. Any reductions in flow will reduce waste dispersal and flushing, potentially resulting in effects that are relatively localised but also more pronounced.

Physical site attributes
The capacity of the environment to disperse and assimilate farm wastes is primarily a function of water depth and current speeds, although assimilative capacity may also vary seasonally in relation to factors such as water temperature. Water depth and current speeds affect the extent of flushing, therefore, they are the primary attributes that modify both the magnitude and spatial extent of seabed effects. Increased flushing not only reduces localised sedimentation and accumulation of organic matter, but it also increases oxygen delivery to the sediments, thus allowing for more efficient mineralisation of farm wastes (Findlay & Watling 1997). Consequently, sites located in deep water (more than 30 metres) and exposed to strong water currents (more than 15 cm s⁻¹ on average) will have more widely dispersed depositional footprints with less intense enrichment than shallow, poorly flushed sites (e.g. Molina Dominguez et al. 2001; Pearson & Black 2001; Aguado-Gimenez & Garcia-Garcia 2004), Keeley et al. 2013a, b).

Contrasts in seabed effects between high and low flow environments are evident under Tasmanian
conditions. For example in the Huon River where there is weak flushing, then there have been found to be quite pronounced effects as demonstrated in ROV footage under and around the pens. By contrast, at the current Huon Aquaculture leases in Storm Bay, the intensity of effects are substantially less when subjected to comparable feed levels.

In terms of the types of seabed effects beneath the farms, organic accumulation tends to be minimal at high flow (dispersive) sites due to the increased levels of resuspension and the exporting of particles elsewhere. This is evidenced by relatively small increases in the sediment organic content (percentage of ash free dry weight (AFDW)) beneath farms at high flow sites compared with low flow sites, where organic content can increase six-fold (Keeley et al. 2012b, 2013a). Changes to the infaunal community at high flow sites are not as obvious during the early stages of enrichment; however, they can be very pronounced and characteristically different at higher feed levels. Most notably, extreme abundances (more than 23 000 individuals/core) of opportunistic species (primarily Capitellid sp. and nematodes) can develop in the centre of the footprint, and natural benthic diversity tends higher and can be maintained throughout higher levels of enrichment. At low flow sites, peak abundances are usually between 2000 to 3000 individuals/core, and diversity is compromised at earlier stages of enrichment.

Seabed recovery

One of the ways in which the significance of human activities in coastal environments can be assessed is to consider whether they cause permanent or long-term changes, or whether adverse effects are reversible once their cause is removed.

This is a pertinent question to address in the case of new farm developments and has particular relevance for the evaluation of mitigation strategies based on farm fallowing and rotation.

Fish farm studies in Tasmania, New Zealand and overseas indicate timescales of recovery ranging from months to years (MacLeod et al., 2014). Recovery rates are influenced by the spatial extent and magnitude of enrichment at the point of fallowing, and the flushing characteristics of the environment (Karakassis et al. 1999; Brooks et al. 2003); larger and more heavily impacted sites, or sites in areas of relatively weak currents, are expected to take longer to recover. A number of Tasmanian and overseas studies describe partial recovery within the first three to six months after the cessation of farming (Mazzola et al. 2000; Brooks et al. 2003; MacLeod et al. 2004a), but complete recovery (i.e. comparable to background conditions) can take many years and is often not fully realised in the timeframe of monitoring programmes (Karakassis et al. 1999; McGhie et al. 2000; Pohle et al. 2001; Pereira et al. 2004). The process tends to involve an initial improvement in the intensity of physico-chemical effects, with a slower timescale of recovery for seabed faunal communities (Pohle et al. 2001; Brooks et al. 2003; MacLeod et al. 2004a). Recovery is also thought to be adversely affected by the presence of contaminants (i.e. copper and zinc) as persistence in the sediments may impede infaunal health and therefore ecological succession. The large range in estimates for seabed remediation and recovery is partly due to the wide variety of criteria that has been proposed.
The full recovery for a fish farm located in a highly depositional site in Tasmania is also described by MacLeod et al., (2014), which was also considered in brief in the IMAS (2015) submission as follows;

‘The next stage in the developing understanding regarding management of the environmental interactions of salmon farming was to consider how areas affected by salmon farming might recover both after farming ceased and as part of the ongoing farming process. An opportunity to study this was provided when a lease in North West Bay was vacated in 2000 (MacLeod et al., 2002). This showed that sediments can recover once farming is removed and that there was potential to manage recovery (MacLeod et al., 2004a).’

It is expected that recovery will be faster at well flushed sites due to the high levels of resuspension, oxygenation and the associated limited propensity to accumulate organic material and become excessively impacted.

**Characterising and quantifying enrichment**

The requirement to characterise and quantify enrichment of the seafloor under fish farms in Tasmania has long been the focus of study for IMAS, and the progress to 2015 (IMAS, 2015) is summarised as follows:

‘… prompted further research to establish farm-based indicators for management of sediment condition, such that conditions beneath cages can be maintained at a level that ensures ongoing farming sustainability (MacLeod et al., 2004b). The research found a clear relationship between farm management practices and level of impact, and identified nine distinct stages of sediment condition that could be used to enable farmers to easily classify sediment condition and manage accordingly (MacLeod et al., 2004b). This research highlighted regional differences in the sediments’ ability to assimilate organic material, and showed that although the fundamental stages of degradation and recovery were consistent, the rate at which these processes occurred differed depending on the prevailing environmental conditions (MacLeod et al., 2007). However, farm management regimes could be manipulated to compensate for this (MacLeod et al., 2006). Although the protocols proposed through this research were developed specifically in relation to on-farm monitoring and management, and were not intended for regulatory or compliance purposes, the findings have informed regulatory processes both in Tasmania and internationally (Woods et al., 2004, Keeley et al., 2014).

The field guide produced as part of the local-scale benthic research (MacLeod et al., 2004b) details in highly specific terms how to undertake the monitoring approaches proposed, and as such has helped to ensure the monitoring is consistent and accurate and therefore that the monitoring results are reliable. As a consequence, the resultant data can be used for broader scale analyses of ecological impact and interactions, with independent studies using the collective monitoring data to assess the broad-scale effects of marine salmonid aquaculture on the sediment environment and the distribution of introduced pests in Tasmania (Edgar et al. 2005, Edgar et al., 2009). The value of these data in supporting our understanding of broader spatial and temporal changes across Tasmania should be acknowledged.’

The nine distinct stages of sediment condition that have been used to enable farmers to easily classify sediment condition and manage accordingly as identified in MacLeod and Forbes (2004) are shown
Figure 65 - General characterisation of impact/recovery stages based on main infaunal community, key faunal indicators and functional changes. Shaded area indicates period when cage was stocked MacLeod and Forbes, 2004.

As stated previously, it is now accepted in Tasmania that this enrichment cycle varies significantly between regions - primarily in relation to their flushing characteristics, and that the characterisation and quantification for each farming region is being addressed through FRDC Project 2015-024, ‘An evaluation of the options for expansion of salmonid aquaculture in Tasmanian Waters’.
6.1.2.2 Expected levels of farming emissions

Fish faeces and feed

For calculating Huon Aquaculture’s emissions uneaten feed has been estimated at 3% of total fed (Cromey et al. 2002). The proportion of dry feed estimated to be lost by Atlantic salmon to faeces is approximately 15%. This exact percentage will vary with the protein content and digestibility of the diet. This estimate is similar to that quoted by Reid et al., 2009. These factors have been used to determine the likely expected faecal load on the proposed new and amended zones and include estimates of nitrogen (Wang et al., 2012) and carbon (Hall et al, 1990) and are presented in Table 27.

Solid effluent stream from in situ net cleaning

The loadings for blasting/suction in situ cleaning for the major components of concern within the solid effluent stream were examined by the Caring for our Country study Improving water quality in cage finfish aquaculture: managing net biofouling. The results shown in Table 36 form part of an internal industry report (Draft), sections of which have been provided to the Federal Government. These represent the best data presently available to the company, and although the data is for the MIC combination suction and blast cleaning method compared to Huon Aquaculture’s RONC cleaning methodology, the nets were cleaned to the same level (little to no bio-fouling left on the net) and the methodology employed collected the vast majority of the effluent. Therefore, the figures indicated are regarded as a reasonable representation of the analyte totals.

Table 36 - Mean total loading for blasting/suction in situ cleaning methodology for one 120m pen and one year (insoluble and soluble components plus solids combined)

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Total loading per cage (kg)</th>
<th>Total loading per lease per year (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids</td>
<td>58.09</td>
<td>4792.89</td>
</tr>
<tr>
<td>Org C</td>
<td>9.32</td>
<td>769.30</td>
</tr>
<tr>
<td>Org N</td>
<td>1.56</td>
<td>128.93</td>
</tr>
<tr>
<td>P</td>
<td>0.36</td>
<td>30.41</td>
</tr>
<tr>
<td>Cu</td>
<td>0.001</td>
<td>0.09</td>
</tr>
<tr>
<td>Zn</td>
<td>0.02</td>
<td>1.70</td>
</tr>
<tr>
<td>N0x mg/L</td>
<td>0.05</td>
<td>4.43</td>
</tr>
<tr>
<td>NH4 mg/L</td>
<td>0.02</td>
<td>1.84</td>
</tr>
</tbody>
</table>
The CfoC study also undertook dispersion modelling of the solids plumes from the combined blasting/suction in situ cleaning process. The study provided the modellers with the analyses of size fractionation of the effluent together with settling rates of the fractions and current meter data for fish farm sites at a low flow and higher flow site. Results from that modelling under low flow conditions showed that 90% of the solids would be deposited within 100m of the pen and in the case of the higher flow site 90% would be deposited within 200m of the pen. While deposition also occurs beyond these points in both cases (and up to 2km but only in the direction of flow), the impacts are considered likely to be negligible due to the minute quantities being spread over a large area.

Huon Aquaculture’s extended in situ cleaning operational protocols are further expected to decrease the total levels of solid waste from net cleans substantially below the figures provided in Table 36 above. This is due to the fact that the nets will be continuously cleaned before the bio-fouling layer accumulates to any significant level of biomass.

The effects of the expected emission levels relative to current emission levels on a local and regional scale

A principle objective in moving fish farming effort offshore is related to the increased dispersal of waste products from the pens to the point that they cannot have a significant non-reversible effect on the receiving environment. Solids dispersal is driven particularly by physical water flow characteristics and bioturbation. In areas where seafloor energy is high, such as Storm Bay (as indicated by rippled sand substrates in the area), then physical re-suspension dominates and will restrict organic accumulation under the pens, in turn resulting in reduced localised biogeochemical activity and nutrient production, although there is some evidence to suggest that waste can be spread further (refer to embedded tables 3.1 & 3.4 in Section 6.1.2.1). There is the possibility of these solids being transported to other locations and accumulating due to eddies and or deposition in adjacent lower energy environments (e.g. bays with restricted flows). For the proposed and amended zones though, the predominant flows in the area, even at depth (Herzfeld, 2008), are generally directed away from or parallel to those possible areas of concern for instance Adventure Bay and the rocky eastern shoreline of North Bruny Island.

As stated previously, Storm Bay is a high energy exposed water body (with an ‘open’ fetch from the south and east) and current flows on the seafloor are quite strong relative to other growing areas in Tasmania and in particular the Huon River and Macquarie harbour, as shown by the fact that the sediments are composed of bio-turbated and rippled sands (see Appendix H). Therefore, Huon Aquaculture expects rapid seafloor recovery at least equivalent to that experienced at its east of Redcliffs lease in the lower D’Entrecasteaux Channel, which consistently demonstrates rapid visual recovery (within a month).

Greater water movement at exposed sites raises the possibility that the organic loading will spread further from the pens than at sheltered sites, either by; increased flow directly spreading fish faeces and excess feed pellets further, or, through tidal and wave forces increasing movement of the pens and grids (in some cases) closer to the lease boundary and
therefore compliance sites. Recent data provided through ROV surveys (2015, 2016 AVS) of the seafloor for both Huon Aquaculture’s original Trumpeter Bay lease and SBI lease demonstrate that for the surface sediments and fauna/flora there are no significant signs of effect at the compliance sites. At the pen sites themselves, apart from an incidence of spilled feed leading to a temporary increase in feed deposits below a number of pens, the organic accumulation under the pens has been much reduced compared to the pen sites in the Huon & Channel. The video footage shows that beneath most pen bays are only small amounts of patchy *Beggiatoa*, no bubbling, and a much thinner layer of faeces and organic build up than pens located in the Huon & Channel.

Details of the expected under pen emission levels or effects are provided through modelling of the spread of the organic matter in the following section.

At the proposed TPDNO level the solids waste emissions for the proposed and amended zones will be:

East of Yellow Bluff – input of 183T of lost feed, 43T of Nitrogen, 274T of carbon and 914T of fish faeces

SBI-4 – input of 612T of lost feed, 143T of Nitrogen, 918T of carbon and 3,062T of fish faeces for the combined SB 1-4 zones.
A detailed assessment of the benthic effects on a cage and lease basis

Background

Predictive modelling was undertaken using DEPOMOD v2.4.1 (Scottish Environment Protection Agency) to predict the solids deposition on the sea bed arising from fish farm operations. DEPOMOD has a modular framework consisting of three main components, grid generation, particle trajectory and re-suspension modules and modelling is undertaken as a step-wise process through the modules (Figure 66). The current version of DEPOMOD does not produce model outputs in conventional cartographic formats and require post-processing using specialised software applications such as Surfer.

Model procedure

The grid generation module converts field derived data into a grid containing information on depth, cage and sampling station positions for the area of interest. The particle tracking module takes information on wastage rates of fish food and faeces and hydrodynamics of the area and calculates the initial deposition of particles on the sea bed. The re-suspension module then redistributes particles according to near-bed current flow fields (utilising both ADCP and Wind data for the site) to predict the net solids accumulated on the sea bed within the grid area.

For modelling total solid deposition arising from waste food and faeces from the farm, the model processes are generally summarised below.

- A grid is generated detailing bathymetry of the area, positions of fish pens and any sampling stations or reference points.
- On a cage by cage basis, specification of feed input (kg feed cage\(^{-1}\) d\(^{-1}\)) and wastage rates (food wastage, food water content and digestibility).
- Settling of waste material (i.e. food and faecal pellets) vertically through the water column described by a range of settling velocities. In the absence of lab verification, default parameter estimates are specified by the model based on the pellet size entered by the user. The model will then assign velocities to particles in the trajectory model based on the pellet size taken from a normal distribution with a specified average velocity and SD.
- Advection of particles in two dimensions by water currents.
- Modelling of turbulence in three dimensions via a random walk model.
- Initial deposition of particles on the sea bed and subsequent erosion, transport and deposition in the model grid area. The particle trajectory module predicts the initial deposition of particles onto the sea bed however the results are not accessible to the user and must be processed through the resuspension module prior to post-processing.
- Determination of solids accumulation (defined as \(S_{\text{avail}}\) in units of g.m\(^{-2}\).yr\(^{-1}\)) or solids deposition (g.m\(^{-2}\)) from a single release of particles. Raw outputs are predictions of
total solids deposition g.m$^{-2}$.yr$^{-1}$, post-processing is required to determine daily and monthly deposition rates.

Model outputs were post-processed using Quantum GIS 2.0.1 and Surfer v11.6 (Golden Software) to derive continuous gridded data from modelled point data.

Main assumptions from the model runs:

- **Bathymetry** - bathymetry grid for the site was generated from detailed field survey data as contained in Appendix H. This comprised a limited number of spot depths dispersed over the greater area of the proposed farming area. Gridding of the sparse bathy data was required to generate a suitable grid for model building.

- **Particle tracking** - settling velocity data for each pellet size was calculated using the DEPOMOD normal frequency distribution model (common approach in the absence of laboratory testing).

- **Re-suspension** - for the North Bruny model, wind speed data from Dennes Point was purchased from BOM covering the same period as the ADCP deployment. Fetch distances from the proposed farming location to landfall at 8 points of the compass (45 degree increments) were calculated using a spatial data layer representing the Tasmanian coastline using a GIS. Fetch distances were capped at 100km.

- **Re-suspension** - bed shear velocity was taken from the deepest cell (1.5m above the seafloor) in the ADCP data supplied. Bed shear is calculated by the model using the bottom layer of the current velocity record. Because DEPOMOD has a limitation of 5 water column layers, and most modern ADCP units sample at a greater resolution, some aggregation of the ADCP data is required.

- **Re-suspension** - wind speed and ADCP data was collected over limited time period and might not be representative of an annual or production cycle. This assumption is correct however there are some limitation with the current DEPOMOD framework and prevent it from effectively handling long time series of fine temporal scale data.

For all model runs, the re-suspension model was enabled using the standard bed shear calculations plus the wind/wave sub-model option. The wind-wave sub-model calculates the effective wave setup as a result of the wind strength, fetch distance and duration, and uses these additional forces to calculate effective re-suspension and dispersal after the initial deposition predicted by the particle trajectory model.
Huon Aquaculture Company

Figure 66 - Overview of DEPOMOD variables and overall structure

DEPOMOD MODULES FOR MODELLING THE EFFECTS OF DEPOSITION FROM MARICULTURE

Model Runs generated

Huon Aquaculture contracted Marine Solutions P/L to set up and run DEPOMOD to model the fate of solids deposition under the fish farm pens and leases for three different Runs (refer to Table 37).
Model Runs 1 & 2 represent stocking of the SB1-4 zones for 240m pens but with a difference in grid orientation of 90 degrees (Figure 67). The two scenarios were designed to provide an understanding of the spread of solids for every possible eventuality for grid orientation within the leases, given that the company continues to improve its understanding of the prevailing forces acting upon, and therefore the optimal orientation of the gear in each zone. In order to ensure that effects distances provided for the North/South pen grid orientation are equally relevant for East/West oriented grids and thereby any orientation in between, a comparison of model Run 1 & 2 results is also provided in Section 6.1.2.3 below. The detailed outputs for Run 1 were provided in the EIS to Amendment 1 and those for Run 2 are provided in Appendix I. Both model runs represent a worst case scenario using a predicted pen stocking estimate well above that considered for the TPDNO limit (refer to Table 37) and including more pens in each grid (10, 12 pens per grid) than will be employed at either the east of Yellow Bluff or SB1-4 zones (6 pens only).

Model Run 3 represents stocking of 168m pens at the proposed new zone amendment location, that is the east of Yellow Bluff zone. This model run uses baseline environmental data (ADCP data, bathymetry as presented in Section 5) and worst case scenario predicted stocking data on a pen by pen basis (refer to Table 37 & Figure 68).

Biomass, stocking density and feed fed data was deliberately maximised to represent worst case transfer delays for all model runs and were therefore significantly greater than values consistent with the proposed TPDNO.

Total solids deposition was chosen as the variable to be modelled in all models as it incorporates all solids including organic carbon (again representing a worst case scenario).

**Additional input data to the models**

*East of Yellow Bluff*

168m circumference pens. Moored centrally in 100m x 100m (1.00ha) grid spaces.

Maximum feed input per day = 1.8 tonnes of (19% is 6mm and 81% 9mm), sink speed 0.1 to 0.12m/s. Maximum stocking density = 10.3Kg/m$^3$ Model run as 3x2 grid of pens.

*SB Zones 1-4*

240m circumference pens. Moored centrally in 140m x 140m (1.96ha) grid spaces

Maximum feed input per day = 3.1 tonnes of 9mm, sink speed 0.1 to 0.12m/s. Maximum stocking density = 6.8Kg/m$^3$ Model run as 2x5 or 6x2 grid of pens.
Table 37 - details of DEPOMOD model scenarios provided for the new and amended zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Long axis of the grids</th>
<th>Purpose</th>
<th>Results provided</th>
<th>Per pen feed inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB 1-4 zones</td>
<td>N - S</td>
<td>Estimate spread and loading from 240m pens and grids</td>
<td>In full – EIS to Amendment No. 1 (Storm Bay off Trumpeter Bay MFDP)</td>
<td>639</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Partial – grid alignment comparison in Section 6.1.2.3.</td>
<td></td>
</tr>
<tr>
<td>SB 1-4 zones</td>
<td>E - W</td>
<td>Provide a comparison between the different orientation of grids</td>
<td>In full – Appendix I</td>
<td>688</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Partial – grid alignment comparison in Section 6.1.2.3.</td>
<td></td>
</tr>
<tr>
<td>East of Yellow Bluff</td>
<td>N - S</td>
<td>Estimate spread and loading from 168m pens and grids</td>
<td>In full – Appendix I</td>
<td>703</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overview of results in Section 6.1.2.3.</td>
<td></td>
</tr>
<tr>
<td>SB 1-4 zones TPDNO limit</td>
<td></td>
<td>Comparison to DEPOMOD loadings</td>
<td></td>
<td>510</td>
</tr>
<tr>
<td>East of Yellow Bluff TPDNO limit</td>
<td></td>
<td>Comparison to DEPOMOD loadings</td>
<td></td>
<td>152</td>
</tr>
</tbody>
</table>
6.1.2.3 Evaluation of potential effects

The ‘effects distances’ derived from DEPOMOD model Runs 1 & 2 comparing the rotation of pens and grid through 90° can be seen in Figure 67 below.

Figure 67 – Total Annual deposition of total solids (including carbon) comparing two opposite grid orientations at SB3. Proposed historic lease boundaries indicated, but not relevant to the exercise.
From Figure 67 above it is clear that the depositional footprint beneath each pen extending out to a limit of 500g/m²/year of total solids is unchanged by the orientation of the grid as the maximum distance from the edge of the pen to the 500g/m²/year contour is 75m (+/-2m) and the direction of maximum spread is to the SW from the south-westernmost pens in both cases. A depositional rate of 500g/m²/year is regarded as providing a relative buffer regarding enrichment of the sediments in dispersive (exposed) sites as stated in Keeley et al. (2013b); ‘Moderate enrichment was associated with a flux of ~0.4 and 1kg/m²/year, whilst highly enriched conditions occurred in response to 6 and 13kg/m²/year, for low and dispersive sites, respectively.

For the East of Yellow Bluff zone the modelling of 168m pens indicates that there is little likelihood for any significant or indeed measurable deposition of solids outside the lease area, with deposition levels as low as 500g/m²/year (equivalent to ~1.4g/m²/day) remaining well within the lease boundary, but notably extending approximately 45m from the pen itself (Figure 68 below). Given the comparison in the previous paragraph of the 240m pen grids in opposite orientation along their longer axis, then Huon Aquaculture is confident that the 500g/m²/year contours will not change significantly due to the re-orientation of the grids through 108 degrees clockwise in Figure 68.

Huon Aquaculture recognises that pens cannot be positioned close to the lease boundary as the risk of affecting compliance sites will be high. In terms of a worst-case scenario for the proposed zone at east of Yellow Bluff then as the corner of the grid in the proposed lease is 58m (refer to Figure 17) from the lease boundary then the pen itself will be approximately 80m from the lease boundary and therefore 115m from any compliance site. All other pens in the grid would be at least 100m from the boundary and therefore 135m minimum from any possible compliance site.

Recent work has suggested that the DEPOMOD model may underestimate the zone of effect at exposed sites compared to high depositional/sheltered sites (Keeley et al., 2013b). There is some evidence for the greater than modelled spread of the ‘zone of effect’ at exposed sites, e.g. leading in some cases to elevated numbers of opportunistic species, and this is despite the fact that organic matter/carbon levels are not necessarily increasing at those sites (Keeley, 2013). Keeley et al. (2013b) caution that, ‘Where depositional models are deployed at dispersive sites, validation data should be obtained to ensure that the impacts are accurately predicted.’ Huon Aquaculture is fortunate that FRDC project 2015/024, ‘Managing Environmental Interactions’ is collecting relevant data from the SB1 lease. On completion, FRDC 2015/024 will help validate the results obtained from both the current and previous amendment DEPOMOD model runs.
Figure 68 - Yellow Bluff solids (including carbon) deposition:

Left hand top - Total annual solids deposition for individual pen bays and fully loaded grids,
Right hand top - Average daily solids deposition for peak production month, December,
Left hand bottom - Average daily solids deposition over the whole year,
Right hand bottom - Cumulative deposition after 9 in 12 months stocking ending in March.

The DEPOMOD modelling confirms that nutrient emissions associated with the proposed development are unlikely to have any broadscale effect on the benthos or substrate. Present compliance monitoring (specifically ROV surveys)) for Huon Aquaculture’s existing leases in the Storm Bay region confirm that there are presently no significant effects at the 35m compliance sites.
6.1.2.4 Other effects of farming operations

Physical/structural disturbance of substrates and fauna

The only physical disturbance to the substrates or fauna apart from the build-up of faeces underneath the pens will be the installation of mooring lines and anchors. The incorrect design of anchors and/or anchor systems can affect benthic flora and fauna and have been associated with clearing areas of seagrasses and possibly affecting the distribution of threatened fish species under certain conditions.

As for all leases, these structures occupy only a very small fraction of the seafloor within the zone and will therefore not cause any significant changes within the proposed zone.

Huon Aquaculture has recently significantly increased the size of the spade or ‘stingray’ type anchors from 1500kg to 2000kg to increase both drag resistance and enhance the burial or grab properties of the anchor. This initiative will reduce the need to piggy-back spade or concrete anchors, which will greatly reduce the total number of anchors required.

6.1.2.5 Mitigation Measures

Fish feeding regimes/feed wastage minimization

In common with all fish grown by Huon Aquaculture, the stock held in the proposed new and amended zones will be fed to appetite with a target of zero waste. Appetite will be assessed by direct observation by video camera and by direct measurement of pellet consumption rates and modulation of feed delivery. Huon Aquaculture feed staff are amongst the most experienced in the world. Waste is minimised by ensuring that fish are fed at the correct rate and until satiated. Further Huon Aquaculture now inspects the seafloor (using ROV) below all pens at all sites every 1-2 months in order to assess feed wastage and collect information on seafloor health.

In situ net cleaning protocols

The in situ net cleaning protocols and mitigation measures have been described earlier (Section 6.1.1.4). The amount of solids produced will not significantly affect seafloor health and the shift of the operations away from high depositional sites will decrease overall deposition and accumulation of organic carbon.

Fallowing principles

Fallowing of all Huon Aquaculture leases is determined through the use of ROV surveys of the seafloor. Huon Aquaculture, through both its internal environmental technical crew and Dr Dom O’Brien of Aquaculture, Management & Development P/L,
has more than 15 years of direct filming experience on the deposition and recovery of the seafloor for all fish farming areas of Tasmania, NSW and parts of Victoria.

Fallowing requirements vary from lease to lease and an adaptive management strategy is used to respond to changes, not only in the physical characteristics of the lease area but also in pen and grid size and fish stocking densities. The lease areas formed and extended through the proposed amendment are to be used in an integrated manner, with the proposed east of Yellow Bluff lease supplying the SB 1-4 leases. This will ensure that each lease can be fallowed for 2 months out of 12, and each pen bay could be fallowed for up to 6 months on a regular basis.

As stated above, the physical characteristics of the proposed east of Yellow Bluff and SB 1-4 leases will ensure excellent, fast seafloor recovery as demonstrated through the Regulatory Annual Video Surveys carried out at the original Trumpeter Bay and SB1 leases (MF 261) over the past two years. This is further emphasised in any comparison of surveys carried out at high organic Huon estuary leases, e.g. Hideaway Bay (MF 93) or Garden Island (MF 141). Huon Aquaculture therefore regards the proposed amendment zones to be ones that will continuously demonstrate good seafloor recovery characteristics.

**Monitoring and management response**

Management responses arise through adapting both fallowing and monitoring strategies to the substrate deposition characteristics at the leases and the stocking requirements for individual year classes and pen sizes. Adjustments of these responses are initiated through the results of the regulatory annual, and Huon Aquaculture internal, video surveys.

Huon Aquaculture will use the results of the FRDC project 2015/024 to validate the DEPOMOD model and in the future better inform the positioning of the pens within the leases in the new and amended zones.

Broadscale benthos and substrate changes will be best verified and managed through an appropriate region-wide monitoring programme coupled with appropriate lease conditions and management controls in discussion with EPA.

**Positioning of pens and grids**

Pending the final FRDC 2015/024 report and any subsequent validation, the current amendment proposal seeks to:

1) Increase the leasable area around the grids and pens at the SB zones through increasing the distance between the pens and compliance sites to >110m in the Yellow Bluff zone and >175m at the more exposed SB 1-4 zones. Both distances are more than twice the that suggested for detectable effects by using the current DEPOMOD model.
2) Ensure the proposed layout of the lease and the size of the grids at the East of Yellow Bluff zone results in a generous amount of space between the grids. Both initiatives allowing for flexibility in the positioning of the fish pens relative to the lease boundaries should that be indicated through any future modelling work being undertaken by IMAS.

Regulatory controls

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedules 3, 3V
MC – 3.1, 3.3, 3.4, 3.5, 3.6.

6.1.2.6 Overall effect following implementation of mitigation measures

Huon Aquaculture does not anticipate any adverse consequences to the seafloor under the proposed new and amended zones, as it is composed of well mixed coarse substrates characterised by bioturbation and rippling suggesting strong scouring conditions. Further, DEPOMOD deposition rates after re-suspension (using DEPOMOD model version 2.4.1) indicate that the accumulation of solids under the pens will be limited to within the lease boundary and, given that the predominant flow direction for the area is north/south or offshore, depending on depth then there is negligible risk that fish farm derived solids will accumulate along the eastern shore of Bruny Island.

6.1.3 Marine Vegetation

6.1.3.1 Recognised effects of farming emissions on marine vegetation

As stated in Section 6.1.1.4, Huon Aquaculture is committed to extending the scope of near-field environmental research to sub tidal reefs in Storm Bay, and is working with IMAS (through FRDC project 2015/024) to facilitate both the review of the data already collected for rocky reefs and also to extend the collection of data in that area into the future. Through these and other initiatives, Huon Aquaculture has already been provided with a baseline survey for both: sub-tidal sites along the eastern shore of North Bruny Island (Valentine et al., 2016), and offshore reefs closest to the SB1
zone (https://auv.aodn.org.au/auv/ - site Tasmania201502, 02 Trumpeter Bay Broad North) which is an IMAS (liaison Dr. Neville Barrett)/Huon Aquaculture initiative.

The significance of the nutrient input depends on many factors, which include other nutrient inputs (e.g. from the open ocean or the Derwent River), the amount and availability of the farm derived nutrients, and the ability of Storm Bay to assimilate nutrients.

Under certain conditions, nutrient increase can lead to the increased proliferation of some types of marine vegetation if those nutrients are limiting in that environment. There can be an increase in biomass of microalgae which is usually (but not exclusively) manifested through either decreased biodiversity or domination of certain species over others, increased growth of algal slimes in enclosed or quiet waters, increased growth of epiphytes and choke weeds on seagrass beds, and/or phytoplankton blooms.

The Huon-Channel region has been the subject of numerous studies of macrophytes (reef and inter-tidal) and phytoplankton (or its surrogate, Chlorophyll a). Given that some slight change might be expected within a few hundred metres of a sheltered fish farm (restricted water exchange), conclusions provided by these studies, presented below, would presently seem to indicate that the farming levels seen within this region are not having a significant effect on macroalgal communities.

Oh (2009) found that the effect of fish farms on reef benthic communities extended to at least 100m from fish farms at both sheltered and exposed sites, where the macroalgal community was significantly different from reference sites. Although 400m sites were collectively not significantly different to reference sites, it is likely that effects extended to at least 400m in some areas but not others. This was indicated by the leave-one-out procedure in the CAP analysis, which revealed that 5 of the 400m sites showed characteristics akin to 100m sites, compared to none of the 5000m reference sites and only two of the 2000m sites. This suggests that variations in the detectable effects of fish farms can be anticipated at scales of hundreds of metres but these would rarely reach distances of more than a kilometre away from farming areas.

Crawford (2003) noted that marine reserves located at Tinderbox and Ninepin Point had been surveyed annually over the ten-year period from 1992 to 2002. Changes in the abundances of algae species were recorded in the reserves and at external control sites. No consistent patterns over time were apparent. Each species varied over time in different ways, depending on location and site. The MDS diagrams show no consistent directional change in community composition that would indicate a change in environmental conditions through time determined by local conditions and recruitment.

The follow up study and re-survey of the MPA sites undertaken by Valentine et al., (2016), and which also included baseline sampling of sites in Storm Bay, provided the following results/key findings:
Analysis of data from MPA monitoring sites for the period 1992-2015 showed no consistent patterns of broad-scale change in macroalgal community structure over time. While key functional groups and dominant taxa showed some variability, these tended to be fluctuations rather than directional change.

Abundance of nutrient indicator species was low and variable over the 1992-2015 period and there was no evidence of an increasing trend over time. There were occasional peaks in abundance of nutrient indicator species, but these were not consistent within each region or between years. It is notable that the frequency and magnitude of peaks in abundance of nutrient indicator species were observed at the Maria Island sites which are remote from salmonid farming operations (> 50 km).

One of the few changes identified in the time series analysis was at one of the Tinderbox sites (Central Tinderbox). At Central Tinderbox, there has been a considerable increase in cover of Caulerpa spp. (particularly C. trifaria) since 2004. Prior to 2004, Caulerpa spp. abundance at this site averaged < 10%, before an increasing trend that reached a maximum of 65% in 2007. Since 2007, Caulerpa spp. cover has been maintained at around 40%. Reasons behind this change remain speculative, but there is no documented evidence in the scientific literature to suggest that Caulerpa spp. respond to increases in nutrient levels. One possible explanation relates to changes in sand or sediment deposition at this site, since Caulerpa species tend to flourish on the reef/sand edge.

The results of the current study were largely consistent with the findings of Crawford et al (2006), who undertook a similar analysis based on annual MPA surveys from 1992-2002. A more recent IMAS study in the D’Entrecasteaux and Huon in 2008 demonstrated changes in abundance of nutrient indicator species consistent with salmonid farming impacts. However, comparisons between the 2008 and current study were limited by differences in the timing and spatial distribution of study sites. Rather than the gradient approach used in the IMAS study, the current study was designed to examine broad scale impacts and most sites were located at considerable distance from fish farms. Differences in survey timing also limit meaningful comparisons with the IMAS study. Nutrient indicator and ephemeral species are typically highly seasonal, and more likely to be encountered in the summer months when the IMAS study was undertaken. It is therefore likely that the low abundance of ephemeral and opportunistic algal species observed in the current survey may at least partially be explained by the autumn timing of the 2015 survey.
6.1.3.2 Expected levels of farming emissions

Soluble nutrient emissions from stock/feed/faeces
See Section 6.1.1.2 Current levels of soluble nutrient emissions from stock/feed/faeces.

Soluble effluent stream from in situ net cleaning
See Section 6.1.1.1.

6.1.3.3 Evaluation of Potential Effects

The present proposal will result in an approximate doubling of output of soluble nutrients within the Storm Bay off Trumpeter Bay North Bruny Island MFDP area. The majority of this output will emanate from the east of Yellow Bluff zone and there will only be a minor increase in nutrient emissions from the south of Trumpeter Bay (SB) 1-4 zones.

As stated for the SB 1-4 zones in Amendment 1 to the Storm Bay off Trumpeter Bay North Bruny Island MFDP, from a broad regional perspective the proposed amendment will enable Huon Aquaculture to expand its operations to offshore sites through ensuring that the company has farm sites suited to the use of the new net-pen design, without which proper predator control combined with low biomass farming would be impossible at such exposed sites. In terms of near-field effects, the proposed amendment maintains the distance of the farming areas to intertidal and subtidal rocky reefs to at least 1km for the SB 1-4 zones, and ensures that the proposed East of Yellow Bluff zone is at least 1.5km from any rocky reef area. Given the fact that significant effects have not been found beyond 400-1000m from fish farms in the more sheltered and less well flushed Huon D’Entrecasteaux area previously (Oh 2009), then Huon Aquaculture would propose that there is negligible risk of any significant effects.

6.1.3.4 Mitigation Measures

Monitoring and management response
Huon Aquaculture has supported FRDC Project 2014/031 (IMAS), the Broadscale Environmental Monitoring Program (BEMP) and the Informd 2 project for continued sustainable and adaptive management. As outlined in Section 6.1.1.4, the company has, or is currently undertaking, baseline surveys to form a comprehensive body of data that will ensure the ability of any future EPA/DPIPWE (Indicative Program provided in Appendix P) directed monitoring plan for Storm Bay. This is to enable detection of significant change across the whole suite of marine vegetation related variables in order to ensure that the industry does not have a significant effect on the vegetation.
in the region. Outcomes of the FRDC research project 2015/024 will also assist in the development of monitoring framework consistent with regulatory management objectives.

**Zone and Lease Locations**

Huon Aquaculture’s choice of location for the new and amended zones considers the distance to a range of ecological and other stakeholder concerns. The positioning of the zones/leases at least 1km from both the submarine reefs to the east of the SB1-4 zones and the closest shoreline to all new and amended zones places them outside the probable zone of effect of fish farms on marine vegetation.

**In situ net cleaning protocols**

Huon Aquaculture’s management strategy is to clean nets before the fouling gets to any significant size on the nets. This is expected to reduce the overall biomass of biofouling in the water column. The shift of farming effort further offshore, where there is greater mixing in the water column and therefore dispersion of the fouling organisms in the water column, will make it less likely that they can collect in significant numbers and recolonise other nets or individual embayments.

**Regulatory controls**

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedules 3, 3V

MC – 3.1, 3.2, 3.3, 3.4, 3.5.

6.1.3.5 Overall effect following implementation of mitigation measures

The location of the proposed zones at least 1.5km offshore will reduce the potential for any effect on shoreline inter-tidal or sub-tidal rocky reef macroalgal vegetation. The expansion and rotation of the leases in the SB 1-4 zones will slightly decrease the distance of the nearest pens to the offshore reefs to the east of the SB1 zone by 100m only, and as the lease has been rotated around its centre point then for every pen bay moving closer to the offshore reefs there will also be a pen moving that distance away. Further, as it is not the intent of Huon Aquaculture to move the grid within the new lease area, the minimum distance to the reef is maintained at (at least) 1.1kms. From Oh’s (2009) work, this distance is well outside of that where a significant effect might be expected, especially as the Storm Bay region is relatively exposed compared to the Huon/Channel. Note that any reefs to the north of the Yellow Bluff zone are at least 6kms away.
On the broad-scale level, the overall nutrient loading to this part of Storm Bay will remain low due to the high mixing effects, influence of oceanic currents and the overall mass transport towards the south-east and out into the open ocean. Therefore, the net effect for phytoplankton/Chlorophyll a production is not expected to change significantly.

6.1.4 Birds

History of bird entanglements/predation issues at proposed sites

Huon Aquaculture’s feed system ensures that the fish are fed to satiation at every meal. The system is acknowledged as being one of the cornerstones for the continued success of the company. However, in the past this has necessitated the use of large feed hoppers in the centre of the pens, causing entanglement and subsequent tearing of the net on the hopper. This has led to periods where bird entanglements have occurred, and it has also allowed seagulls into the pens where they have then fed on the fish pellets. The bird entanglements have been predominantly silver gulls but in the past sea eagles have also been caught in these nets. All trapped or entangled eagles have either been immediately released or, if found tired or wet, taken to the Raptor Refuge facility at Kettering and subsequently returned to the wild upon recovery.

Preventing birds from becoming entangled or drowning inside pens has been a driver in the development of the Company’s “Fortress Pens”. Designed in-house by Huon Aquaculture staff, the Fortress Pens have been specifically developed to avoid bird entries and entanglement.

The new pens have been rolled out across Huon Aquaculture farm sites and use world-first technology in pen structure and netting. All nets are made using the same material used in bullet-proof vests, and are the strongest developed and used in fish farming world-wide.

Specifically, the design includes higher, tauter nets that keep birds perched on the pens well above the water and therefore keeping the birds away from the fish and the fish feed pellets. Importantly, the fully enclosed net using the smaller mesh size (60mm) can keep out all birds, including the smaller cormorants that traditionally have been able to get through any mesh above 75mm.

By denying birds the opportunity to perch and access to both fish and feed, they are discouraged from viewing our pens as a place to rest and as a source of food.

Huon Aquaculture intends to exclusively use the Fortress Pens at all zones in Storm Bay. Initial indications from the original Trumpeter Bay and SB1 leases are that the rougher weather conditions have led to some nets being ripped due to the continued use of centralised feed hoppers. The proposed east of Yellow Bluff lease is designed for feed barges which will remove the need for centralised feed hoppers.
Bird entanglements are displayed on the Huon Aquaculture website at https://www.huonaqua.com.au/sustainability/wildlife/birds/ and the current information is included below:

**Table 38 - Bird mortality at Storm Bay 2016-2017**

<table>
<thead>
<tr>
<th>Month</th>
<th>Number</th>
<th>Species</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1</td>
<td>Cormorant</td>
<td>Entanglement</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>February</td>
<td>1</td>
<td>Cormorant</td>
<td>Entanglement</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>March</td>
<td>2</td>
<td>Pacific Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>April</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>2</td>
<td>Pacific Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>June</td>
<td>1</td>
<td>Pacific Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>July</td>
<td>3</td>
<td>Pacific Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>August</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>1</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>October</td>
<td>1</td>
<td>Kelp Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>November</td>
<td>1</td>
<td>Pacific Gull</td>
<td>Found floating (unable to determine if associated with aquaculture operations)</td>
</tr>
<tr>
<td>December</td>
<td>1</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>January</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>1</td>
<td>Kelp Gull</td>
<td>Entanglement</td>
</tr>
<tr>
<td>March</td>
<td>1</td>
<td>Silver Gull</td>
<td>Entanglement</td>
</tr>
</tbody>
</table>
6.1.4.1 Migratory bird species listed under international agreements (e.g. JAMBA/CAMBA/ROKAMBA)

Migratory bird species listed under international agreements, including JAMBA, CAMBA, ROKAMBA and the Bonn Convention, as listed on the EPBC Migratory Species Lists which may frequent the surrounding area of the proposed development are shown in Table 39.

Table 39 - Listed migratory bird species that may occur in the area

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Bonn</th>
<th>CAMBA</th>
<th>JAMBA</th>
<th>ROKAMBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haliaeetus leucogaster</td>
<td>White-bellied Sea-Eagle</td>
<td>Listed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thalassarche cauta cauta</td>
<td>Shy Albatross, Tasmanian Shy Albatross</td>
<td>A25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.1.4.2 Roosting, nesting and feeding sites

Bruny Island contains nesting, feeding and roosting habitat for a range of bird species, and the area in and south of Yellow Bluff/Trumpeter Bay is likely to offer a range of habitats to a wide variety of bird species in the area. Some of the species will be those that have been identified (see Section 5.2.4), and other species may be present based on the presence of suitable habitat. It is likely that bird species nest, roost and feed in the surrounding land areas. As the proposed development is in a marine area, there is considered to be negligible or no impact on roosting or nesting habitat of any species. The marine area is likely to provide feeding habitat for some bird species. However, given the size of the development in relation to the surrounding marine area, the impact on feeding habitat is considered not to be significant.

6.1.4.3 Potential Impacts

Provided by Birdlife Tasmania. For full report, refer to Appendix J.

The potential impacts on bird species arising from the proposed new and amended zones alterations comprise:

- entanglement - marine farming equipment such as predator nets, bird netting and mooring lines have the potential to entangle birds resulting in injury or death
- habitat loss - the deployment of marine farming equipment within a lease area may degrade suitable habitat for some marine species. Fish pens restricting access (pelagic species)
- behavioural change - the presence of marine farms may cause some species to alter their behaviour, particularly foraging behaviour by seabirds and eagles
- alteration of breeding behaviour – the presence and intensity of marine farming activities may interrupt breeding and reduce breeding success from disturbance
- other effects - noise, lighting, wastes and vessel movements all have the potential to impact on threatened species.

The species included below have been selected on the basis that (a) they have been recorded at Yellow Bluff/Trumpeter Bay, or (b) they have been observed within 5 km radius of the current meter, based on records in the BirdLife Tasmania database. These are:

- White-bellied Sea-eagle
- Wedge-tailed Eagle
- Shy Albatross
- Yellow-nosed Albatross
- Swift Parrot.

Figure 69 - Map showing the locations of bird records from BirdLife Tasmania database. All records within 5km (left) and 10km (right) of the new current meter coordinates are highlighted.

In Figure 69 the east of Yellow Bluff lease is shown as the blue polygon in the centre of the map, and marine leases in the D’Entrecasteaux Channel are shown in yellow. The 10km UTM map grid is shown and the scale bar is 20km. and marine leases in the D’Entrecasteaux Channel are shown in yellow. The 10km UTM map grid is shown and the scale bar is 20km.
White-bellied Sea-eagle *Haliaeetus leucogaster*

The White-bellied Sea-Eagle occurs in Tasmania as a single population containing fewer than 1,000 individuals, and typically nests within 5km of the coast, estuaries or large inland lakes. Large estuaries and convoluted coastlines are favoured sites for both nesting and foraging as these provide a longer interface between land and water. This species is commonly observed within marine coastal waters of south-east Tasmania, and nests for this species have been recorded in close proximity to Yellow Bluff/Trumpeter Bay.

Key potential threats to the species from activities associated with the proposed alteration may include:

- nest disturbance
- marine debris
- modification of foraging behaviour
- reduction in habitat quality and quantity.

**Nest Disturbance**

Disturbance to nests can impact on White-bellied Sea Eagles. The Recovery Plan includes buffers of 500m and 1000m line of sight to protect nests from disturbance arising from human activities during the breeding season. Nesting sites have been recorded close to Trumpeter Bay as shown in Figure 70.

![Figure 70 - Map of White-bellied Sea-eagle nests (extract of map in Threatened Species Section 2006, Threatened Tasmanian Eagles Recovery Plan 2006-2010)](image)

**Marine Debris**

White-bellied Sea-eagles may potentially be affected by marine farming-derived debris located within the water column or on shorelines around Storm Bay. White-bellied Sea-eagles may become entangled in marine debris resulting in injury or death. It is possible that the proposed new and amended zones may result in an increase in marine debris in surrounding waters and along the foreshore. However, the potential scale of any increase in marine debris is not expected to pose any significant risks to White-
bellied Sea-eagle populations within Yellow Bluff/Trumpeter Bay and surrounding areas.

Foraging habitat

White-bellied Sea-eagles are attracted to fish farms and will extend their foraging range to include fish farms, although they rarely exploit fish directly due to the large size of the fish and the aerial netting deployed on all sea cages. The presence of leases within potential foraging habitat is not expected to significantly impact on the foraging behaviour or capacity of White-bellied Sea-eagles to source an adequate supply of marine prey.

Depletion of habitat

Marine farms pose a potential threat to White-bellied Sea-eagles through the reduction of available habitat and a reduction in habitat quality. It is unlikely that the proposed alteration in and around Yellow Bluff/Trumpeter Bay would result in a significant loss of habitat for the White-bellied Sea-eagles present close to Yellow Bluff/Trumpeter Bay.

Wedge-tailed Eagle *Aquila audax*

The Tasmanian Wedge-tailed Eagle is an endemic subspecies is listed as Endangered under the TSPA and the EPBCA. The Wedge-tailed Eagle occurs as a single population in Tasmania of fewer than 1,000 individuals. Wedge-tailed Eagles are landscape hunters with a wide distribution throughout Tasmania. Nesting sites for this species have been recorded within 5km of Yellow Bluff/Trumpeter Bay (Figure 71).

Key potential threats to the species from activities associated with the proposed alteration may include:

- nest disturbance
- marine debris
- modification of foraging behaviour
- depletion of habitat.

Nest Disturbance

Nesting sites for this species have been recorded within 5km of Yellow Bluff/Trumpeter Bay. High and medium levels of disturbance during nesting have been known to adversely affect the success of breeding birds. The proposed lease alteration is unlikely to adversely affect the breeding success of Wedge-tailed Eagles within Yellow Bluff/Trumpeter Bay and surrounding areas.
**Marine Debris**

Wedge-tailed Eagles may potentially be affected by marine farming-derived debris located on the shorelines around Yellow Bluff/Trumpeter Bay. Wedge-tailed Eagles may become entangled in marine debris resulting in injury or death. It is possible that the proposed new and amended zones may result in an increase in marine debris in surrounding waters and along the foreshore. However, the potential scale of any increase in marine debris is not expected to pose any significant risks to Wedge-tailed Eagle populations within Yellow Bluff/Trumpeter Bay and surrounding areas.

![Map of Wedge-tailed Eagle nests](image)

*Figure 71 - Map of Wedge-tailed Eagle nests (extracted from map in Threatened Species Section 2006, Threatened Tasmanian Eagles Recovery Plan 2006-2010).*

**Foraging habitat**

Wedge-tailed Eagles may be attracted to fish farms, however they are generally known to favour hunting in open areas and have been recorded hunting over most terrestrial Tasmanian habitat types. The presence of leases within potential foraging habitat is not expected to significantly impact on the foraging behaviour or capacity of Wedge-tailed Eagles to forage and obtain adequate levels of prey.

**Depletion of habitat**

Marine farms potentially pose a threat to Wedge-tailed Eagles through a reduction of available habitat and a reduction in habitat quality. However, it is unlikely that the proposed alteration in Yellow Bluff/Trumpeter Bay would result in a significant loss of foraging and nesting habitats for Wedge-tailed Eagles present close to Yellow Bluff/Trumpeter Bay.

**White-bellied Eagle and Wedge-tailed Eagle Recovery Plan**

Both eagle species share a common Recovery Plan (DPIW 2006). The key threats to the eagles identified in the recovery plan are loss of nesting habitat, nest disturbance, persecution and accidental death (e.g. electrocution, collision, entanglement). Of these threats, entanglement is relevant to a fish farm. Huon Aquaculture has experienced situations of eagles becoming trapped underneath bird netting; they could...
also potentially become entangled in the netting itself. These risks arise from holes in the netting or netting being too loose, and could be mitigated by improved net-pen design, maintenance and deployment.

**Shy Albatross Thalassarche cauta**

The Shy Albatross is the only albatross species endemic to Australia and Tasmania, with colonies present on three islands: Albatross Island off Tasmania’s northwest, and the Mewstone and Pedra Branca off the Tasmanian south coast. The Shy Albatross is listed as Vulnerable under the EPBCA (and as a Marine and Migratory Species) and the TSPA. The total breeding population is currently around 14,000 birds. Adults remain close to breeding colonies year-round, whereas juvenile birds – predominantly from the Mewstone - have been recorded foraging at sites as distant as southern Africa. Key potential threats to the species from activities associated with the proposed alteration may include:

- collisions with anthropogenic structures
- behavioural change - the presence of marine farms may cause individuals to alter their behaviour
- entanglement in marine farming equipment, and ingestion of marine debris.

*Collisions with anthropogenic structures, behavioural change(s)*

The foraging range of Shy Albatrosses is extensive, and it is likely that Yellow Bluff/Trumpeter Bay would be included within this foraging range. Shy Albatrosses feed in waters over the continental shelf, including bays and readily follows fishing vessels.

Marine farming activities may attract Shy Albatrosses during foraging and feeding activities in Storm Bay; the most likely scenario is that albatrosses would be attracted to the area to scavenge food, and so there is potential for interaction between the albatrosses and fish farms. It is considered unlikely that incidental mortality events would occur within the waters of the proposed alteration, but the likelihood would increase if large vessels (with artificial deck lighting) were attending the leases during night-time, hours of low light, or during foggy/misty conditions when illumination can result in disorientation of the birds.

*Entanglement in fishing equipment, and ingestion of marine debris*

Shy Albatrosses may potentially be affected by marine farming-derived debris around Yellow Bluff/Trumpeter Bay, or may become entangled resulting in injury or death. An additional cause of incidental mortality occurs through the ingestion of fishing equipment and marine debris. The incidental mortality of Shy Albatrosses from
entanglement and ingestion of fishing equipment has been identified as a key threat to the species.

**Yellow-nosed Albatross *Thalassarche carteri***

The Indian Yellow-nosed Albatross breeds on islands and island groups in the Indian Ocean, and travel widely, reaching New Zealand and the western Pacific Ocean. The individuals range from temperate to subantarctic waters, typically between 30° and 50° South. The current population is fewer than 65,000 birds, and the species is listed as globally Endangered under IUCN criteria, and Vulnerable (and Marine and Migratory) under the EPBCA.

Key potential threats to the species from activities associated with the proposed alteration may include:

- collisions with anthropogenic structures
- behavioural change - the presence of marine farms may cause individuals to alter their behaviour
- entanglement in marine farming equipment, and ingestion of marine debris.

*Collisions with anthropogenic structures, behavioural change(s)*

The oceanic range of Yellow-nosed Albatross is extensive, and it is likely that Yellow Bluff/Trumpeter Bay would be included within this foraging range, given records from Storm Bay. Marine farming activities may attract Yellow-nosed Albatrosses during foraging and feeding activities in Storm Bay; the most likely scenario is that albatrosses would be attracted to the area to scavenge food, and so there is potential for interaction between the albatrosses and fish farms. It is considered unlikely that incidental mortality events would occur within the waters of the proposed alteration, but the likelihood would increase if large vessels (with artificial deck lighting) were attending the leases during night-time, hours of low light, or during foggy/misty conditions when illumination can result in disorientation of the birds.

*Entanglement in fishing equipment, and ingestion of marine debris*

Yellow-nosed Albatrosses may potentially be affected by marine farming-derived debris around Yellow Bluff/Trumpeter Bay, or may become entangled, resulting in injury or death. An additional cause of incidental mortality occurs through the ingestion of fishing equipment and marine debris.
**Swift Parrot Lathamus discolor**

The Swift Parrot is a small, fast-flying parrot that occurs in eucalypt forests in southeastern Australia and is listed as Endangered on the EPBCA and TSPA. The Swift Parrot breeds only in Tasmania and migrates to mainland Australia in autumn. The breeding season of the Swift Parrot coincides with the flowering of blue gum, as the nectar of this eucalypt is the main source of food for the parrots during breeding. The breeding distribution varies inter-annually, reflecting food availability and quality of flowering gums. The Swift Parrot suffers from high mortality during the breeding season, arising from collisions with man-made structures such as windows, wire-mesh fences and vehicles. There are presently no records of Swift Parrots from Yellow Bluff/Trumpeter Bay but the species has been included here as a precaution.

Key potential threats to the species from activities associated with the proposed alteration may include:

- collision with fish-farm structures.

*Collisions with fish farm structures*

There is the possibility of Swift Parrots colliding with fish farm structures. There are presently no data to assess the likelihood of collisions.

**Forty-Spotted Pardalote Pardalotus quadragintus**

The Forty-spotted Pardalote is only found in Tasmania, and its distribution is restricted to four locations along Tasmania’s east coast, with Bruny Island being one. The colonies of the Forty-spotted Pardalote are mostly along the western side of Bruny Island, although there is a colony in the Yellow Bluff/Trumpeter Bay area. The greatest threat to the Forty-spotted Pardalote is habitat loss and competition from other species. The Forty-spotted Pardalote, is considered unlikely to be impacted by the lease area, which will have no impact on the coast or land habitat that may potentially support them. Therefore no mitigation measures are presently suggested/required for this species as a result of the present proposal.

### 6.1.4.4 Mitigation Measures

In its 2017 report (Appendix J), Birdlife Tasmania has provided specific measures and management controls to mitigate the risk of impacts on birds, these are outlined below and will be adopted where appropriate in Huon Aquaculture SOP’s.
**White-bellied Sea-eagle**

*Marine Debris*

Marine waste receptacles are present on all vessels and barges to prevent marine debris entering the marine environment. Marine debris collections are currently undertaken as part of the *Adopt a Shoreline* program during the winter months to avoid disturbing nesting birds. Huon Aquaculture also supports the Raptor and Wildlife Refuge centre at Kettering which rehabilitates birds of prey.

*Foraging*

No mitigation measures are required for the proposed alteration.

*Nest disturbance*

No mitigation measures are required for the proposed alteration.

*Reduction in habitat quality and quantity*

No mitigation measures are required for the proposed alteration.

**Wedge-tailed Eagle**

*Marine Debris*

Marine waste receptacles are present on all vessels and barges to prevent marine debris entering the marine environment. Marine debris collections are currently undertaken as part of the *Adopt a Shoreline* program during the winter months to avoid disturbing nesting birds. Huon Aquaculture also supports the Raptor and Wildlife Refuge centre at Kettering which rehabilitates birds of prey.

*Nest disturbance*

No mitigation measures are required for the proposed alteration.

*Modification of foraging behaviour*

No mitigation measures are required for the proposed alteration.

*Reduction in habitat quality and quantity*

No mitigation measures are required for the proposed alteration.

**Shy and Yellow-nosed Albatrosses**

*Collisions with man-made structures*

Data surrounding the circumstances of any collision events must be collated to assess if common elements are present (including lighting from both land bases and work vessels) and if so, how they are to be addressed to reduce or remove the potential threat to albatrosses.
Entanglement and ingestion of marine farming equipment (marine debris)

The main threat to the Shy Albatross would be through entanglement and/or ingestion of marine-farm derived debris in the marine environment. Marine debris collections are currently undertaken during the winter months reduce the volume of material present in the marine and coastal environment.

*Note that the adoption of the mitigation measures for these two species of albatross would also represent mitigation for all albatrosses, giant petrels and petrels that are present within Storm Bay at different times of the year.*

Swift Parrot

Collisions with man-made structures

Data surrounding the circumstances of any collision events must be collated to assess if common elements are present, and if so, how they are to be addressed to reduce or remove the threat to Swift Parrots.

Bird netting and other exclusion mechanisms

Huon Aquaculture uses its Fortress Pens in all operations. The Fortress Pens use world first technology in structure and netting. All nets have been made using Dyneema® fibre or equivalent, and are the strongest developed and used in fish farming world-wide. This design includes:

- A bird net which sits higher than on previous pens, suspended by strong and light, yet flexible poles from the top of the pen’s outer fencing, extending 6m above the water surface. The height of the poles and their ability to flex keeps the net well above the water at all times, keeping the birds away from the fish and also the fish feed pellets.
- The fence posts and poles ensure that the net is pulled tight to make it ultra-strong, with a break load of 70kg to keep out all seabirds.
- The mesh size for bird nets on all new pens will be 60mm to keep out all birds, including the smaller cormorants that traditionally have been able to get through any mesh above 75mm.
- The sides of the net hang down vertically and tie off to the inner stock net, producing a fully enclosed net around the fish and feeding system (refer also to **Figure 20** and **Figure 21**).
The benefits of these nets to bird safety are as follows:

- Small birds which perch on the net will not be able to weigh it down to a point where they can reach the water.
- The mesh size of netting means that small fish cannot be taken from the pen through the netting, discouraging birds from viewing the pen as a source of food.
- There are no rigid fence posts and poles supporting the bird net, removing places where predatory birds can perch, and subsequently reducing attraction to the pens in general.
- Attaching the net from the outer fence of the pen means that both small and predatory birds will have no means by which to enter it.
- The height and strength of the net significantly reduces the likelihood of tears from both machinery and wildlife.
- There have been far fewer holes and tears in these bird nets since their deployment. Only where the company has had to retain centralised feed hoppers, for younger fish in smaller pens, have there been issues with holes and tears in these nets.

**Protocols for managing bird entanglements**

As described above, Huon Aquaculture has a dedicated environmental technical crew and a works crew. The environmental technical crew is responsible for monitoring equipment and ensuring that entanglements are managed and reported in line with the Aquaculture Stewardship Council (ASC requirements). The environmental technical crew work closely with the works crew who are tasked with maintaining all anti-predator systems on the pens and ensuring that seals and birds have no means for net-pen entry. They also have the responsibility for removing entangled birds from the nets (where possible, subject to OHS considerations).
Maintenance regime for inspection and repair of bird nets and other exclusion devices

All net pens are inspected on a daily basis by works crews, feeders and the environmental technical crew. Once any need for repairs is established, the predator control team take responsibility for ensuring that those repairs are undertaken that day.

Collisions with Marine Farm Infrastructure

Data surrounding the circumstances of any collision events must be collated to assess if common elements are present (including lighting from both land bases and work vessels) and if so, how they are to be addressed to address or remove the potential threat to albatrosses. This data will then be used to adapt operations so as to minimise such interactions.

Regulatory controls

Bird netting requirements are set out in the DPIPWE Minimum Requirements for Predator Exclusion 2013.1 (MPE2013.1) standards and are included in company SOP’s (Appendix B, Appendix D).

Refer to Appendix E – Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

MC - 3.4, 3.6, 3.8, 3.12.

6.1.4.5 Overall effect following implementation of mitigation measures

Huon Aquaculture proposes to use the combined mitigation measures outlined above at the proposed zones.

Although it is very difficult to predict that interactions with birds will be eliminated altogether, the combination of the net-pen design and the vigilance of all crews and the dedicated environmental technical crew will significantly reduce the potential for gulls and cormorants to be caught in the nets and remove the possibility for eagles to perch on and subsequently get trapped in the new net-pens.

The result will be the reduced likelihood, if not elimination of the risk of bird entrapment and entanglement, especially for threatened species such as Wedge-tailed Eagles and White-bellied Sea-eagles.
6.1.5 Marine Mammals

History of marine mammal interactions at existing sites

Since the roll out of Fortress Pens across all of Huon’s leases and an increase in resources for predator control, there has be a drastic reduction in marine mammal interactions at existing sites. Provided that the Fortress Pens are rigged correctly and are well maintained, they have proved very successful in excluding seals from the pens. Despite seal haul-out at Friars Rock (Figure 73) being roughly equidistant to the Zuidpool/Storm Bay off Trumpeter Bay lease MF261, there have been more seal entries and more seal related fish mortality at Storm Bay than other leases. This may be indirectly related to the lease location – the higher energy environment may be adding more stress/fatigue to the infrastructure, and then the weather making repairs more difficult. With a greater understanding of how infrastructure tolerates the high-energy locations, combined with increased resources, Huon is confident it can reduce marine mammal interactions even further at its Storm Bay leases.

Figure 73 - Friars Rock seal haul-out (indicated by red dot)
6.1.5.1 Potential Impacts

Impacts on Marine Farms

Seal interactions are a significant issue for the finfish farming industry causing a range of negative effects, including:

- predation of farmed stock - seals damage and kill fish by biting fish through netting
- causing stress in fish - ongoing attacks on fish within pens causes stress to fish and a concomitant reduction in feeding rates
- increases in the cost of production - seal defence systems such as predator netting and seal trapping/removal and damage to nets caused by seals – this currently equates to millions of dollars per year for Huon Aquaculture, and
- Workplace Health and Safety issues - aggressive seals may cause injury to personnel employed on marine farms.

Impacts on Marine Mammals

Potential direct impacts on marine mammals may include:

- local significant increases in predator numbers, affecting not only marine based industries but also potentially affecting the general underwater ecology of the area
- behavioural management - trapping and relocation of seals from marine farming areas may cause animals to experience stress
- modification of behaviour in seals that habituate to marine farms, which may, for example, alter foraging behaviours
- potential for marine mammals such as whales to have higher survival rates where there are stranding events due to rescue response support from aquaculture staff and their equipment – similar to assistance given by Tassal to Parks and Wildlife in saving eleven animals during a stranding in the south east of Tasmanian in March 2011, and
- potential for dolphins and seals to become entangled in predator netting, resulting in injury or death.

6.1.5.2 Mitigation Measures

The new net-pen design has as its basis the intended complete exclusion of all predators. The key anti-predator components of that system are described below. Huon Aquaculture has replaced all of its marine farm pens with the new design, at a cost of approximately $80 million. This is possibly the first time in the history of the
industry world-wide that one company has made such a commitment to anti-predator system design and roll-out. All pens deployed at Storm Bay off Trumpeter Bay will be of the new design.

In relation to marine mammals, vessel operators will always keep a lookout for marine mammals, including whales, and will take avoidance action if and as necessary in accordance with the Tasmanian Parks & Wildlife’s whale watching guidelines²⁰, including:

- not approaching in a boat any closer than 100m to a whale, which is the recommended distance for boats moving at slow speed and with no wake (that is, less than 8 knots)
- vessels under steam not approaching any closer than 300m
- withdrawing immediately if the whale shows any kind of disturbance
- adopting a slow speed while in the area
- not approaching from the rear of the animal

The regular inspections of net-pens will maximise the likelihood of marine mammals, including whales, being spotted before they enter a marine farm area. Judicious positioning of crew vessels between an approaching whale and the marine farm, with motors off or idling, will be used to try to passively divert whales away. No active diversion or harassment of the animals would occur. If whales nevertheless venture into a situation of potential harm, the crew will immediately advise the Parks & Wildlife Service. Huon Aquaculture will establish this protocol in advance, through consultation with the Service.

The risk of dolphin entrapment under bathing liners is now nil in Huon Aquaculture’s Storm Bay operations. The replacement of the liner bathing system by the well-boat for bathing operations has eliminated the use of liners within netted pens.

Daily removal of salmon morts from the pens will minimise any attraction the farm might have for seals.

**Details of any marine mammal interaction plan**

At present marine mammal interactions are guided by the DPIPWE seal management protocols (Appendix B).

In addition and through Huon Aquaculture’s expansion into marine farming in NSW, Huon Aquaculture and the NSW Department of Primary Industries have jointly prepared a Marine Fauna Interaction Management Plan (MFIMP). Despite this plan being specific for NSW operations, there are common components regarding whale and dolphin interactions which are relevant to Huon Aquaculture’s operations in

Tasmania. The MFIMP is reviewed by the joint Marine Fauna Interaction Committee, which includes the following members:

- Dr. Melissa Giese, NSW National Parks & Wildlife Service, Office of the Environment & Heritage
- Professor Robert Harcourt, Department of Biological Sciences, Macquarie University
- Professor Wayne O’Connor (Principal Research Scientist), NSW Department of Primary Industries
- Mr David Whyte (Group Technical Manager), Huon Aquaculture Group Limited
- Mr Luke Erskine (Manager, Port Stephens – Great Lakes Marine Park), NSW Department of Primary Industries.

**Seal netting – tensioning and stiffening**

The key anti-predator properties of Huon Aquaculture’s new net-pen design are as follows. White numbers in Figure 74 correspond to numbers in brackets below:

a) The weighted sinker tube (1) allows for even and “bar-tight” tensioning around the whole of the predator (2) and stock (3) nets.

b) Attachment of both nets to the same sinker tube ensures that a very significant gap (4) is maintained between the nets, preventing seals from pushing the other net right in to the stock net to attack the fish.

c) Development work ultra-high-molecular-weight polyethylene (UHMWPE) has ensured that the stretch is predictable and consistent, allowing for very precise fitting of both nets to the pen/sinker tube configuration, which also ensures that both nets are ‘bar-tight’ around their whole circumference and across the base.

d) The outer predator net is designed to come up to a height of 2-3m above the water line supported by the extended stanchions designed by Huon Aquaculture (6).

e) The bird net now has its own 6m carbon fibre supports (5) that exert an outward tension from the centre of the pen to keep the bird net taut and well above any feeder bin or feeder spreader in the pen.

f) The pens and nets are further designed so that tension can be regulated from the surface on the drop ropes (7) down to the sinker tube. Through this world first design, Huon Aquaculture have set up an impregnable predator defence system both above and under the water line.

g) Lift-up mort retrieval systems transfer all morts immediately to collection bins at the surface, thereby eliminating a source of food for seals at the base of the pen.
The new net pen design and operational systems associated with the development of the design are also described in an article by Walker in *Austasia Aquaculture* (vol 27 (3), pp. 4-6, 2013).

**DPIPWE seal management protocols**

Huon Aquaculture manages all seal interactions and systems development under the guidance of the Seal Management Framework 2012 (the Framework) and its associated Minimum Requirements. These are provided in Appendix B.

The framework provides a management structure based on the requirement that marine farm operators move to implement the standards set out in *Minimum Requirements for Predator Exclusion 2013.1* (MPE2013.1) to be eligible to operate under the Framework. The requirements set out in MPE2013.1 came into effect on 1 August 2013. The requirements defined in MPE2012 are set at a standard approved by the Minister in August 2010.

The Framework provides for the overall management system of seal interactions with marine farms to be defined and authorised by the Minister. With the Framework approved by the Minister, the minimum requirements for each management action, plus predator exclusion, are then able to be modified, added or removed, from time to time, by the Secretary in consultation with the industry. Management actions and procedures implemented by industry must meet and, where possible, exceed the minimum requirements identified for each management option and described in Standard Operating Procedures prepared by individual marine farm operators and approved by the Department.

Under the Framework, marine farms that demonstrate approved exclusion methodology, technology, and equipment standards, and have agreed to implement policies and procedures in accordance with the minimum requirements for a particular management option, are permitted to undertake appropriate seal management actions.
The Department provides an oversight and audit role. This will facilitate more effective and timely management of seal interaction issues by marine farm staff, while ensuring that management actions are undertaken in an agreed, appropriate and transparent manner.

The Framework is primarily based on protocols and procedures approved by the Minister in 2010, but with modifications through discussion between the marine farming industry and the Department. For the purposes of the Framework, protocols will be modified and known as ‘Minimum Requirements’ supporting the Framework. The Framework recognises that management approaches, technology and available materials will change with time, as will appropriate up-to-date techniques. These changes will not impact on the overall purpose and outcomes of the Framework (effective and humane seal management). Consequently, these changes do not need to be evident in the Framework, and changes to the minimum requirements (including the addition of new ones) will not require Ministerial approval. Rather, approval will be determined by the Secretary.

**Regulatory controls**

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedule 3

MC – 3.3, 3.8, 3.12.

**6.1.5.3 Overall effect following implementation of mitigation measures**

**Seals**

Amendment No 1 to the Storm Bay off Trumpeter Bay North Bruny Island MFDP and the proposed new and amended zones will and indeed have allowed Huon Aquaculture to make commercial and effective use of its new net pen design. Company wide data collected over an 18-month period since the implementation of the Fortress Pens showed a significant reduction in mortality - in particular, seal-associated mortality. The most useful information available is from the dead fish collected from the pens that are examined for seal activity (either a seal strike or having been ‘munched’ by seals once dead and in the base of the net awaiting collection). This data covering the last 18 months shows reduced seal-associated mortality in the new Fortress Pens, with most of the seal-related mortality recorded associated with bathing of the fish from one pen to another where the fish are more susceptible to seal attack. The reduction in seal related mortality corresponds with observed reduction in seals present around Huon Aquaculture’s marine leases.

**Whales**

Huon Aquaculture have never recorded a large whale entanglement in over 30 years of operation in South East Tasmania.

Notably, since commencing operations in Storm Bay in 2014, Huon has recorded no whale sightings in proximity to its leases and has had no whale interactions of any type at current lease sites Storm Bay.
Dolphins
Dolphin entanglements are a rare occurrence and are largely prevented through net design and adherence to net weighting protocols. The Fortress pen design with continuous weight ring and tensioned panels has been introduced over the last four years and no entanglements have been reported in this pen type.

6.1.6 Threatened Species

History of threatened species interactions at existing sites
Since Huon Aquaculture commenced farming in Storm Bay, there have been no reported interactions with threatened species. Huon Aquaculture has over 30 years of constant presence out on the water and, in that time, interactions with threatened species have been rare. Apart from interactions with eagles, threatened species interactions have been restricted to the occasional dolphin (including one trapped underneath a bathing liner) and sightings of whales in the distance.

6.1.6.1 Potential impacts on threatened species, communities and habitats listed under the EPBCA and the TSPA

The threatened species potentially occurring in the area and their EPBCA and TSPA status' are listed in Section 5.2.6 Threatened Species.

The potential impacts on threatened bird species, White-bellied Sea-eagle Haliaeetus leucogaster, Wedge-tailed Eagle Aquila audax, Shy Albatross Thalassarche cauta, Swift Parrot Lathamus discolor and Forty-Spotted Pardalote Pardalotus quadragintus are discussed above in Section 6.1.4.

Spotted Handfish Brachionichthys hirsutus
The Spotted Handfish is a small, colourful, relatively sedentary, benthic fish that more commonly ‘walks’ on its pectoral fins rather than swim. Spotted Handfish are endemic to south-eastern Tasmania with a highly restrictive population size and distribution. Spotted Handfish have been found in areas of the lower Derwent River estuary, Frederick Henry Bay and in isolated locations in the D’Entrecasteaux Channel. The Spotted Handfish are most commonly recorded in coastal regions between 5-10m depth on unconsolidated sandy habitat where they are known to eat small crustaceans, polychaete worms and small molluscs. It is suggested that the Spotted Handfish reaches sexual maturity after two years of age, with females laying 80 to 250 eggs onto
vertical substrates during each spawn. The Spotted Handfish is listed as critically endangered under the EPBCA and endangered under the TSPA.

Key potential threats to the species from activities associated with the proposed alteration may include:

- depletion of habitat from anthropogenic structures
- organic enrichment of benthic environment.

Depletion of habitat from anthropogenic structures

There is the possibility that anthropogenic structures can degrade the benthic habitat via physical disturbance. Structures such as moorings can reduce usable habitat area and damage vertical substrates that are used by Spotted Handfish for laying eggs.

Organic enrichment of benthic environment

There is the possibility of sediment disturbance of the seafloor directly beneath salmon pens caused by uneaten fish feed pellets and salmon faeces. These products can give rise to organic enrichment followed by degradation processes: reduction in dissolved oxygen levels, generation of high levels of sulphides, changes of benthic conditions, and even azoic conditions.

**Red Handfish Thymichthys politus**

The Red Handfish is a small, slow moving benthic fish that is mostly red in colour with lighter areas of pink. The species grows to a maximum size of 80mm in length, with males suggested to be significantly smaller than females. The largest known population was found at Frederick Henry Bay, with smaller populations located from Port Arthur to Marion Bay, around the Forestier Peninsula and the Actaeon Islands. Previous surveys have indicated that the Red Handfish live around reefs in more exposed locations than those inhabited by the Spotted Handfish. Red Handfish have been found in a variety of locations at depths between 2 and 20m, such as on top of rocks, amongst macro-algae, and in sandy areas surrounding rocks. The green alga (*Caulerpa simpliciuscula*) has been observed to be the preferred spawning habitat and appears to be critical to the spawning success. The Red Handfish is listed as critically endangered under the EPBCA and endangered under the TSPA.

Key potential threats to the species from activities associated with the proposed alteration are the same as those listed for the Spotted Handfish above.

**Giant Kelp Marine Forest of South East Australia**

Giant Kelp (*Macrocystis pyrifera*) plants are the foundation species of Giant Kelp Marine Forests of South East Australia. Their presence, along with a range of marine algae, provides suitable habitat for a range of fish and invertebrates that shelter, feed and
reproduce within Giant Kelp Marine Forests. Giant Kelp are the largest and fastest growing marine plants, with their large string like stalks extending from rocky reefs situated from eight meters below sea level and deeper. Within Australia, the Giant Kelp Marine Forests are found predominantly in south-eastern waters where water conditions are cool, relatively nutrient rich and moderately calm. In Tasmania, Giant Kelp Marine Forests can be found from Eddystone Point in the north, all along the east coast, around the southern coast to Port Davey, and intermittently on the northern and western coasts.

The main threats to the ecological community include increasing sea surface temperatures, changes in nutrient availability in warmer waters, changes in weather patterns and large scale oceanographic conditions, catastrophic storm events and associated range expansion of invasive species. These threats are all mainly driven by climate change.

The key potential threat to the Giant Kelp Forests from activities associated with the proposed alteration may be impacts on water quality, including:

- solid wastes
- soluble wastes
- oil spills or chemical contaminants.

**Solid wastes**

It is possible that both solid and soluble waste from salmon farming can impact on water quality. Solid wastes attributable to salmon farming are localised in relation to impact on sediments below cages, and effects beyond 35m from the lease boundary are minor. Given the offshore location of the proposed new and amended zones, solid waste is unlikely to impact on the reef communities along the Bruny Island coast.

**Soluble wastes**

Soluble waste is more easily dispersed than solid waste and the impact on reefs is less well understood, however a recent review of the Broadscale Environmental Monitoring Program (BEMP) found no evidence of any major broadscale impacts of salmon farming at present in the Huon/D’Entrecasteaux Channel region. The soluble waste impacts in exposed oceanic environments such as Storm Bay are likely to be similar to those in sheltered waters in south-east Tasmania, however, the impacts are likely to be diluted more quickly and dispersed more widely. However, there is also some likelihood that any increase in nutrients provided by the fish farms may actually benefit stands of giant kelp through replacing those nutrients lost through East Australia Current (“warming”) effects.

**Oil spills or chemical contaminants**

A major oil spill or chemical contamination could potentially impact on the local reef community including the giant kelp forests near the marine lease. Chemical contamination from the proposed new and amended zones would be considered extremely
unlikely given the low quantity of chemicals currently used on Huon’s marine leases (refer to Section 6.1.8). A major oil spill from a feed barge or the well-boat is possible, although also considered to be very unlikely.

Long-nosed Fur Seal *Arctocephalus forsteri*

The long-nosed fur seal, formally known as the New Zealand fur seal, is currently listed as rare under the TSA. The long-nosed fur seal is restricted to only two breeding sites within Tasmanian waters: Tasman and Maatsuyker Islands. Long-nosed fur seals can dive deeper and longer than any other fur seal and typically feed on cephalopods, fish and birds. Long-nosed fur seals have low reproduction rates, as females do not reach sexual maturity until four years of age and only produce one pup per year.

Key potential threats to the species from activities associated with the proposed alteration may include:

- entanglement and drowning
- modification of normal behaviour
- collision with vessels.

*Entanglement and drowning*

There is the possibility that a seal might get entangled in nets or lines whilst attempting to access fish within the pens. This may lead to injury, or in some cases, drowning. Although liners are rarely used now by Huon Aquaculture, they also pose a threat to seals if they get trapped beneath them.

*Modification of normal behaviour*

The presence of fish farms may modify the behaviour of individual seals, whereby they become persistent and/or aggressive in their attempts to access salmon. This modification of behaviour may necessitate the use of approved seal deterrents, trapping, sedation, translocation and, in severe case, destruction.

*Collision with vessels*

Although unlikely, given the agility and awareness of seals, there is the possibility that they may be struck by a moving vessel.

Southern Right Whale *Eubalaena australis*

The Southern Right Whale is a baleen whale that can grow up to 17.5-18m and weigh up to 80 tonnes. The estimated population of southern right whales is 10,000, which is spread throughout the southern part of the Southern Hemisphere. The Southern Right Whale spends summer feeding in the far Southern Ocean (close to Antarctica) and migrates north to warmer waters during the winter. The whales tend to maintain distinct populations, with mothers passing on migratory routes to their calves. There
are two genetically distinct groups that inhabit Australian waters: a south-western group and a south-eastern group that is critically endangered. The Southern Right Whale is listed as endangered under both the EPBCA and the TSPA.

Key potential threats to the species from activities associated with the proposed alteration may include:

- entanglement in lines or netting
- collision with floating structures or vessels.

**Entanglement in lines or netting**

Although unlikely, whales could conceivably pass close to or even through a marine farm, potentially becoming entangled with mooring lines or nets. However, given the large size of the animals and the low recorded numbers in Storm Bay, the likelihood of a whale entering the marine farm is relatively low. The new design of the fortress pens minimises the amount of external ropes and lines required to secure the nets and pens. The mooring lines are the main external ropes/lines present at the marine lease. Given their diameter and tension, it would be very difficult for a marine animal to become entangled.

**Collisions with floating structures or vessels**

There is the possibility of whales colliding with fish farm structures or vessels. However, as mentioned above, the likelihood of whales entering the marine lease is relatively low. Vessel operators are qualified and competent persons who take great care to avoid interactions with all wildlife, including whales.

**Humpback Whale *Eubalaena australis***

The Humpback Whale is a baleen whale that can grow to 15 metres in length and weigh up to 40 tonnes. Humpback Whales are one of the most active whales in terms of behaviour, as they frequently breach or slap their tails and fins on the water surface. Humpback Whales spend their summer months feeding, mostly on krill in the Southern Ocean, before migrating north for the winter. In Australia, Humpback Whales breed inside the Great Barrier Reef on the eastern coast and on the northwest shelf along the west Kimberly coast. The Humpback Whale is listed as vulnerable under the EPBCA and endangered under the TSPA.

Key potential threats to the species from activities associated with the proposed alteration are the same as those listed for the Southern Right Whale above.

Huon staff are being trained in large whale disentanglement techniques by specialist trainers in New South Wales in early February 2017. The techniques and protocols developed from this training will be utilised wherever the risk of whale entanglement is material.
Great White Shark *Carcharodon carcharias*

The Great White Shark is one of the more infamous marine animals, notable for its size (up to 6.1m in length and 1,950kg in weight). Great White Sharks can be found in the coastal waters of all major oceans which have water temperatures between 12°C and 24°C. They are estimated to live for up to 70 years or more, however males do not reach maturity until 26 years of age and females do not mature until 33 years of age. The shark’s slow growth rate, late sexual maturity and low reproductive rate make it vulnerable to pressures such as overfishing and environmental change. The Great White Shark is listed as vulnerable under both the EPBCA and the TSPA.

The main potential threat to the species from activities associated with the proposed alteration may be entanglement in lines or netting.

*Entanglement in lines or netting*

Although unlikely, Great White Sharks could conceivably pass close to, or even through, a marine farm, attracted by seal activity or salmon mortality. There is the potential for entanglement, although given the relatively low numbers, intelligence and strength of the animals, the likelihood of entanglement is low.

Gunn’s Screw Shell *Gazameda gunnii*

The Gunn’s Screw Shell is a native gastropod belonging to the family *Turritelidae* that lives interstitially in sand and mud, being most prevalent in coarser-grained substrata in depths from 8 m to at least 140 m. The colour of the shell is typically white with pale brown or purple bands. They can reach a length of 69 mm, although more commonly found to be 30-40 mm. The Gunn’s Screw Shell is endemic to Australia and can be found from Cape Moreton in Queensland, and southwards to northern and eastern Tasmania. The Gunn’s Screw Shell is listed as vulnerable under the TSPA.

Huon Aquaculture contracted Marine Solutions to undertake sampling of the Gunn’s Screw Shell in the benthic habitats occurring within the bounds of the SB 1-4 south of Trumpeter Bay marine leases (appendix A), and Aquaculture, Management & Development (AMD) to survey the Yellow Bluff zone (appendix H). No evidence of the Gunn’s Screw Shell was found in either of the survey zones and Marine Solutions/AMD determined that there was a low likelihood of a population currently living in any of the areas surveyed.

Key potential threats to the species from activities associated with the proposed alteration may include:

- Depletion of habitat from anthropogenic structures
- Organic enrichment of benthic environment.
Depletion of habitat from anthropogenic structures

There is the possibility that anthropogenic structures can degrade the benthic habitat via physical disturbance.

Organic enrichment of benthic environment

There is the possibility of sediment disturbance of the seafloor directly beneath salmon pens caused by uneaten fish feed pellets and salmon faeces. These products can give rise to organic enrichment followed by degradation processes; reduction in dissolved oxygen levels, generation of high levels of sulphides, changes of benthic conditions, and even azoic conditions.

6.1.6.2 Mitigation Measures

Specific mitigation measures for individual species are shown below, with all threatened bird species previously covered in Section 6.1.4.

Spotted Handfish, Red Handfish, Gunn’s Screw shell and Giant Kelp

Depletion of habitat from anthropogenic structures

No mitigation measures are required for the proposed alteration, as no anthropogenic structures will be placed near known handfish, Gunn’s Screw shell or Giant Kelp habitat.

Regulatory controls

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedule 3 (2.3)

MC – 3.1, 3.3, 3.4, 3.5, 3.6, 3.8, 3.12
Marine Mammals

In relation to marine mammals, vessel operators will always keep a lookout for marine mammals, including whales, and will take avoidance action if and as necessary in accordance with the Parks & Wildlife’s whale watching guidelines\(^{21}\), including:

- not approaching any closer in a boat than 100m to a whale – this is the recommended distance for boats moving at slow speed and with no wake (that is less than 8 knots)
- vessels under steam not approaching any closer than 300m
- withdrawing immediately if the whale shows any kind of disturbance
- adopting a slow speed while in the area
- not approaching from the rear of the animal.

The predator crew’s regular inspections of net-pens will maximise the likelihood of marine mammals, including whales, being spotted before they enter a marine farm area. Judicious positioning of predator crew vessels between an approaching whale and the marine farm, with motors off or idling, will be used to try and passively divert whales away. No active diversion or harassment or the animals would occur. If whales nevertheless venture into a situation of potential harm, the crew will immediately advise the Parks & Wildlife Service. Huon Aquaculture will establish this protocol in advance, through consultation with the Service.

The risk of dolphin entrapment under bathing liners is now nil in Storm Bay off Trumpeter Bay. The replacement of the liner bathing system by the well-boat for bathing operations has eliminated the use of liners.

Daily removal of salmon morts from the pens will minimise any attraction the farm might have for sharks and, to some extent, seals.

Regulatory controls

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay, North Bruny Island MFDP (MC)

LC – Schedule 3 (2.3)
MC – 3.1, 3.3, 3.4, 3.5, 3.6, 3.8, 3.12

6.1.6.3 Overall effect following implementation of mitigation measures

Huon Aquaculture expects that any negative interactions with any threatened species will now be largely eliminated, save for any unexpected weather damage that might occur on occasion, to the nets in particular. Even under such circumstances, Huon Aquaculture’s operational crew should now be able to make repairs before problems arise.

The net result is that there should be no significant negative impacts on threatened species.

6.1.7 Geoconservation

6.1.7.1 Potential impacts on sites of geoconservation significance listed on the Tasmanian Geoconservation Database

Although there are a small number of sites of geoconservation significance listed on the Tasmanian Geoconservation Database on North Bruny Island (refer to ), the closest sites are over 6.5 km away at Adams Bay and Variety Bay. Neither of these geoconservation sites will be impacted as a result of the proposed project.

6.1.7.2 Mitigation Measures

There are no mitigation measures required, as there are no impacts on geoconservation as a result of the project.

6.1.7.3 Overall effect following implementation of mitigation measures

There are no impacts on geoconservation.
6.1.8 Chemicals

6.1.8.1 Proposed usage of chemicals including antifoulants, therapeutants (such as antibiotics) and disinfectants

Therapeutants

It is expected that antibiotic use will be minimal, based on the first two years of stocking at the Storm Bay lease MF261 (presently contained within the original Trumpeter Bay zone and SB1 zone). Therapeutants have been administered only once during that time where 4kg of Oxytetracycline was used in June 2016 to treat one pen for excessive skin lesions.

Disinfectants and Anaesthetics

The disinfectant “Virkon” is used by Huon Aquaculture as a key component of Huon Aquaculture’s biosecurity strategy. Based on risk assessment certain equipment is disinfected (either sprayed or soaked) into and out of the Storm Bay sites (e.g., boats) or between pens on the site (e.g., diving bags). Virkon use in relation to farming activities at the Zuidpool Lease is < 50kg/yr.

Anaesthetics (AquIS and Benzocaine) are used to sedate fish prior to health examinations. Total anaesthetic use at Huon Aquaculture Leases is < 1kg/yr

Anti-foulings

Anti-foulings will not be used.

6.1.8.2 Recognised localised and system-wide effects of chemical usage on water quality, the benthic environment and other fauna

The impact of the antibiotic oxytetracycline (OTC) treatment on residues in water, sediments, farmed salmon and wild species were assessed during peak industry antibiotic use in 2006/2007. Conclusions from those studies undertaken in conjunction with the DPIPWE, FSANZ and APVMA were that there were no significant ecological or public health risks associated with antibiotic use at that time. Further studies were proposed and formed part of regulatory requirements, should antibiotic use exceed threshold amounts. However, there has been no antibiotic use at the Zuidpool site and only one pen treated in Storm Bay since that period.

Huon Aquaculture no longer coats any of its nets with anti-foulings, and all nets to be deployed at Trumpeter Bay will be new or previously uncoated nets.
6.1.8.3 Public health risks

A study by FSANZ undertaken in 2007 (at the time of peak industry use of antibiotics) is attached as Appendix G. The initial paragraph of the conclusion stated, “On the whole, the findings of this risk assessment indicate that the consumption of Tasmanian farmed salmon and wild fish living in the waters surrounding their pens does not raise health concerns for any Australian population groups. The current treatment procedures using OTC as a measure to control bacterial diseases among farmed fish are shown to be at a level which is safe for recreational fishermen eating their own catch to consume”. Over recent years, antibiotic use has been very minimal.

6.1.8.4 Mitigation Measures

Huon Aquaculture strives for a proactive and preventative health strategy that maintains the highest standards of fish husbandry, nutrition and biosecurity as a basis for maximising fish performance and welfare. A culture of continuous review and improvement is encouraged. The Huon Aquaculture Veterinary Health Plan is a key component of the Huon Aquaculture Fish Health Strategy.

Written Protocols and Standard Operating Procedures (SOPs) are an important basis for Best Practice Management. These documents promote a well thought through and comprehensive approach to all farming operations that have the potential to impact negatively on fish health and welfare. These documents serve several functions, as outlined below.

Enables broad staff participation which:

• increases the likelihood that the best and most cost-effective measures are identified
• gives staff ownership of the final agreed protocols and SOPs, thus increasing likelihood of compliance
• promotes ongoing input from staff into seeking improvements
• provides a clear and effective education resource for training staff
• provides a clear reference on which internal and external auditing can be based.

It is critical that agreed measures are adhered to

• provides a clear ongoing basis for regular review and continual improvement.

Protocols and SOPs must aim to:

• maintain the good health and welfare of farmed stock through promoting a strong immune system, good physical condition, low stress/low impact handling, good nutrition and optimal growing environment
• avoid the introduction of new or exotic diseases into farmed stock
• minimise the spread and impact of diseases already present.

Use of therapeutants, disinfectants and anaesthetics is covered in detail in the Huon Aquaculture Veterinary Health Plan (VHP). Sections not only refer to specific SOPs for safe and effective use, but also include an introductory section outlining the background behind use to improve staff understanding and implementation of SOPs.

Huon Aquaculture also sees vaccination as a critical strategy currently and into the future to control the incidence of key disease issues. To this end, Huon Aquaculture strongly supports and funds projects to develop vaccines.

Finally, for all sites serviced from the Hideaway Bay shore base, hazards, control measures and management plan references are recorded in AQM0020.2 Risk Assessment – Hideaway Bay. Hazards specifically associated with use of chemicals and chemical waste management include:

• AQM0081 Chemical Storage and Handling Procedure
• AQM0130 Huon Aquaculture Environmental Management Plan
• AQM0130.6 Site Environmental Management Plan – Hideaway Bay
• Huon Aquaculture Site Waste Management Plan (SWMP) Hideaway Bay
• CSOP0128.2 Fuel/Oil Spill Management, Emergency Action Plan Hideaway Bay
• CQM0103 Dangerous Substances.

The above documents are provided in Appendices C & D.

Regulatory controls
Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedule 3 (1.6, 1.7 & 1.11)
MC – 3.5

6.1.8.5 Overall effect following implementation of mitigation measure
The implementation of a well thought through and structured approach to fish health and biosecurity assists in minimising subsequent need to use therapeutants and aids in achieving effective biosecurity with as little use of disinfectants as possible.
It is probably not possible to eliminate all antibiotic use, but Huon Aquaculture strives, as a priority, to minimise the need for use. Further, the amendment will act to reduce any use of antibiotics, as the proposed East of Yellow Bluff lease will act as a smolt site which will enable the separation of year classes and or cohorts within year classes, thereby reducing the risk of disease in the MFDP area.

The use of chemicals is not expected to increase above the already insignificant levels used in the presently at MF261.

6.1.9 Species Escapes

Thorstad et al. (2008) have documented the most extensive review yet of the incidence and impacts of escaped farmed Atlantic salmon in nature, and the review covers all of the major commercial salmon farming regions of the world. Major topics covered in the review of relevance to Tasmanian salmon farming include:

- geographic and temporal trends in numbers and proportions of escaped farmed salmon in nature
- effects of escaped farmed salmon in regions where the Atlantic salmon is an exotic species
- technologies and other efforts for escape prevention
- technologies and efforts to reduce impacts of escapes.

The report also summarises the knowledge gaps in each of these areas and suggests areas of research to better understand the issue.

Jensen et al (2010) provide further detail on the causes, consequences and prevention of escapes in a Norwegian context.

History of escape events within MFDP area

Sea cage culture of salmonids first commenced in south-east Tasmania in the late 1980’s, but data relating to escape events are only available from 2002 onwards. Between 2002 and 2011, Huon Aquaculture had eight reported significant escape events resulting in the release of an estimated 66,000 fish, ranging in size from 270g to 5.4kg. Huon Aquaculture transferred a total of 31.3 million smolt to sea in south-east Tasmania during this period. The escape rate is therefore 0.21%. Huon Aquaculture’s fish escape events are summarised in Table 40.
Importantly, since 2011, Huon has had only one escape event. The event took place at its Zuidpool lease when a net developed a tear when a mort cone was lifted. At the time of writing, the scale of the escape event was unknown and could not be verified until the pen is harvested in 2017.

Published results from the Norwegian and Scottish salmon farming industries for the years 2002-2009 (Table 41) enable a comparison with Huon Aquaculture’s figures.

Table 41 - Farmed salmonid escapes in Norway, Scotland and SE Tasmania

<table>
<thead>
<tr>
<th>Species Lost</th>
<th>Input Years</th>
<th>Number of smolt to sea (000,000)</th>
<th>Number of reported fish losses (000,000)</th>
<th>% loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic salmon</td>
<td>2001-2009</td>
<td>1791.6</td>
<td>6.65</td>
<td>0.37%</td>
</tr>
</tbody>
</table>

Huon Aquaculture’s fish escape rate compares favourably with industry experience world-wide.

For Huon Aquaculture, escape events, where documented, were all related to tears and holes in nets and these were predominantly due to seals damaging the nets.

Low number escape events also occur through small, undetected holes in nets, through losses during routine handling of fish and from bird, shark and marine mammal predation. However, the absolute magnitude of these low level releases is unknown (Naylor et al 2005).

### 6.1.9.1 Recognised ecological effects of escaped stock

Marine farming practices and equipment specifications are designed to avoid the release of fish. However, despite the best of intentions and practices, the occasional escape of salmonids can occur.

There are a number of potential concerns associated with the escape of farmed salmonids into the marine environment. These include:

- establishment of feral populations
- impact on native fish populations through predation or competition for resources
- disease/parasite transfer from farmed fish to native fish populations.

The major concern for northern hemisphere farming countries, genetic pollution of wild stocks of Atlantic salmon, is not relevant in Tasmania. Although the numbers of escaped fish in these overseas countries are small compared to the number stocked, they are highly significant in the context of low numbers of genetically distinct wild populations in small river systems.

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<table>
<thead>
<tr>
<th>Input Years</th>
<th>Number of smolt to sea (000,000)</th>
<th>Number of reported fish losses (000,000)</th>
<th>% loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scotland23</td>
<td>2002-2010</td>
<td>323.5</td>
<td>2.13</td>
</tr>
<tr>
<td>Huon Aquaculture south-east TAS24</td>
<td>2002-2011</td>
<td>31.3</td>
<td>0.066</td>
</tr>
</tbody>
</table>

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24 Huon Aquaculture Pty Ltd
Sea cage farming of salmonids in Tasmania commenced in the 1970s (rainbow trout), but did not become a significant industry until late in the 1980s, with the focus moving to Atlantic salmon. To date, there has been no documented evidence of the establishment of feral populations of Atlantic salmon in Tasmania.

Commencing in 1865 and continuing until the 1930s, numerous attempts were made to establish self-supporting populations of both Atlantic salmon and Pacific salmon. Hundreds of thousands of juveniles were released in river systems all over the state, but the goal of establishing self-supporting populations for recreational purposes was never achieved (Clements 1988). In fact, there is no documented evidence to suggest that Atlantic salmon have established successful breeding populations outside their normal home range in the northern hemisphere (Thorstad et al. 2008).

In 2003, researchers from the Tasmanian Aquaculture and Fisheries Institute in conjunction with the Tasmanian Salmonid Growers Association conducted preliminary research into salmonid escapees from marine farming operations in Macquarie Harbour, on the west coast of Tasmania.

The study primarily focused on aspects of post-escape feeding activity and involved examination of stomach contents and condition of escaped fish. Results indicated that escapees did not appear to successfully forage outside of the farm nets and they lost condition, which supports the contention that escaped fish do not appear to thrive in the wild (Steer and Lyle 2003). However, some of the fish examined did have prey items in their stomachs, which indicated that they were feeding on native species. This suggested that more work was required to achieve a greater understanding of the fate of escaped salmonids in the marine environment in Tasmania.

Abrantes et al. (2010) used biochemical, stable isotope and fatty acid analyses to determine whether escaped salmonids in Macquarie Harbour feed on native fauna. They established that one Atlantic salmon (of 13 sampled) and one rainbow trout (of 38 sampled) had successfully fed on native fauna post escape. The authors concluded that, in general, escaped salmonids do not switch to feed on native fauna, but because of the limited sample size the results were not conclusive and there was still no definitive answer regarding the fate of salmonid escapees in Tasmania.

A number of social and economic impacts, both negative and positive, may also be associated with escaped salmonids, but to date there has been little work done to estimate these impacts. The aquaculture sector bears the direct losses in foregone revenue, loss of capital in the stock and poor public perceptions (Naylor et al. 2005). Escapes can be seen as a bonus for local recreational fishing interests and the tourism industry, providing extra revenue from new target species. This was particularly apparent in Dover in March 2000, when the loss of a significant number of salmon provided the businesses in the town with a major economic boost for several days.


6.1.9.2 Spread of disease from escaped fish

There has been no evidence that farmed Tasmanian salmon are responsible for transmission of diseases to either native species or wild salmonid populations. None of the major infectious bacterial or viral disease agents known overseas have been found in Tasmania and there have been no problems associated with salmon lice. While there is the potential for disease transfer from escaped fish, the low level of disease in farmed Tasmanian salmonids, combined with relatively low loss rates from recent years, means that such a risk is very low.

6.1.9.3 Mitigation Measures

Risk minimisation strategies

There are a number of elements in place in Tasmania that provide a management framework regarding the issue of farmed salmonid escapes (DPIW unpublished report, 2006).

Regulatory controls

Refer to Appendix E – Licence conditions (LC), Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedule 3 (2.4)

MC – 3.11

Legislative controls include marine farming licence conditions under the Living Marine Resources Management Act 1995 that prohibit the intentional release of fish and requirements to report significant escapes. There is also a mechanism for the Secretary of DP/IPWE to require fish-down of escapees. In addition, Tasmanian salmonid growers have adopted (June 2004) a voluntary code of practice that includes sections on gear maintenance and escape mitigation.

Following general community concerns over fish escapes, Huon Aquaculture further endorsed the following measures to prevent escapes at all farms:

- A comprehensive diving regime to routinely monitor net integrity. The frequency of dive inspections should be increased following severe weather events, movement of stocked pens, net changes and transfer of stock between pens. Huon Aquaculture now uses a dedicated sub-sea team with state-of-the-art remotely operated vehicles (ROVs) in place of divers where possible.
- All newly deployed nets should be dived prior to fish stocking.
- All stock transactions (grading, swim throughs) to be conducted in weather conditions that do not present an unacceptable risk of fish escape.
• All pens, nets and mooring systems must be appropriate for the prevailing weather conditions, currents, water depths and seabed characteristics.
• Integrity of all farm systems should be checked and repaired as a matter of priority after severe weather events.
• Ensuring daily removal of salmon morts from the pens using lift up systems to minimise any attraction for sharks and seals.

Following an escape event in May 2010 in Macquarie Harbour, involving the loss of more than 10,000 large Atlantic salmon, one of the companies operating in the harbour contracted a licensed fisherman to recover as many escaped fish as possible. A permit was issued under Section 12 (4) of the *Living Marine Resources Management Act 1995*. However, over four days of netting effort only 45 fish were caught. There was no native species by-catch taken during this netting exercise.

Thorstad *et al* (2008) found that escaped salmon move away from the release site within a few hours of an event, and even a huge catch effort over large areas may not effectively recapture salmon after large scale escapes. A number of examples are cited where the recapture of escaped fish has been less than 3% of the initial loss.

Anecdotal evidence from escape events within the Tasmanian industry suggests that recreational fishing is far more successful in recapturing escaped farmed salmonids – recreational net fishing is still permitted within Tasmanian waters. Professional net fishermen have also taken significant numbers of salmon as by-catch. However, there have been no studies to quantify the effectiveness of the recapture effort in Tasmania.

**Other mitigation measures**

The new Fortress Pen net-pen design is intended to prevent the ingress of seals to Huon Aquaculture’s net-pens. The operational management of the new Fortress Pens will allow for all pens and therefore nets to remain in the same grid position through any particular year class lifecycle at sea. This will help eliminate both the presence of seals and the need for net tows, which cause more than 90% of all significant holes and tears in nets. The majority of stock transactions are now conducted using the well-boat, further minimising the risk of escape.

Notwithstanding these improvements, and while it is important to have gear of the right specifications that is well maintained, staff training and education remain very important. A relatively large percentage of reported escape incidents are either due to operator error or to operations damaging equipment that leads to escapes (Jensen *et al* 2010). Certain operations within fish farming (e.g. anchoring and mooring, net changes and maintenance, and fish transfers) are likely to pose a higher risk of an escape event if not performed correctly. These key processes have already been identified, together with the mandatory training of staff.
Protocols for managing escape events

In general, these form part of the wider SOP’s for the company such as the diving and net cleaning related SOP’s.

Nets are inspected by ROVs or divers following any movement of a pen or any other pen transaction (such as a bath, ~every 30 days). In addition, all net cleaning includes a routine inspection of the net being cleaned for any holes. In response to any reports of salmon outside of pens, all the pens at a lease site are dived and the nets inspected for holes. If a hole is discovered, the pen of fish is counted at its next transaction to evaluate any potential escape. Any escapes are reported to the Marine Farming Branch as per Licence Conditions specified in the Marine Farming Licence.

6.1.9.4 Overall effect following implementation of mitigation measures

As described above, the levels of escapes in south-east Tasmania were already low on a world-wide scale prior to the design and rollout of the new net-pen design. Huon Aquaculture has proven that the new net-pen design has significantly decreased interactions between mammals and its stock, infrastructure and personnel.

Although the increased intensity of fish farming in Storm Bay off Trumpeter Bay North Bruny Island MFDP might otherwise increase the overall incidence of fish escapes, the combination of the new net-pen design, together with using the well-boat for all bathing operations and thereby eliminating towing of pens and nets, will greatly reduce the risk of escape.

6.1.10 Disease and Biosecurity

History of disease within MFDP area and bioregion

As in any livestock production, there are bacterial, viral and parasitic organisms that can impact the health of farmed salmon. The most important salmon disease in the south-east region of Tasmania is amoebic gill disease (AGD) (Neoparamoeba perurans). AGD has been present since the start of the Tasmanian industry and is routinely controlled through regular freshwater bathing of affected salmon. Mortality is minimal, but the resources required for bathing are significant.

Other diseases found in the south-east include the viral diseases: Pilchard Orthomyxovirus (POMV) and Tasmanian Aquareovirus (Reovirus), and the bacterial diseases: RLO, Yersinia ruckeri, Tenacibaculum maritimum and Flavobacterium. The impact of these diseases is minimised through good quality nutrition, husbandry and biosecurity.

All Huon Aquaculture’s fish are vaccinated against Yersinia ruckeri in the hatchery stage using a dip vaccination when the fish are 1g, 2g and 5g. A strategy to give a booster
injection vaccine against *Yersinia ruckeri* closer to the time of smolt transfer is being developed to prevent any occurrence of yersiniosis post-transfer. Vaccines are currently also being developed for POMV and Reovirus. A trial RLO vaccine has proven to be effective in tank challenge trials at the Fish Health Unit in Launceston and is now being tested in commercial pens. There is also the potential for including other disease organisms (e.g. *Tenacibaculum* and *Flavobacterium*) in multivalent vaccines in the future.

*Tenacibaculum maritimum* and *Flavobacterium* are bacteria that can cause skin infections if the skin of fish is physically damaged (e.g., scale loss at handling). The incidence of *Yersinia ruckeri* infection and skin lesions is minimal through careful, low stress handling and use of healthy feed formulations (i.e. good quality ingredients, fortified levels of vitamins to boost the fish’s immune system). Antibiotics are rarely needed to treat these bacterial conditions, but are used on occasion to protect animal welfare. Effectiveness of vaccination regimes and feed formulations are continuing to be investigated and implemented as improvements are established.

Viral infections sometimes occur when environmental conditions (e.g. phytoplankton blooms, warmer water conditions in summer) are stressful to fish. Again, the incidence of viral infections is usually minimised through good nutrition, husbandry and biosecurity. However, certain viral diseases e.g., POMV are potentially serious emerging issues for the industry. It is critical that appropriate biosecurity measures are incorporated into planning and farming practices to minimise the threat this poses. Viral infections are not treated with antibiotics.

### 6.1.10.1 Recognised ecological effects of disease

There is no evidence that any of the diseases that sometimes impact farmed salmon in Tasmania have any impact on wild stocks. In fact, evidence indicates that wild fish probably act as a reservoir for certain disease organisms which subsequently get transmitted to the salmon. For example, Pilchard Orthomyxovirus (as the name suggests) is carried in pilchard populations.

### 6.1.10.2 Assessment of potential biosecurity risks to marine farming operations in leases and shore base facilities held by other salmonid growing companies

Disease can be caused by a range of agents, including bacteria, viruses and parasites. While Tasmania is free of many serious diseases affecting salmonid farming overseas it is nevertheless important to implement biosecurity measures to prevent the spread of existing disease agents as well as prevent the introduction of new diseases such as those that exist overseas or might reside in local wild populations of aquatic species.
Currently, there are no other salmonid farming companies operating in Storm Bay. However, this may change with other companies currently investigating farming opportunities in the area.

Key biosecurity measures include:

- Appropriate distances between operators and leases
- Separation of year classes
- Effective fallowing of leases
- Effective management of wildlife interactions
- Effective control of infectious disease cases, including: effective and timely treatment of AGD, rapid separation of disease affected stock and effective and timely removal of mortalities
- Effective maintenance of farm infrastructure e.g., net cleaning
- Biosecure movement of live and dead fish
- Good fish husbandry practices

Biosecurity risks in Storm Bay may be exacerbated by the high energy/ exposed nature of the farming region (Salama and Murray, 2013).

Advice provided by the Planning Authority

The Planning Authority (PA) sought advice from the Chief Veterinary Officer (CVO), DPIPWE, regarding disease and biosecurity issues associated with the proposed salmon farming developments within Storm Bay. The CVO considered modelling outputs from CSIRO Connie 3 for all existing and proposed sites within Storm Bay. Advice received from the CVO regarding biosecurity and separation distances included:

- Separation of salmon farms by distance is aimed at reducing the risk of transmission of disease pathogens in the water column. While this is an important aspect of biosecurity it must be considered in association with other risks of disease introduction such as movement of staff, boats and fish between and around sites.
- Separation of farms as a biosecurity measure relies on the fact that the likelihood of infection declines over distance. There is usually an initial rapid decline in the likelihood of disease with distance but a risk may still remain over longer distances. This decline over distance is due to a number of factors, principally the dilution of the pathogen with distance and the reduction in infectivity of the pathogen over time.
The risk of spread of a disease pathogen in the water column is dependent on a number of variables such as water temperature, salinity which impact the pathogens survival. Different pathogens will survive for differing period in the water column.

The risk of spread can also be impacted by things such as the size of farms – the larger the farm the more likely it is to become infected if exposed to a risk due to the greater number of fish being exposed.

Water flows in Storm Bay drive quite variable movements of any particle based on point of release and season, with possible movements of infective material in the order of 10-30 km over 24hrs.

There is no separation distance that can be applied to reduce the potential risk of spread of infective material in the water column between sites in Storm Bay to zero. Separation of companies within Storm Bay needs to be based on the acceptable level of risk.

A separation distance between companies of approximately 5km would provide some protection but would not be a complete barrier. Reduced distances would be considered appropriate where agreement exists between affected companies.

To make the most of separation distances, especially of leases under management of different companies, companies need to adhere to best practice disease and biosecurity management practices to address the risks.

Storm Bay would be considered by the CVO as a single area from a disease management perspective and deemed to be contiguous with existing salmon farming sites in the northern section of the D’Entrecasteaux Channel and on the western side of the Tasman Peninsula. In an emergency animal disease response these areas would be considered as one region and all leases in the area would be regarded as at risk.

### 6.1.10.3 Mitigation Measures

**Fish health strategies**

Huon Aquaculture has a comprehensive approach to fish health. Fish health and biosecurity is managed by a full time veterinarian (with more than 25 years experience in salmon farming), who is supported by a full time assistant veterinarian, along with an experienced team of technical staff (mostly university graduates). Fish health is underpinned by Huon Aquaculture’s Veterinary Health Plan (VHP) and commitment over many years to the Tasmanian Salmonid Health Surveillance Program.

**Huon Aquaculture Veterinary Health Plan (VHP)**

Huon Aquaculture’s VHP describes the principles and procedures used by Huon Aquaculture to maintain the health and wellbeing of fish throughout the lifecycle and to describe the accepted veterinary practices used. The VHP encompasses all marine farm
and hatchery sites operated by Huon Aquaculture and aims to identify and define areas of management and husbandry where agreed protocols and procedures are targeted at “Best Practice” to optimise fish health and welfare. The VHP is regularly reviewed and updated to promote continuous improvement in all areas.

Disease control in intensive aquaculture production requires a holistic approach. Good site management, animal husbandry and rigorous biosecurity measures are central to reducing the risk of disease outbreaks and controlling the spread of infectious diseases. Vaccination plays an important role in preventing disease outbreaks where effective vaccines are available, but cannot be expected to control all losses. Medication is only used as a last resort to avoid any significant animal welfare issues and stock losses.

The VHP has been developed by Operational Managers and Fish Health Staff, under the guidance of the company Veterinarian. The VHP is an integral part of Huon’s farming strategy and is well understood by all relevant staff within the company (e.g. Veterinarians, Senior Managers, Production Managers and Fish Health staff).

Key topics covered by the VHP are:

- animal welfare
- biosecurity
- general operational management
- disease and physical damage – control and monitoring
- training
- government legislation
- research and development
- harvesting operations.

**Tasmania Salmonid Health Surveillance Program**

All Huon Aquaculture stock (including those sourced from non-Huon sites) is covered under the Tasmanian Salmonid Health Surveillance Program (TSHSP), which is jointly funded by the salmonid industry in Tasmania and the DPIPWE.

The TSHSP is a key component of any fish health management within Tasmania, ensuring open communication within industry, together with the early notification of significant disease events by the producer or diagnostic laboratory. In the event of a fish health emergency, the Tasmanian Chief Veterinary Officer (CVO) will activate the emergency management structure within DPIPWE to coordinate a structured response.
The TSHSP has been in operation since 1994 and is reviewed annually to ensure that it meets the ongoing needs of industry. The objective of the TSHSP is to ensure that a coordinated disease surveillance program, in-line with international recommendations (particularly the OIE), is operational throughout the Tasmanian Salmonid Industry.

Agreed objectives of the Program are:

**Objective I:** Demonstration of freedom from a range of salmonid diseases considered exotic to Tasmania, but not necessarily Australia.

**Objective II:** Monitoring of significant endemic diseases and their causative agents in order to provide evidence of regional biosecurity within Tasmania.

**Objective III:** Investigation of significant or unusual disease events in a rapid and efficient manner.

**Objective IV:** Program activities contribute to a disease database that may be used to further analyse trends in salmonid diseases or conditions over time.

Research and Development (R&D)

Huon Aquaculture invests considerable resources into R&D to better understand fish health and disease processes and develop improved fish health outcomes. This includes active participation in, and contribution to, the Tasmanian Salmonid Growers Association’s Technical Committee and R&D Program, as well as an extensive program of internal health related R&D. A component of the role of the Huon Aquaculture technical team is to operate 34 small trial pens at Huon Aquaculture leases on a continuous basis. This research is instrumental in improving fish health, particularly through improved nutrition.

Huon Aquaculture has also contributed significant funding to the upcoming expansion of the R&D capability of the DPIPWE Fish Health Unit (FHU). This will enable more effective and efficient R&D into fish health related issues, in particular improved disease diagnostics and vaccine development.

Huon Aquaculture is also a one-third partner in the IMAS Experimental Aquaculture Facility at Taroona in Hobart, where R&D is focused on improving diets and AGD control.

Biosecurity

Biosecurity, in its broadest definition, is the prevention of disease-causing organisms entering, spreading within or leaving any site where they pose a risk to farmed stock, other animals, humans or the safety and quality of food. Biosecurity in an aquatic environment poses many challenges as often pathogens can be carried in wild fish and never totally eliminated from the aquatic environment.
A Biosecurity Plan identifies potential disease risks and implements effective mitigation strategies. Biosecurity plays an important role throughout every stage of the life-cycle, from hatching through to processing. It is not just a case of good hygiene and disinfection procedures. The level of risk at each stage should be identified and procedures established to significantly reduce risks. Biosecurity aims to avoid spread of infectious agents within sites as well as between sites.

Huon Aquaculture actively contributed to the development of the Tasmanian Salmonid Growers Association (TSGA) Biosecurity Program, and operates within the guidelines and protocols within the Program.

The Overseas Experience

Inadequate or poor biosecurity practices have seen the collapse of the salmon farming industry in many countries internationally. In each case, industry recovery has only been possible following difficult rationalisation of the industry and the implementation of key biosecurity measures that are strictly adhered to.

Previous government/industry planning and regulation in Tasmania has not always addressed the important biosecurity issues now dealt with routinely in overseas salmon producing countries. Dealing with these legacy issues at existing farming sites will be somewhat difficult and complex in certain areas requiring some time for transition. It is nevertheless critical that they are addressed as soon as possible.

In the meantime however, it is critical that we learn from overseas experience in developing new farming areas in a way that encompasses good biosecurity upfront.

The proposed multi-company expansion in Storm Bay must be managed to provide positive biosecurity outcomes. It is incumbent on the salmonid industry and the Planning Authority to ensure that biosecurity in this developing region is a high priority consideration.

The Farming Challenges in Storm Bay

Huon Aquaculture’s experience to date in the high energy exposed conditions of Storm Bay has also reinforced the need for more robust farming equipment and procedures than those required for lower energy inshore sites to enable good fish health and biosecurity. As always, the highest priority is to avoid the introduction and establishment of infectious disease in a new area such as Storm Bay. However, if and when an infectious disease does occur in an individual farm population (i.e., a pen) it can be spread to the wider region through:

- Transfer in wild aquatic organisms (e.g., baitfish and phytoplankton)
  - Virtually impossible to control, although measures to keep baitfish separated from the salmon within pens may help to reduce transmission between the two.
- Spread of disease organisms in the water with tide and wind driven currents
  - This mechanism of transmission can only be effectively controlled by adequate separation of sites.
- Spread in live or dead farmed fish
  - Requires specific biosecurity protocols
- Spread by movement of contaminated farm or public, farm staff and/or farm equipment

**Appropriate Separation of Year Classes**

Alvial et. al (2012) stated that despite the new regulations and practices implemented in Chile following the collapse of the Chilean salmon industry due to ISA, there were still important issues to address including (among other things) the need for:

- “mechanisms to ensure that over-concentration of farming activity in certain areas is avoided”
- “improved pathogen dispersion control strategies”

The Chilean salmonid industry “now considers site selection one of the most important factors for reducing the risk of infectious diseases due to the proximity to their neighbours” (Alvial et. al., 2012). Bakkefrost (Appendix O), report “minimum distances between farms” as a key factor in the new legislation and regulation introduced in the Faroes in 2003 following the collapse of the industry due to increasing disease issues. The Faroes have also rationalised the industry to minimise overlap of companies within the same growing area as well as ensuring a high degree of cooperation between operators in the same area.

**Site Separation (What distance is adequate?)**

The Tasmanian Pilchard Orthomyxovirus (POMV) is not the same as Infectious Salmon Anaemia orthomyxovirus (ISA) which has devastated overseas salmon farming regions. However, both disease organisms are orthomyxoviruses and there are similarities in the pattern of disease. Therefore, biosecurity information relating to ISA can provide a useful basis on which to manage POMV.

ISA is transmitted mainly by passive movement of infected sea water, with higher risk the closer a susceptible farm is to an infected farm or processing plant (Mardones et. al., 2009; Mardones et. al. 2014). This same general principle applies to all infectious disease organisms in the aquatic environment (e.g., bacteria, viruses and parasites).

The Office International des Epizooties (OIE), which is the World Organisation for Animal Health states that sites within 5 kms of an infected farm or processing plant are at high risk of acquiring ISA (Alvial et. al., 2012). Investigation of the Chilean ISA epidemic indicated that at least 10 km is a more appropriate infection zone (Alvial et. al., 2012).
al., 2012). Investigation of Norwegian ISA outbreaks demonstrated transmission between farms over distances of 20-30 kms. The authors concluded that the risk involved in local transmission extends well beyond 10 km (Alvial et. al., 2012).

Investigation of Scottish ISA outbreaks resulted in “Best Practice” recommendations for biological separation as 2 x tidal excursions, including for oceanic sites. This takes into account the local hydrodynamics rather than a distance per se. In Scotland 2 x tidal excursions is deemed to be 14.4 km (Salama and Murray, 2013).

Effective site separation also depends on the robustness of the infectious organism in question (i.e., how long does it survive for in the water outside the host). ISA is not a particularly robust organism compared to some others e.g., bacterial pathogens such as Aeromonas salmonicida (same bacterial group as the atypical Aeromonas salmonicida subtype acheron which occurs in Macquarie Harbour) and viruses such as Infectious Pancreatic Necrosis Virus (IPN virus) (same virus group as the Tasmanian Aquabirnavirus which occurs in Macquarie Harbour). Modelling in Scotland (Salama and Murray, 2013). indicates that Aeromonas salmonicida requires tens of kms separation and IPN virus requires hundreds of kms separation to avoid transmission of infection. Offshore sites in Scotland where stocking levels are higher and current speeds greater will likely require even greater distances to avoid transmission of infection.

Overseas experience and contemporary regulation indicates that “best practice” would be to have two tidal excursions between companies.

CSIRO advise that the diurnal tidal excursion on the eastern side of Bruny Island is 4.8km and is approximately half this for the more dominant semi diurnal tides. If we define biological separation as 2 x tidal excursions, 9.6km would be the recommended biological separation distance in Storm Bay. This is reasonably consistent with (but less than some) published information from different countries that transmission of ISA can occur through infected water over at least 10 km (possibly up to 30 km) (Aldrin et al. 2011). This distance would be inadequate for more robust disease organisms experienced overseas like Aeromonas salmonicida and IPN virus.

Adequate site separation provides the best and most controllable means of minimising disease transmission between companies. “Lowest common denominator” health and biosecurity management practices define the risk. Therefore, it is essential that any and all companies farming in a region like Storm Bay undertake “best practice” biosecurity regimes.

**Separation of Year Classes**

Different year classes of fish should not be held on the same lease as this facilitates the transmission of disease organisms from the older year class to the younger year class when they are usually most vulnerable to infection.
One of the key biosecurity and sanitary regulations adopted by the Chilean Industry after the ISA crisis was “all in all out stocking i.e., no mixing of separate year classes” (Alvial et al., 2012).

**Effective Fallowing Period Between Year Classes**

Fallowing between stocking is a well-recognised biosecurity measure important in all livestock industries. Fallowing not only allows time for the sediments under pens within the lease to recover, but also assists in breaking the cycle of disease transmission to the new stock.

One of the key issues identified in the World Bank analysis of the Chilean ISA crisis was that “there was no mandatory break between year classes of fish on a farm (i.e., fallow periods were voluntary).” One of the key biosecurity regulations adopted was “Mandatory site fallowing between year classes” (Alvial et al., 2012). A key measure in the new legislation introduced in the Faroes in 2003 was also “a one generation based farming model with fallowing periods between each generation” (Bakkefrost, 2016, Appendix O).

Key measures in the Scottish Salmon Industry Code of Good Practice (2014, ‘thecodeofgoodpractice.co.uk’) include:

- All seawater sites should adhere to a written fallowing plan
- Farmers should fallow sites on a single-year class basis in seawater pen production units
- The minimum fallow period should be 4 weeks at the end of each cycle.
- Pens, nets and other equipment should be cleaned and disinfected before the site is restocked with fish

**Effective Management of Wildlife Interactions (e.g., seals and birds)**

It is not only important to keep seals and birds away from farming operations for their own welfare. Predators such as seals and birds (smaller fish) also cause stress which means the fish are more susceptible to disease and become vectors for the transmission of disease. Birds must also be excluded from accessing feed or resting on farm infrastructure because bird faeces is a known vector of disease organisms.

Farm infrastructure must be robust enough to exclude wildlife effectively and consistently in the challenging weather conditions experienced in Storm Bay. The failure of any one company to exclude wildlife put the biosecurity of other farms in the area at risk. In addition, the failure of any one company to exclude seals means that seals will learn to see farmed fish as a food source encouraging their behaviour to become entrenched and more difficult to change.

**Effective Management of Disease Incidents**

*Capacity to isolate populations affected by infectious disease (if required)* - Huon Aquaculture will be allocating an existing lease as a contingency site, which can quarantine fish.
reasonably suspected of clinical disease by a veterinarian. This existing lease will either be at Norfolk Bay or in the south of Trumpeter Bay zones (under the TPDNO limits this may be SB4). This biosecurity measure has proven to be very effective in controlling spread of POMV in the Huon region, if implemented rapidly after identification of initial infection in single populations. Fish will be moved in the closed valve well-boat which is designed and certified capable of working in the strictest biosecurity regimes anywhere in the world. This level of contingency and redundancy is critical to expansion of operations in Storm Bay.

Capacity to remove morts in a timely manner – Morts are a high risk vector for transmission of disease. Mort retrieval systems must be in place that enable at least daily recovery of all morts during a disease incident. Huon has developed an automated mort retrieval system whereby morts can be identified and retrieved quickly using remote camera technology. Morts are pumped along pipes directly into an ensiling system located on the site feed barge. Ensiled material is then regularly pumped on a service vessel and transported back to shore for transfer to approved fish waste facilities.

Robust Characteristics and Effective Maintenance of Farm Infrastructure

Farm infrastructure must be robust enough to withstand the challenging environmental conditions in Storm Bay.


- “Pens, including all ancillary and swim-through pens, should be designed and constructed so as to be capable of dealing with the weather and other environmental conditions likely to be experienced at the specific farm site. They should be selected with a sufficient safety margin to allow for year to year variations in weather patterns. Farmers should obtain from the manufacturers or other suitable qualified persons full information on the installation; on the important design features and the suitability of the design for the planned mounting of additional equipment; on the materials used in construction; and on the strength of the design and its suitability for the environment in which it is to be deployed.”

Huon Aquaculture has been successfully farming now for approx. two years in Storm Bay using the Fortress Pen designed and developed by Huon along with all the associated ancillary equipment e.g., feeding systems, mort lift-up systems, feed barges, lighting systems etc..

Net Biofouling - The marine biofouling which grows on marine pens and nets has been shown to be a reservoir for AGD, as well as other pathogens such as bacteria and viruses. Huon Aquaculture will undertake regular in situ net cleaning which will reduce the presence of biofouling that could be harbouring pathogens. Removing the need to tow pens with biofouled nets will further reduced the risk of translocating disease
between leases. Effective net cleaning also maintains the best water quality environment within the net to maximise fish health.

Biosecure Movement of Live and Dead Fish

All movement of live and dead fish between sites must be done in a biosecure way to avoid the transmission of disease within companies and between companies. Towing of fish populations in open pens is not an acceptable method for moving live fish and would not be allowed anywhere else in the world.

Well-boat Operations - Huon have been operating the Ronja Huon, a well-boat that is one of, if not the most, modern of its kind in the world since late 2014. Huon believes a well-boat is integral for successful offshore farming and it is one of the most effective measures for reducing biosecurity risk for the following reasons:

- The ability to freshwater bath large volumes of fish during short unpredictable weather windows
- The ability to move fish in a quarantined environment (ie. closed valve technology). This removes the need to tow fish past neighbouring marine leases, which is internationally recognised as high risk from a biosecurity perspective and would not be allowed anywhere else in the world.

Huon Aquaculture were integrally involved in the development of the Ronja Huon, having sent Huon staff to Norway to spend time working on the sister ship. Huon Aquaculture developed biosecurity procedures which were circulated to and ratified by relevant government agencies and industry companies for comment prior to the arrival of the well-boat in Tasmania.

Huon Aquaculture has recently commissioned the build of a new larger well boat that will hold four times the volume of water that can currently be held on the Ronja Huon and has been specifically designed for Tasmanian conditions and farming practices based on several years experience with the operation of the Ronja Huon.

Low Stocking Densities

New net–pen design - The move to Fortress pens is accompanied with an increase in depth of net. This means that, although the number of the fish in the pens will increase, the actual stocking density of the fish in the pen will decrease to approximately 8-10 kg/m$^3$ at harvest. To Huon Aquaculture’s knowledge, this is the lowest stocking rate in the world for Atlantic salmon in pens. It will help to reduce the incidence and spread of disease at Huon Aquaculture’s leases.

Regulatory controls

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedule 3 (1.4, 1.5, 1.8 & 2.2)
6.1.10.4 Overall effect following implementation of mitigation measures

Huon Aquaculture’s commitment to the above mitigation strategies facilitates continual improvement on fish health and biosecurity. It also ensures that fish health and welfare maintains a high profile within the company. The company is currently addressing all of the known fish health and biosecurity related farming challenges in Storm Bay and throughout the company’s marine operations. Huon Aquaculture is basing future fish health and biosecurity strategies on those lessons learnt overseas and seeks support from the Regulatory Authority in order to minimise the risk of disease through both; planning adequate distances between fish farm companies in the region, and, ensuring that any other fish farm companies that might farm the area are also adhering to best practice principles as detailed above.

In terms of the continued development of the company’s marine farming operations, the proposed new and amended zones will allow our most susceptible fish, the smolt, to be grown in better mixed and oxygenated waters than in the Huon River and Port Esperance and D’Entrecasteaux Channel MFDP’s.

6.1.11 Waste Streams Disposed on Land

Huon Aquaculture has developed a comprehensive risk assessment program across all of its marine and freshwater operations. These risk assessments specifically consider hazards associated with waste at all stages of operations. Management plans have been developed to specifically mitigate these risks. Examples of these include:

- Huon Aquaculture Site Waste Management Plan (SWMP) Hideaway Bay
- AQM0130.6 Site Environmental Management Plan – Hideaway Bay.

6.1.11.1 Dilapidated or broken equipment

Dilapidated or broken equipment is generally removed from the water as soon as possible after discovery. The company naturally seeks to recycle and reuse much of its equipment and is fortunate to have substantial areas of land to store old equipment for turnaround.

6.1.11.2 Soluble and solid waste streams from land-based maintenance of nets

All historical maintenance of anti-fouled nets was undertaken at the Port Huon site, where the nets were washed, repaired, coated with WB100 product and stored. The
site is subject to an EPA Environment Protection Notice (EPN) through which all waste processes and discharges are regulated. Presently, all solids containing anti-fouling paints are stored in bunded covered facilities on site under the EPN. Under the present proposal the throughput should decrease, as the level of total biofouling at the end of the net-pen stocking cycle will be greatly reduced due to the ongoing *in situ* cleaning of the nets through their time at sea. In addition, with the cessation of use of antifouling paints, the company will in future seek (through the EPA) to re-use the resulting solids from the net-wash system through spreading on agricultural land, or providing the high nutrient organic solids as compost.

### 6.1.11.3 Blood-water

All blood-water is directed/injected into the onsite ensiling system at Hideaway Bay. The present proposal will not affect the current process for blood-water treatment.

### 6.1.11.4 Black and grey water from on-site barges and other installations

As described in Section 3.6.2 *Liquid Waste*, sewage will be stored on the feed barge and removed every 4-6 weeks to shore for disposal to a municipal waste system through a TasWater licence (Port Huon), and grey water will discharge directly from the barge.

### 6.1.11.5 Potential Impacts

**Fish Mortalities**

If dead fish are not removed from the cage on a regular basis, there is the potential for some impact on the environment as well as the populations of stock within the cage and in adjacent pens.

Potential impacts on the natural and human environment include:

- spread of disease to wild fish
- attraction of predators
- organic enrichment of the water column and the seabed from putrefying fish
- odour issues affecting public amenity and aesthetics
- changes in water quality.

Potential impacts on stock populations within cage and on adjacent pens include:

- spread of disease and parasites
- lowering of dissolved oxygen (DO) (and impact on other water quality physico-chemical parameters), due to microbial degradation of putrefying fish
- stress on existing populations and potential health impacts.

**Waste from General Operations**

**Marine debris**

There is potential that some forms of rubbish may be found within the water column or on the eastern shoreline of Bruny Island and other shorelines within Storm Bay.

Potential impacts on the natural and human environment include:

- entanglement or other physical impact on local fauna (e.g. birds and marine mammals)
- public amenity and aesthetics
- hazards to navigation e.g. propeller entanglement.

**Black and Grey Water**

The inappropriate discharge of black water directly into the marine environment has the potential to cause environmental and human health issues including:

- impacts on physico-chemical properties leading to undesirable impacts on water quality
- contamination of seawater with faecal coliforms
- health related impacts for fish.

**Organic Net Fouling from Net Cleaning Operations**

The potential impacts on water quality and substrates related to in situ net cleaning are outlined in Sections 6.1.1 and 6.1.2. Effluents from land based net-washing systems include; organic solids that can be reused as fertiliser, and, nutrient enriched wastewater which can also be reused or recycled on land or can be evaporated if high in salt content consistent with EPA guidelines or EPN’s.

**Harvesting Operations**

Blood water from marine harvesting operations has the potential to organically enrich surrounding waters and potentially spread disease amongst fish stocks if released into the marine environment.

**6.1.11.6 Mitigation Measures**

**Fish Mortalities**
Huon Aquaculture continually aim to reduce the number of mortalities occurring within its aquaculture leases by means of best practice husbandry, biosecurity measures, and by utilising only the best available stock identified through the Selective Breeding Program (SBP). Seal exclusion measures, in the form of the new net-pen design, will be implemented across all pens at the proposed site and will have the greatest direct effect on reducing fish mortalities. Diseases are managed by appropriate vaccinations and the employment of a veterinarian who implements the VHP across the Company.

Mortalities will be collected daily through the lift-up systems on the pens and transferred to ensiling facilities on the feed barges. Periodic collection will be made from the feed barges by one of the larger vessels servicing the leases and the ensiled material taken to North West Bay or Hideaway Bay for intermediate collection and storage. Thereafter, the ensiled waste will go on to either registered fish waste processing contractors or compost contractors.

**Waste from General Operations**

**Marine Debris**

Huon Aquaculture has strategies in place to limit the amount of marine debris that is generated from their operations. Most notably, since replacing all traditional production pens with "fortress pens" and the attending reductions to towing operations (resulting from the use of the well-boat) as well as the use of *in situ* net cleaning technology, has resulted in a sharp decline in the potential for marine debris to be generated from farming operations. This is evidenced by the Company's reduction of rope use within the business of over 50%.

In addition, the Company has a documented marine debris policy that sets out responsibilities and methods for reducing marine debris and includes:

- Standardising pen and other equipment;
- Standardising knots to 4 knots used within the operation;
- Cutting rope and removing packaging on-shore wherever possible;
- Secure, covered bins on all vessels

The policy and its practical application are regularly reinforced and communicated to operational teams.

Further, the Company recognises the navigational hazard associated with loss of large pieces of equipment. In 2016, the Company trialled the installation and use of GPS trackers on a piece of equipment known as a "mamba." This trial and wider policy to manage the use of mambas to prevent their loss was fully implemented in late 2016.

Huon Aquaculture recognises that marine debris cannot be completely eradicated due to; human error, weather conditions and equipment failure. To ensure the Company
meets its responsibilities to remove marine debris, employees have been cleaning up the local beaches and foreshores around their operations for several years. These activities have recently been formalised under the Adopt a Shoreline program administered by the Tasmanian Seafood Industry Council. Each marine farm has a designated shoreline in their area which they are responsible for keeping clear of marine debris. The general public have been informed of the initiative through the distribution of maps detailing those beaches for which Huon Aquaculture is responsible and the appropriate contact(s) within the company, who can organise any clean-up when required.

Marine debris clean-up activities are currently conducted at regular intervals (12 monthly minimum) and also on an as-needs basis when members of the public and other stakeholders notify the company of areas requiring particular attention. Rubbish collected has historically consisted of aquaculture, commercial fishing and household/domestic derived debris. Larger items (for example, lengths of poly pipe) that occasionally wash up on shorelines are collected immediately by the company once they are notified of their existence. Further, the company will extend its Adopt a Shoreline commitment (through TSIC) to that stretch of coastline between Cape Queen Elizabeth and One Tree Point.

Huon Aquaculture is of the view that recent investment in technology, changes to operational management of farms, as well as new policies and procedures will be effective is dramatically reducing the potential for marine debris from operations, traditionally to manage both the prevention of and safe retrieval of equipment.

**Black and Grey Water**

Consistent with the existing marine farming licence conditions, grey water is discharged to the marine environment only in the case that biodegradable and phosphate free detergents and soaps are used. Sullage (black water) from the feed barges will be collected and returned periodically to Port Huon for approved disposal to the local municipal sewerage scheme, under an agreement with TasWater.

**Other General Waste**

Weekly general waste is taken from the Hideaway Bay shore base, the nets facility at Whalepoint Road, Port Huon and the Port Huon Jetty workshop by Huon Rubbish Removal, and goes through the Huonville waste transfer station and would then be sent on to Hobart. Hideaway Bay also uses Veolia to collect most of the larger items once a month, which are taken directly to the South Hobart facility.

Most HDPE waste (old stanchions, pipe etc.) is recycled through Mitchell Plastic at Port Huon. The company also uses Veolia to transfer our scrap metals (steel, aluminium, etc.) to Simms Metal for recycling. Drysdale Engineering also recycle smaller amounts of metals, old engines and anything else worth recycling through Gumtree, Ebay, etc.

Huon Aquaculture are part of the national packaging covenant.
Organic Net Fouling from Net Cleaning Operations

Refer to Section 6.1.1.4 above.

Harvesting Operations

Huon Aquaculture disposes of the blood-water directly into the onsite (Hideaway Bay) ensiling system.

Huon Aquaculture uses the very latest humane harvesting system designed by Seafood Innovations International Group Pty Ltd. A fish harvest technology where instinctive fish behaviour is used to provide efficient, automated, stress-free and humane fish stunning and bleeding systems.

The system is designed in modules which are transportable and enclosed in containers, thereby providing for a water-tight slaughter room, and wash down grey water is collected and pumped to the processing ponds located at the Hideaway Bay shore-base. These systems are located on-shore at Hideaway Bay. In the longer term, the systems may be upgraded to accommodate the use of a well-boat for harvesting.

Post processing, fish heads and frames go to Mars Petcare with excess to NuBlend in Triabunna. Fish guts along with ensiled waste are also taken to NuBlend.

Proponent management plan to manage mass mortality events

While there is no expectation that a large scale mass mortality event will occur, Huon Aquaculture has reviewed the measures that would be required in this eventuality.

In conjunction with DPIWPE (including EPA and the Biosecurity and Marine Farming Branches) and other salmonid companies, Huon Aquaculture has been working on an agreed “Mass Mortality” strategy. Existing mort disposal pathways can deal with relatively modest large mortality events, but could not cope with a large scale regional mass mortality. Therefore, it is considered prudent to have a plan in place. In conjunction with the EPA, Huon Aquaculture has established a site on land adjacent to the Huon River where further composting of morts could occur. In addition, and in consultation with the “Mass Mortality” group, Huon Aquaculture (and, in some cases, the industry generally) is investigating the suitability of a number of privately owned large landholdings for composting, burial or ensilage of a very large biomass of morts, including a present application through the Huon Valley Council and the EPA for its own composting facility, should any of these ever be required. This issue is not unique to salmon farming and the likely need is not high, so the possibility of a suitable State site(s) being designated for disposal of any mass mortality of aquaculture and/or terrestrial farming stock is also being considered.

Regulatory controls
Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

LC – Schedule 3

MC – 3.1, 3.5, 3.6, 3.7, 3.10, 3.12.

6.1.11.7 Overall effect following implementation of mitigation measures

Waste management imperatives, and indeed opportunities, are continually shifting and progressing. In large part, bio-security drives many of these imperatives, and Huon Aquaculture has therefore decided to continue to adhere to World’s Best Practice in order to ensure the safety of its stock. Presently, through the VHP and associated industry government initiatives such as the mass mortality group, Huon Aquaculture is ensuring that all present and potential waste emissions are well controlled and subject to both within-company and across-sector planning. The present amendment proposal will significantly improve the general disposal of fish waste through the use of both lift-up systems in all pens and their subsequent rapid ensiling either on the feed barges or at the Hideaway Bay facility. Cartage of ensiled waste instead of mortalities in sealed tanker trucks from the Huon Aquaculture shore bases will ensure that the risk of disease transfer due to spillage is eliminated.

The overall effect of the waste management initiatives associated with the new net-pen operational systems, and therefore the present amendment, will act to reduce any impact that these waste streams might have on the environment and will improve the company’s ability to reduce, reuse and recycle waste.

6.1.12 Introduced Marine Pests (IMP’s)

6.1.12.1 Marine pest species present

The Initial Environmental Assessment (Appendix H) identified only the Screw shell *Maoricolpus roseus*, and the Japanese seastar, *Asterias amurensis* in the proposed amendment areas.

The Screw shell (*Maoricolpus roseus*) and American spider crab (*Pyromaia tuberculata*) were recorded in low densities in the Environmental Baseline surveys (Appendix A) undertaken at the original Trumpeter Bay lease, 3.5-4kms to the south of the proposed East of Yellow Bluff zone.

The Derwent Estuary Program Report, ‘Derwent Estuary Introduced Marine and Intertidal Species - Review of distribution, issues, recent actions and management options’ (Whitehead, 2008) provides the following summary for introduced species in the estuary:
Of the 70 introduced species recorded in the Derwent Estuary, Asterias amurensis (northern Pacific seastar), Gymnodinium catenatum (toxic dinoflagellate), Crassostrea gigas (feral Pacific oyster), Undaria pinnatifida (Japanese seaweed ‘wakame’), Patiriella regularis (New Zealand seastar), Maoricolpus roseus (New Zealand screw shell) and Petrolisthes elongatus (New Zealand half crab), European clam (Varicorbula gibba) are likely to be impacting on the ecology of the environment (Aquenal 2002; MacLeod and Heliodoniotis 2005). These species are widespread or frequently reach high abundances within specific areas of the Derwent Estuary.

It is therefore likely that a number of these species present in the high numbers the Derwent will be present in the Storm Bay region, albeit in lower numbers. Some of those species like Varicorbula would not be expected to occur in the vicinity of the zones as they are associated more with higher organic sediments (Whitehead, 2008).

Storm Bay is subject to at least two significant introductions of phytoplankton pest species, Gymnodinium catenatum and Noctiluca scintillans (Crawford et al., 2011), although Noctiluca is not officially classified as a pest species.

6.1.12.2 Assessment of the likelihood for introduced marine pest translocation by activities associated with the proposed zones

By far the greatest vector for the spread of IMP’s is through transport, either in the holds or on the hull of marine vessels travelling between sites.

Huon Aquaculture’s biosecurity protocols will act to minimise the risk of any translocation. These protocols (and indeed the VHP) are very similar to the industry Fish Health Management Plan for Macquarie Harbour (as part of the Area Management Agreement for the harbour). Through these industry and company fish health management plans the translocation of gear between regions is now subject to very tight control and scrutiny. For Huon Aquaculture, this means that all equipment deployed in the southeast region will stay in the south-east, and that any boats that pass through the region will be subject to strict disinfection protocols and slipping arrangements.

Movement between the Huon/Channel region and Storm Bay will be subject to the biosecurity arrangements outlined in Section 6.1.10.

Within south-east Tasmania, all pest species described are widespread but a certain level of biosecurity is nevertheless maintained to prevent the spread of disease between year classes and between MFDP areas.

Further, there is evidence that the vast majority of the introduced species of concern are relatively widespread across the Derwent/Huon region, thereby including the Channel and in all probability Storm Bay (MacLeod and Helidoniotis, 2005).
6.1.12.3 Potential Impacts

Globally, human-mediated biological introductions have been recognised as one of the top five threats to marine biodiversity (Elton 1958; Carlton 1989; Drake et al 1989; Vitousek et al 1997). Invasive marine species (IMS) have had devastating effects on some international marine industries, in particular wild fisheries and aquaculture operations.

The potential environmental impacts from IMS include:
- introduction and establishment of non-indigenous species, diseases and parasites
- changes to nutrient and energy cycles
- changes to ecosystem stability
- loss of biodiversity and abundance from predation and/or competition
- competitive exclusion of native species
- mortality from infection.

IMS have the potential to impact on salmonid farming operations including:
- predation on stock
- cause nuisance fouling on equipment
- finfish stock mortalities e.g. from toxic algal blooms.

The key risk pathways for introduction of IMS are via contaminated (biofouling) vessels, immersed equipment and ballast water discharge (Hallegraef, 1998). Successful establishment of IMS depends upon the introduction, colonisation and establishment and further dispersal (Sakai et al., 2001). In relation to the salmonid farming industry, IMS can be translocated between growing regions within Tasmania through the movement of marine farming vessels, equipment and stock.

With regard to the Storm Bay region in particular, the seafloor species identified in the region present a threat through their ability to out-compete the local species occupying the same niche - the New Zealand screwshell Maoricolpus roseus versus the native screwshell Gazamedi gunii, and the Pacific seastar Asterias amurensis versus native Coccinasterias sp. seastars.

The phytoplankton species are of particular threat to the fish farms themselves, as they can either deplete the water column of oxygen through the night through respiration when in dense blooms (and also on decomposition), or they can produce toxins which can directly kill the fish.
6.1.12.4 Mitigation Measures

The movement of all gear and equipment is subject to strict biosecurity protocols as outlined in Appendix C and elsewhere in the VHP. These protocols are regarded as more than adequate in also preventing the transfer of marine pests, as they are designed to prevent the spread of bacterial and viral disease between farming regions in Tasmania.

All sediment monitoring is undertaken by contracted specialists who have a good knowledge of the biosecurity protocols. All new contractors are inducted on the biosecurity requirements for working on and around Huon Aquaculture’s leases or shore based sites.

Regulatory controls

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay, North Bruny Island MFDP (MC)

LC – Schedule 3 (2.3)
MC – 3.11, 3.12.

6.1.12.5 Overall effect following implementation of mitigation measures

The biosecurity protocols as provided for in Huon Aquaculture’s VHP will provide adequate safeguards against the introduction of marine pests. As the amendment will result in relatively minor changes to vessel movements in the area due to; proximity to existing farm leases (SB zones 1-4), use of the well-boat, and remote feeding operations, there should be no net effect on introduced marine pests especially when compared with the historical industry standard for vessel movements attending farming operations.

Therefore, no net increase in effect or risk is expected through the present amendment.

6.1.13 Marine and Coastal

6.1.13.1 Effects of structures on sediment dynamics regarding channels and sand bars in proximity to the proposed zone

No effects are expected.
6.1.13.2 Mitigation Measures
No mitigation is required.

6.1.13.3 Overall effect following implementation of mitigation measures
No effects are expected.

6.1.14 Climate Change
The potential impacts of climate change on the salmonid industry have been examined in a number of studies (Battaglene et al (2008), Doubleday et al (2013), Australian Fisheries Climate Change Program (2012)). The most detailed analysis relevant to Tasmania is that of Battaglene et al (2008) and the following sections are based on the findings of that study.

6.1.14.1 Sea level rise
Sea level rise is not expected to have any significant direct implications for the farming operations. The rate of rise is too slow relative to the life expectancy of equipment and structures (e.g. moorings) to require any adjustments to be made within those time frames.

Sea level rise may have indirect influences through resultant changes in oceanic circulation and consequently water temperature and water quality, but these changes are difficult to predict and are likely to be small relative to the overall rise in sea temperature.

6.1.14.2 Changes in weather patterns (rainfall and wind)
Increase heat in the atmosphere is expected to lead to changes to atmospheric circulation and rainfall patterns. More energetic weather systems, with increased wind speeds and rainfall, could emerge although predicting changes at the scale of the Huon-Channel region is problematic.

Predictive modelling based on global circulation models (GCMs) suggests changes in wind speed in the order of 2-5% (either up or down) in summer, autumn and spring and an increase of 5-10% in winter. Rainfall is predicted to change by around 2% (either up or down) in autumn, winter and spring and reduce by 2-5% in summer.
6.1.14.3 Water temperature and chemistry

GCM modelling suggests that water temperatures in south-east Tasmania could increase by 0.6°C to 1.0°C by 2030, but Battaglene et al (2008) note that eastern Australian waters are warming at more than three times the global rate, suggesting that the change in southern Tasmanian waters could accordingly be greater than that predicted by the GCMs. An increase in the order of 3°C can be assumed.

Temperature observations from an IMAS nutrient and phytoplankton study (Crawford et al (2011)) show that current summer temperatures reach 19°C. With a 3°C increase, the peak summer temperatures could reach 22°C by 2030.

The preferred temperature range for Atlantic salmon is 16-18°C. Post-smolt fish show signs of thermal stress at 18°C, and growth and development is impaired at temperatures above 18.9°C. The incipient lethal temperature is 27.8°C.

As the temperature of water increases, its oxygen content decreases and lowered oxygen availability can exacerbate the temperature stress. At fish temperatures above their optimal, immunosuppression can also occur, increasing fish susceptibility to infectious diseases (such as amoebic gill disease, rickettsia-like organism, marine flexibacteriosis and yersiniosis).

Temperature increases could also have indirect impacts on farmed fish, for example through jellyfish blooms, which can cause toxic impacts and reduce oxygen availability, and through phytoplankton blooms, which can also diminish oxygen availability.

6.1.14.4 Mitigation Measures

The potential changes in wind speeds due to climate change will be inconsequential for Huon Aquaculture’s operations. Existing mooring systems and work practices are well adapted to a wide variety of conditions.

The potentially reduced summer rainfall could increase the salinity of estuarine waters and exacerbate problems with gill amoeba disease, possibly requiring more frequent freshwater bathing during summer. The well-boat bathing system is more than adequate to manage this risk.

The predicted climate change temperature increases at Trumpeter Bay are unlikely to subject fish to temperature and associated stress. The deeper, better flowing waters at the Trumpeter Bay zone location provide security against climate change impacts.

Huon Aquaculture also has its own in-house selective breeding programme and is a partner in the TSGA funded Selective Breeding Programme run through CSIRO. Both of these programmes are continuously selecting for fish that exhibit the most resistance to disease and in particular gill amoeba and also for best growth. Through these breeding programmes all of Huon Aquacultures stock is therefore being selected to perform best in under the prevailing Tasmanian conditions.
Venturation, which is the pumping of cooler mid-depth water up into pens, is used by Huon Aquaculture on its Channel leases but is unlikely to be required at Trumpeter Bay.
6.1.14.5 Overall effect following implementation of mitigation measures

Huon Aquaculture already has management measures and systems in place to address the range of environmental stressor that climate change may exacerbate, and the location of the Trumpeter Bay lease provides additional security against climate change.

Huon Aquaculture expects there to be a significant reduction in its risk exposure to climate change through the use of the lease.

6.1.15 Greenhouse gases and ozone depleting substances

The proposed development will generate greenhouse gases. No ozone depleting substances will be generated as part of the proposed development.

The change or increase in greenhouse gas emissions from the proposed development should be considered in the context of the Huon Aquaculture’s overall operations and the ongoing consolidation of several smaller lease areas into fewer larger areas. This has the potential to reduce greenhouse gas emissions through reducing fuel usage, by reducing the number of service and maintenance trips to separate sites.

Although the Trumpeter Bay zones will require longer travel distances by vessels, considerable fuel reductions will be achieved through the permanent mooring of the new feed barge at the lease. The barge has its own feed storage and can deliver feed to pens through pipelines, minimising vessel movements at the lease.

The well-boat provides for very efficient transport of fish compared with the current systems, which would require pens to be towed at very slow, energy inefficient speeds.

Greenhouse gas emissions have recently been addressed in the Environmental Impact Statement to accompany the Draft Amendment No.1 to the Macquarie Harbour Marine Farming Development Plan October 2005 (MHEIS) and the following summarises that information.

Salmonid farming, like all forms of farming, will incur some energy costs, and salmon farming ranks alongside beef and lamb production in terms of industrial energy inputs required for edible protein energy outputs in modern production systems. However, farmed aquatic organisms do not emit methane, unlike beef and lamb production, and because methane is estimated to have 23 times the global warming potential of carbon dioxide, salmon farming will produce lower greenhouse gas emissions compared with beef and lamb production.

It is estimated that the entire Tasmanian salmon farming industry emits between 10,000 and 15,000 tonnes of CO$_2$-e (carbon dioxide equivalent) per year. This compares with the top 500 companies in Australia which each emit over 25,000 tonnes of CO$_2$-e per year.
6.1.16 Environmental Management

6.1.16.1 Environmental management systems

Refer to Section 6.1 above.

Huon Aquaculture has an overarching Environmental Management Plan (Appendix C) supported by site-specific Environmental Management Plans and topic specific policies, such as Marine Debris (examples provided in Appendix C). In addition to ensuring sound environmental management in its own right, these plans also form part of Huon Aquaculture’s fulfilment of its Global Gap certification.

No specific changes to these plans are considered necessary for the proposed new and amended zones.

6.1.16.2 Organisational structure

Huon Aquaculture’s key management structure is shown in Figure 76.
Figure 76 - Huon Aquaculture’s key management hierarchy
**6.1.16.3 Procedures and instructions to employees**

All visitors to Huon Aquaculture sites must read and sign acknowledgement of our Visitor’s Protocols (AQM0005.1 Appendix C). These protocols contain specific requirements with regard to waste and any work that may create possible contamination. As specified in our Waste Management Plans, all contractors are made aware of the relevant Site Waste Management Plan. All new employees receive an induction that includes fish welfare and which specifically considers environmental impacts that can significantly affect fish welfare and their possible mitigation. All employees receive annual fish welfare training which also covers these issues. Procedure ASOP0052 Emergency Procedure in the Event of Significant Risk to Fish Health (Appendix C) specifically covers adverse environmental effects of activities and ways of minimising these effects to ensure an appropriate response to operational environmental concerns. This procedure is prominently displayed in the workplace and employees have received training in it.

**6.1.16.4 EPA environmental monitoring program**

Marine farming in Tasmania is managed under an adaptive monitoring and management regime. Adaptive management is a structured, iterative process of optimal decision making using the best science available with an aim to further improve our knowledge of the system over time using comprehensive monitoring. Through this adaptive process rigorous control can be applied that assures sustainable operation and development, with monitoring and management decisions continually updated to reflect latest knowledge.

An effective ongoing adaptive management process requires clearly defined objectives, the selection of appropriate indicators and performance measures and a monitoring program that has the ability to detect any adverse effects associated with marine farming operations. The outcomes of this monitoring then inform decision making around the implementation of mitigation measures designed to reduce environmental effects.

An indicative monitoring program (Appendix P) has been developed by the PA that presents an approach for monitoring stressor levels and potential biological responses of key receptors at varying spatial and temporal scales. This program involves proposal-specific monitoring of water quality and sediment condition geared to production cycles and ongoing broadscale monitoring to assess water quality, sediment condition and reef community structure at intermediate and far-field scales.

Following the completion of the planning process, responsibility for the establishment, implementation and ongoing management of the environmental monitoring program for proposed salmonid marine farming operations will rest with the EPA. A range of
management controls contained within the Storm Bay off Trumpeter Bay North Bruny Island MFDP area provide for the implementation of environmental monitoring requirements and specific measures to mitigate environmental effects.

In relation to the management of potential environmental effects on water quality, substrates and fauna and marine vegetation, it is the planning authority’s intent that in accordance with the provisions of relevant management controls:

1. The initial maximum biomass load across the region will not exceed 40,000 tonnes and that this will be managed through a TPDNO that will be determined by the Director EPA pursuant to management controls.

2. An ongoing monitoring program (Indicative Plan provided in Appendix P) to assess the environmental condition of the Storm Bay region at varying spatial scales will be established and mandated by the Director EPA in marine farming licences.

3. Guideline limit levels be established in marine farming licences for relevant water quality and biological indicators by the Director EPA and that where relevant these be used as performance measures in future sustainability assessment and review of the TPDNO.
6.2 Impacts on the Human Environment

Huon Aquaculture is committed to minimising the impact of its operations on the local community, such as visual, noise, odour and public amenity (e.g. marine debris) impacts. Huon uses a variety of measures to achieve this. In addition to adhering to current legislation and regulation, Huon also makes procurement and operational decisions that consider the potential impacts on the communities in which it operates. Further, Huon Aquaculture uses standard operating procedures (SOP’s) to manage and guide behaviour of employees. This is an effective method of minimising impact, particularly in the absence of clear regulation or legislation regarding a particular issue.

6.2.1 Visual

6.2.1.1 Specific visual impact assessment for proposed zone

Proposed infrastructure (including height above sea level and colour)

The pens used within the proposed east of Yellow Bluff zone will be 168m in circumference and 240m in circumference at the SB 1-4 zones, arranged within 6 pen grids (Figure 9). A cross section of a pen was shown earlier in Figure 19. The above water components will comprise the float collar and stanchions, from which flexible pole supports will extend vertically to support a bird mesh net, and a surrounding perimeter of support poles for the predator net.

The pen stanchions and predator net poles extend approximately 2m above the water line and the tops of the bird net poles will be approximately 6m above the water line.

A photograph of a pen using a similar predator net and bird net system is shown in Figure 77. This pen is smaller than the large pens that will be used on the amended lease but the general appearance is the same.

![Figure 77 - Huon Aquaculture new net-pen design as seen on-water](image-url)
There will be one feed barge moored between two 6 pen grids along an approximate north/south axis to gain some shelter from the prevailing swell and waves. Therefore, there will be one feed barge in each of the SB 1-4 zones and a maximum of 4 feed barges in the Yellow Bluff zone. The expected dimensions of the barges are shown in Figure 78.
Figure 78 - Feed barge dimensions

Note: Heights are for an unladen vessel - heights will be 1 m lower when loaded.

Top of antenna 10.13 m

Top of control room 7.98 m

Top of silo deck 5.0 m

24 m
**Sensitive receptors having direct view lines to the proposed zone**

The proposed lease East of Yellow Bluff will be approximately 1.6km from the nearest point of land. This location is lightly populated (3 landholders with direct view lines) representing an increase of 2 sensitive receptors for visual impacts. More broadly, land-based view fields towards the lease/zones would predominantly be from walking tracks although one landholder has direct line of site from the home on the property. The lease will also be seen from vessels travelling along the Bruny Island coastline and further into Storm Bay in all directions.

Figure 79 below shows a map of the proposed zone and amended zones and location of sensitive receptors.

![Map of the proposed zone and amended zones](image)

**Figure 79 - Location of sensitive receptors having direct view lines from the proposed and amended zones**

Huon Aquaculture notes that the proposed amendments to the SB zones 1-4 will have no appreciable change on visual impact.

**Likely visual impact (include photomontages, images, plans and elevations)**

Huon Aquaculture has prepared viewsheds for the potential visual impact of the proposed East of Yellow Bluff lease (shown in Figure 80, Figure 81 and Figure 82) on the three properties closest to the proposed lease.

In addition, Huon Aquaculture has prepared an expected visibility of the proposed East of Yellow Bluff lease from the sensitive receptors from both the dwelling on the property as well as the shoreline (cliff) nearest the dwelling. These can be found as Figures 80-88.
Figure 80 - Viewshed for the property “Waterview”
Figure 81 - Viewshed for the property “Oceanview” at 649 Main Road Barnes Bay
Figure 82 - Viewshed for the property “Murrayfield”
Figure 83 - Potential view (A) from accommodation at "Waterview" of proposed East of Yellow Bluff lease
Figure 84 - Potential view (B) from shoreline at "Waterview" of proposed East of Yellow Bluff lease
Figure 85 - Potential view (A) from residence at "Oceanview" to proposed East of Yellow Bluff lease
Figure 86 - Potential view (B) from cliff-top of "Oceanview" to proposed East of Yellow Bluff lease
Figure 87 - Potential view (A) from buildings on "Weetapoona" to proposed East of Yellow Bluff lease
Figure 88 - Potential view (B) from shoreline on "Murrayfield" to proposed new East of Yellow Bluff lease
As can be seen from Figures 81-86, the proposed East of Yellow Bluff lease will be partially visible or fully visible from the homes/operations on each property. The property with the greatest visibility of the proposed lease is “Oceanview” at 649 Main road, Bruny Island. This is a privately held agricultural property. The properties known as "Waterview" and "Murrayfield" have less visibility of the proposed lease.

There is potential for the proposed new lease to be visible from other parts of each property but for the purpose of preparing viewsheds, the focus has been taken on potential impact at the primary residence on the property and also showing potential impact from shore closest to the proposed lease.

Huon notes that the owners of the two properties with limited visibility of the new lease have expressed views that they intend to develop tourism offerings on their properties. One property owner has expressed a view that the proposed lease could form part of the tourism offering whilst the other is of the view that it will detract from the intended offering.

In terms of the specific visual impact from the proposed lease Huon provides the following information.

The well-boat will be used to service the proposed new lease site. The well-boat will operate at any times of the day on any days of the week and will be visible from most locations in the Huon estuary and Channel as it travels from Hideaway Bay, up the Channel and around Dennes Point to the proposed new lease site and back again.

To demonstrate what the well-boat will look like, digital visualisation techniques were used to simulate its appearance in the Channel.

The digital visualisations were created using Blender and Photoshop. A 3-D mesh of the vessel was sculptured in Blender using NURBS (non-uniform rational B-splines), based on the general arrangement drawings25 supplied by Rolls-Royce Marine AS in Norway, where the vessel is being constructed. The mesh was rendered in the Huon Aquaculture colours.

Georeferenced photographs of Channel scenes were taken, from which representative views were selected for the visualisations. The combination of georeferenced location and camera focal length allowed the vessel mesh to be inserted into the scene with the correct scale and perspective, using Blender. Photoshop was then used for the final rendering.

The visualisations of the well-boat within Channel scenery are shown in Figure 89, Figure 90 and Figure 91.

In relation to the proposed amendments to SB 1-4, there is not expected to be any significant change to the visibility of the operations.

Figure 89 - Visualisation of the well-boat from Alonnah

Figure 90 - Visualisation of the well-boat from Peppermint Bay
Visibility from waterlevel

Figure 92 shows photos of what a lease looks like from 0.5 and 1.4km distances (example shown is taken from south of Zuidpool in the D'Entrecasteaux Channel MFDP) away which provides an indication of the potential visual impact at sea-level from two different directions. It should be noted that the east of Yellow bluff lease is a minimum of 1.6km's from shore so appearance would be further reduced.

However, other than from very close viewing locations, the general appearance will be similar to what is shown in Figure 91.
Figure 92 - Photos of the current Zuidpool lease at 0.5 and 1.4 km distance

Figure 92 shows that the lease infrastructure is discernible on the water horizon from 0.5 km away but visibility is much reduced at greater distances, and the pens are barely visible approximately 1.5 km or more away. People on vessels passing by inside these
distances will probably notice the pens but they occupy only a very small proportion of the viewfield.

### 6.2.1.2 Mitigation Measures

Management controls contained within the Storm Bay off Trumpeter Bay MFDP 1998 (Appendix E) aim to optimise the visibility of marine farming operations depending on their location and include:

- All fish cages, buoys, netting and other floating marine farming structures and equipment on State waters, other than that specified for navigational requirements, must be grey to black in colour, or be any other colour that is specified in the relevant marine farming licence.

- Marine farming structures and equipment must be low in profile and be of a uniform size and shape to the satisfaction of the Secretary. The Secretary will determine what constitutes a low profile and uniform size and shape.

- Floating storage huts, grading facilities and shelters must not be located within a lease area unless authorised under the relevant marine farming licence.

- Lessees are to ensure that light generated from marine farming operations does not create a nuisance. The Secretary will determine what constitutes a nuisance.

Huon will comply with all management controls and directives of the regulator in relation to visual impacts.

Huon has worked with owners of the property “Murrayfield” in relation to visual impacts from the former Trumpeter Bay lease and specifically light emanating from the Company’s feed barge. To mitigate light pooling at night from the feed-barge, Huon implemented a new procedure that requires minimum light standards (closing of blinds and switching off all lights except those required for navigation and safety) in dark hours. This arrangement has been successful and reduced light emissions significantly and only when the site is being actively serviced by the Company. Huon anticipates implementing a similar arrangement in relation to the proposed new lease site East of Yellow Bluff and at SB 1-4 in consultation with neighbours of the operations.

### Regulatory controls

Refer to Appendix E – Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

MC – 3.8
6.2.1.3 Overall effect following implementation of mitigation measures

The Company notes that there are a range of views from individual property owners in relation to the visibility of the proposed lease East of Yellow Bluff. There will be some residual visual impact following implementation of the management controls although this is expected to be relatively minor with low visibility from settlements and roads. The proposed new lease will have low visibility to vessels greater than approximately 1km away.

The amendment to the SB 1-4 zones is not expected to have any significant visual impact on settlements or roads following implementation of the management controls.

6.2.2 Navigation

6.2.2.1 Results of consultation with maritime stakeholders – TasPorts, MAST and local boating clubs.

Huon Aquaculture has consulted directly with MAST and a range of recreational boating clubs in relation to the changes contained in this proposal. The company provided a chart of the proposed change together with an information brochure outlining its broader planned changes. In addition, Huon Aquaculture requested direct formal feedback from all yacht clubs and recreational boating clubs from Hobart through to Dover.

Summarised below are the outcomes of the consultation.

MAST

Huon Aquaculture has met with MAST on multiple occasions to discuss the Draft Amendment. MAST expressed a preference for the original proposal (which was to re-occupy the old Storm Bay off Trumpeter Bay lease), to be relocated offshore as the old Storm Bay off Trumpeter lease would interfere with a direct line of sight along the inshore area of North Bruny Island. MAST’s preference was for any new lease to be positioned outside of recommended navigation lines. MAST’s view resulted in Huon Aquaculture moving the proposed East of Yellow Bluff lease to the current proposed position shown in Figure 93 below through an interactive process.
Figure 93 - Proposed lease area in relation to Navigation lines/channels off the Eastern shore of North Bruny Island

Recreational Boaters (Yacht and Boating Clubs)

The following yacht clubs have been provided a map showing the planned changes to Huon’s lease sites and general information regarding the proposed changes. An information brochure regarding these changes and their impact on farming infrastructure and methods has also been distributed.

This information has been provided to;

- Royal Hobart Yacht Club
- Derwent Sailing Squadron
- Bellerive Yacht Club
- Kingston Boating Club
The major concerns raised by the clubs were lighting of the leases at night-time, a preference for the zones to be moved further offshore and the potential for fish farms to take up too much of the coastal amenity area in general.

Huon Aquaculture will continue to engage directly with clubs to receive specific feedback on its proposal.

Huon Aquaculture notes that engagement with the organisers of the Sydney to Hobart Yacht Race in relation to potential effects and mitigation measures was continuing at the time of writing. Importantly, Huon has not had any negative interactions with sailing races and specifically the Sydney to Hobart Yacht Race since the Company commenced farming operations in the area covered by this Draft Amendment in 2014. This equates to 3 completions of the Sydney to Hobart Yacht Race without incident or any contact from organisers to express concern about Huon’s operations in the area or wishing to discuss potential need to mitigate any perceived risk.

In addition, Huon has not had any negative interactions with sailing or motored recreational vessels since it commenced operations in the area in 2014.

We have complied with TasPorts’ recommendation in this submission.

6.2.2.2 Potential Impacts

As a result of the consultation described above Huon Aquaculture has updated its formal risk assessment (RA) for navigation in general and for the Storm Bay area in particular. The RA included, but was not restricted to; positioning of fish farms affecting shipping lanes, transit lines, anchorages, and, safe navigation at night-time (lighting/marking issues). A specific action (among others) or update in the past year has been to modify marine farm lighting in the area, now using 3-5 nautical mile lights with GSM capabilities that can both in real time provide information on the position and the operational status of the lights thereby providing for a safer lighting regime for that area. The RA has been employed to identify the potential impacts for the Storm Bay off Trumpeter Bay proposed amendment, and is provided as Appendix F.
6.2.2.3 Mitigation Measures

In response to the concerns raised during stakeholder consultation and the resulting RA (Appendix F) Huon Aquaculture has advised MAST, recreational fishers and boat owners that it would:

- Move the zone further offshore and away from the Navigation channels thereby improving access and navigation in the area between the zones and the shoreline. This move is already reflected in the positions of the zone provided in the current EIS (e.g. Figure 93).

- Form a working group including; Huon Aquaculture, MAST and Boating Club representatives to investigate if there are any issues with lighting associated with the proposed amendment.

- Provide MAST with detailed maps of lease changes to ensure all maps and information provided to recreational users of the waterway are current.

- Provide maps of lease changes in local towns and at or near to boat ramps where possible.

Proposed management controls will prescribe that surface-located marine farming equipment and equipment less than 5m below the surface will occupy no more than 50 ha within each of zone 1, 2, 3 and 4.

The requirements for marking in Storm Bay may differ from what is in place in other marine farming areas around Tasmania, due to the exposed location. MAST and DPIPWE are expected to determine marking requirements with primary consideration given to safety of operations and safety of navigation for vessels transiting and using the proposed zone. The draft special management controls provide flexibility for marking requirements that maximise safety and also allow for public access where possible.

Regulatory controls

Refer to Appendix E – Licence conditions (LC) and Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)
LC – Schedule 1.
MC – 3.8, 3.9, 3.12.

The draft amendment proposes the following special management control;
3.13 Zone 1, 2, 3 and 4 – (south of Trumpeter Bay)
3.13.1 Within Zone 1, 2, 3, and 4, an area or areas that, in total, do not exceed 50 ha in each zone, are to be known as the farmed areas. The farmed areas may be defined by coordinates, physical markers visible on the water surface or as otherwise specified in the relevant marine farming licence.

3.13.2 Within Zone 1, 2, 3 and 4, the lessee is to ensure that all marine farming equipment is contained within the farmed area(s), unless otherwise specified in the relevant marine farming licence. Marine farming equipment is contained in the farmed area if:

- Equipment that is present on or above the water surface is only in the farmed area;
- Equipment that is less than 5 metres below the surface of the water is only in the farmed area.

3.13.3 The lessee must mark any area or marine farming equipment within Zone 1, 2, 3 and 4 in whatever manner is required by the Secretary and by the Marine and Safety Authority.

3.13.4 The leaseholder of any marine farming lease allocated within the Zone 1, 2, 3 and 4 shall provide unrestricted access to the public to that section of the lease that is not:

- the farmed area; and
- any other area specified in the relevant marine farming licence.

**6.2.2.4 Overall effect following implementation of mitigation measures**

Given the results of the consultation with boating groups and regulatory authorities and RA there are not expected to be any unacceptable significant impacts on recreational boating activities as a result of the changes proposed in this amendment.
6.2.3 European and Other Heritage

6.2.3.1 Potential Impacts
The proposed project will have no impacts on European or other cultural heritage sites as there are no historic heritage sites or areas that could be impacted by the sea-based farming activities and there will be no land activities.

6.2.3.2 Mitigation Measures
There are no mitigation measures required, as there are no impacts on historic or cultural heritage sites or areas as a result of the project.

6.2.3.3 Overall effect following implementation of mitigation measures
There will be no impacts on European or other cultural heritage sites.

6.2.4 Aboriginal heritage

6.2.4.1 Outcomes of consultation with Aboriginal Heritage Tasmania and other Aboriginal groups and communities
Aboriginal Heritage Tasmania
Huon Aquaculture contacted Aboriginal Heritage Tasmania (AHT) who completed a search of the Aboriginal Heritage Register (AHR) regarding the Draft Amendment in February 2017. AHT advised that there are no Aboriginal heritage sites recorded in the area covered by the Draft Amendment and specifically that as the proposal is wholly sea based, and no land based infrastructure is being considered, that there is no danger of impact to Aboriginal heritage.

Accordingly there is no requirement for an Aboriginal heritage investigation and AHT advised that they have no objection to the proposal proceeding and there is no requirement for an Aboriginal heritage investigation.

weetapoona Aboriginal corporation
Before commencing operations in Storm Bay in 2013-14, Huon commenced engagement with local Aboriginal community organisation weetapoona. This engagement formed the basis for the company’s approach to management of potential
aboriginal sites in the area, respect for culture through cultural awareness training for employees working in the area as well as potential to deliver training and employment opportunities to local youth of aboriginal descent. A joint school-based apprenticeship program for agriculture and aquaculture commenced in January 2017 and represents the open and considered approach the Company takes to engagement with local indigenous groups.

In relation to the proposed lease East of Yellow Point, Huon met with both weetapoona and the Indigenous Land Council (ILC) to discuss the Draft Amendment. The first discussion was regarding the retention of the original Trumpeter Bay lease site which was not a preferred option. Through this consultation as well as with commercial and recreational users that the company relocated the proposed east of Yellow Bluff site further north from the original Trumpeter Bay lease site.

weetapoona representatives were more supportive of this relocated site as it would be less visible and outside of Trumpeter Bay which is used for cultural fishing practices.

6.2.4.2 Consideration of places within the area listed on the Tasmanian Aboriginal Site Index (maintained by Aboriginal Heritage Tasmania) including consideration of cultural landscapes

There are no places within the project area listed on the Tasmanian Aboriginal Site Index (TASI). Advice from Aboriginal Heritage Tasmania indicated that the area did not contain any listed sites and had a low probability of Aboriginal heritage being present. However, the weetapoona Aboriginal Corporation have indicated that there may be some sites of interest in the area.

6.2.4.3 Potential Impacts

There are no potential impacts on Aboriginal heritage sites, as there are no known sites or places present in and around the zones, nor on the adjacent shoreline.

Marine debris may wash up on the cliffs and shore at or near to potential sites of interest, if not identified Aboriginal Heritage sites.

The amendment will take aquaculture operations further away from the area currently used for sea-based cultural practices.

6.2.4.4 Mitigation Measures

Specific mitigation measures for marine debris can be found in Section 6.2.11.3.

Huon Aquaculture is taking a precautionary approach to mitigate potential impact on the Northern Bruny Island eastern shoreline. Huon Aquaculture will ensure that
employees based at the zones and other key Huon personnel undertake Aboriginal cultural awareness training.

### 6.2.4.5 Overall effect following implementation of mitigation measures

As there are no known Aboriginal Heritage sites then there will be negligible impact on such sites.

Huon Aquaculture will manage its operations so as to minimise all impact on the adjacent shoreline.

As a result of the low risk coupled with mitigation actions, the overall effect is expected to be minimal.

### 6.2.5 Reservations

#### 6.2.5.1 Outcomes of consultation

No consultation was undertaken in relation to reservations.

#### 6.2.5.2 World Heritage Area properties and values

There are no World Heritage Area properties or values impacted by the proposed development.

#### 6.2.5.3 Ramsar site properties and values

There will be no Ramsar sites impacted by the proposed development.

#### 6.2.5.4 Marine Reserve properties and values

No Marine Reserves will be impacted by the proposed development.

#### 6.2.5.5 National Park properties and values

There will be no National Parks impacted by the proposed development.

### Other Conservation areas

No direct significant impacts on the game reserves or conservation areas to the west on North Bruny Island are anticipated as the amendment will have no impact on the coast or land habitat due to the distance between them and the proposed zones.
6.2.5.6 Mitigation Measures

There are no mitigation measures proposed for Reservations, as there will be no impacts on land in the vicinity of the lease and hence no impact on any Reservations.
6.2.5.7 Overall effect following implementation of mitigation measures

There will be no impact on Reservations.

6.2.6 Noise

6.2.6.1 Specific noise impact assessment for proposed zone/s

Amended zones SB1-4

There are no significant changes to planned activity levels for Zone 1-4. Thus, noise from farming activities at the proposed amended leases (SB1-4) will not vary for that described and approved through Amendment 1 of the Storm Bay off Trumpeter Bay MFDP. Therefore, this section focuses on the specific noise impact for the proposed East of Yellow Bluff zone.

Proposed East of Yellow Bluff zone

The proposed East of Yellow Bluff lease is a minimum 1.6km from the nearest shore of Bruny Island. The area is lightly populated with three known residences in the vicinity. The area around the proposed East of Yellow Bluff lease is regularly utilised by recreational boaters and commercial fishers using motorised vessels. The proposed East of Yellow Bluff lease is also adjacent to a commercial shipping lane which is used by a range of medium to large vessels transiting through to Hobart Port. These vessels would all emit noise at varying levels, times and proximities to shore. The nature of the waterway (high wind and energy) would also result in noise at varying levels at all times and include waves onto cliffs and wind noise.

In preparing this EIS a range of methods were used to determine the potential noise impacts from the proposed lease. Specifically, the Company considered noise emissions in the context of compliance with the regulatory framework as described below and used actual measurement of noise emitted from vessels to be used at the proposed lease, maximum noise levels provided by equipment suppliers that may be used, as well as potential noise received at sensitive receptors through modelling based on actual monitoring data at a range of locations.

The methodology and assumptions are contained in the sections below in the context in which they were used to determine potential noise impact. A description of the regulatory framework and how it has been interpreted is provided here:

Regulatory Framework

The *Environmental Management and Pollution Control Act 1994* (EMPCA) is the primary environmental legislation in Tasmania. EMPCA calls for best practice environmental
management in order to achieve an ongoing minimisation of an activity’s environmental harm through cost effective measures assessed against the current relevant international and national standards.

An Environmental Protection Policy (Noise) 2009 (EPP) has been established under EMPCA. The objective of this policy is to define environmental objectives with programs on how to achieve them. Part 5 of this policy relates to commercial and industrial activities. It states that regulatory authorities should assess, manage and regulate proposed commercial and industrial activities with the objective of protecting environmental values.

Best practice environmental management should be employed in every activity to reduce noise emissions to the greatest extent that is reasonable.

The EPP also provides guidance on acoustic environment indicator levels. The relevant levels are listed in Table 42.

Table 42 - Acoustic environment indicator levels (from the Environmental Protection Policy (Noise) 2009)

<table>
<thead>
<tr>
<th>Location</th>
<th>Critical health effect(s)</th>
<th>LA\text{eq} dB(A)</th>
<th>Time base (hours)</th>
<th>LA\text{max} (fast) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor living area</td>
<td>Serious annoyance, daytime and evening</td>
<td>55</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Moderate annoyance, daytime and evening</td>
<td>50</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Dwelling, indoors</td>
<td>Speech intelligibility &amp; moderate annoyance, daytime and evening</td>
<td>35</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Outside bedrooms</td>
<td>Sleep disturbance, window open (outdoor values)</td>
<td>45</td>
<td>8</td>
<td>60</td>
</tr>
</tbody>
</table>

The EPP indicator levels are not regulatory limits for individual activities but rather indicators of the desirable quality of the ambient noise environment.

In addition to these indicators, it is generally considered that a new activity could potentially cause an environmental noise nuisance if the noise from that activity exceeds the background noise level by more than 5 dB(A).

DPIPWE’s Requirements for the Control of Noise Emissions from Marine Farms (2001) (the Requirements) describe the specific requirements for managing noise from marine farms.

Under the Requirements, motors, pumps, generators, feed blowers and other plant should be fitted with appropriate mufflers and must comply with the relevant requirements of the Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004. Vessel operational noise should also comply with those regulations.

The regulations require that noise from a motor vessel must not exceed 74 dB(A) at
a distance of 25 metres when operated on water. This limit includes any penalties that need to be added if some frequency bands stand out above others (‘tonal penalties’).

The Requirements also specify that noise from marine farm operations must not exceed the normal ambient sound level at residential facades by more than 5 dB(A) between the hours of 2100 and 0700.

In a discussion paper on the Requirements (A Discussion of the Management of Noise from Marine Farming Activities, DPIPWE March 2012), the EPA noted that its general practice is to set limits of 35, 40 and 45 dB(A) for night, evening and day respectively. The EPA noted also that a common alternative approach is to determine a ‘rating background level’ (RBL) of noise at the location of interest (measured as the long term L90, which is the noise level exceeded 90% of the time) and then set a compliance objective of RBL + 5 dB(A).

The EPA recommended that for consistency with contemporary practice the Requirements should therefore be interpreted as follows26 (the names Set Limit and RBL Limit are not terms used by the EPA but have been added here for convenience):

- **Set Limit**: For operating marine farms, the farming noise level at a residence should not exceed 35, 40 and 45 dB(A) for night, evening and day times but if the noise from other sources is greater than those limits then the marine farming noise should not exceed the normal ambient level by more than 5 dB(A) (after adjusting it for tonality and impulsiveness characteristics).

- **RBL Limit**: For proposed new marine farms, the RBL limit of RBL + 5 dB(A) should be used to set lease-specific noise limits.

The Requirements explicitly relate only to the noise generated from activities occurring within marine farm leases and do not relate to noise from vessels moving to and from the leases. Other than the Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004, there are no specific requirements for travelling vessels.

### 6.2.6.2 Potential sources of noise identified and described

A feed barge will be permanently moored at the proposed lease (East of Yellow Bluff). In addition, two work vessels will also be stationed at the lease for most of the time. The well-boat will also be stationed in the zone for an estimated average of 4-5 days per week. A raft-based generator (contained in a cabinet) to support lighting systems

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26 Rephrased from original to remove ambiguity
Huon Aquaculture estimates that start up for the East of Yellow Bluff zone would take approximately 8 weeks. Start-up includes 6 weeks for mooring installation and 2 weeks to remove existing grids at the original Trumpeter site.

Installation of equipment would take place in daylight hours using three of the vessels identified earlier in this section. As all vessels are compliant, works are undertaken during daytime hours, and the distance from shore, Huon Aquaculture does not anticipate a significant increase in the overall noise levels in the area or received at sensitive receptors.

Following installation of the necessary mooring system and other equipment, fish would be transferred to East of Yellow Bluff using a combination of towing and the
well-boat. The Company expects that towing would not exceed 14 movements at one movement per day adding a further two to three weeks to the start-up timetable.

Towing is known to impact sensitive receptors in the Huon and Channel. The Company will comply with the voluntary agreement reached with local residents to avoid towing above Brabazon Point in the Huon River after 9pm (except in extenuating circumstances). Towing pens to the Yellow Bluff zone would need to be undertaken in daylight hours for operational safety and therefore it is unlikely there would be any towing in the region at night in the area that could potentially impact at sensitive receptors during the quieter night-time period.

6.2.6.4 Potential for noise emissions (both construction and operational phases) for nearby sensitive receptors.

Vessels, during both the start-up and operational phase, will service the proposed and amended zones from Electrona, Gunpowder Jetty and Hideaway Bay. The typical travel route will be into Storm Bay via Dennes Point. The current background (L_{A90}) and ambient (L_{Aeq}) noise levels at various locations between Hideaway Bay and Dennes Point were measured by Pitt & Sherry using the extended measurement procedures outlined in the DPIPWE Noise Measurement Procedures Manual (July 2008). Noise loggers were deployed for approximately 2 weeks at four locations. The locations and vessel routes are shown in Figure 94.
The logger measurements were divided into three periods, day, evening and night in accordance with the EPA Noise Procedures Manual.
(a) Day – 7.00 am to 6.00 pm;
(b) Evening – 6.00 pm to 10.00 pm; and
(c) Night – 10.00 pm to 7.00 am.

Based on the limit setting approach described above, the Set Limits and RBL Limits were determined and are shown in Table 44. As described above, these only apply as actual limits to on-farm activities.

Table 44 - Noise limits for farm noise when measured at any residential house (source: Pitt & Sherry)

<table>
<thead>
<tr>
<th>Location</th>
<th>D</th>
<th>E</th>
<th>N</th>
<th>D</th>
<th>E</th>
<th>N</th>
<th>D</th>
<th>E</th>
<th>N</th>
<th>D</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huon Point</td>
<td>36.8</td>
<td>37.5</td>
<td>36.3</td>
<td>42.9</td>
<td>39.5</td>
<td>41.2</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>45</td>
<td>40</td>
<td>46</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Peppermint Bay</td>
<td>34.7</td>
<td>33.0</td>
<td>30.5</td>
<td>46.4</td>
<td>36.4</td>
<td>34.5</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>51</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Gunpowder Jetty</td>
<td>32.7</td>
<td>29.0</td>
<td>25.2</td>
<td>41.3</td>
<td>33.3</td>
<td>33.1</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>45</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dennes Point</td>
<td>40.6</td>
<td>38.9</td>
<td>36.9</td>
<td>51.7</td>
<td>46.6</td>
<td>48.0</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>57</td>
<td>52</td>
<td>53</td>
</tr>
</tbody>
</table>

D: 7 am to 6 pm | E: 6 pm to 10 pm | N: 10 pm to 7 am

*Equals the default set limit if LAeq noise is less than the set limit, otherwise the new Set Limit is LAeq + 5 (rounded to nearest whole number)

**Equals LA90 + 5 (rounded to nearest whole number)

Noise will be generated from farming activities at the proposed East of Yellow Bluff lease as detailed below.

One or more feed barges (maximum of 4) will always be on site at the proposed East of Yellow Bluff lease/zone approximately a minimum distance of 3.0 km from the closest residence (649 Main Road, Bruny Island). Feed barges have generators and feed blowers, which will produce noise. As measured by Pitt & Sherry the level of noise emitted from the feed barge is low: 67.2 dB(A) at 1m or 41.1 dB(A) at 25m (with penalties). At these distances the barge noise would be less than 2.3 dB(A), which would be inaudible.

Huon Aquaculture will use a cabinet contained generator to support lighting systems between March and October each year. The expected generator to be used is a Caterpillar Olympian (model GEP165) with a maximum sound pressure of 63.8dB(A) at 15m. This will be fully compliment with the regulatory limit of 74 dB(A) at 25 metres.

Pitt & Sherry has also measured the noise emitted by existing Huon Aquaculture vessels likely to be used on the lease. Noise from the well-boat (Ronja Huon) was
measured by ScanVibra in Norway. Pitt & Sherry’s measurements were undertaken in accordance with the EPA’s Noise Measurement Procedures Manual July 2008 as vessels passed by the measurement location at their normal operating speed, with measured noise then adjusted to the standard 25 m distance. The well-boat measurement in Norway was undertaken on-board the vessel at a representative position while the vessel was travelling at its normal cruising speed.

The measurements were done to confirm that the vessels met the regulatory limit of 74 dB(A) at 25 m (including tonal penalties) specified by the *Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004*. All vessels apart from one workboat meet the regulatory limit of 74 dB(A) at 25 m. The 0.3 dB(A) exceedance by this boat is marginal and would be imperceptible to the human ear. Nevertheless, this boat will now be retrofitted with increased sound proofing to bring it comfortably under the limit.

**Modelling results**

The vessel noise measurement data has also been used by Pitt & Sherry to model the expected noise generated by the vessels when they are at the lease. The modelling was undertaken using SoundPLAN, a computerised noise prediction model.

In a worst case scenario, the feed barge and all service vessels working during a particular time period might be on the lease at the same time.

Table 45 shows the modelled noise levels at the model receptor points on the assumption that all these vessels operating in their particular time periods are located together at the same time in the centre of the lease. The vessel noise emission levels assumed for these calculations were the same as if they were at cruising speed, which would obviously not be the case if they were at the centre of the lease, and the calculations are therefore conservatively high.
Table 45 - Worst case scenario maximum noise level from lease activities if all vessels were at the lease at the same time in their respective operational time periods (source: Pitt & Sherry)

<table>
<thead>
<tr>
<th>Location</th>
<th>Morning (0600-0700)</th>
<th>Daytime (0700-1800)</th>
<th>Evening (1800-2200)</th>
<th>Night time (2200-0700)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predict LAeq</td>
<td>Set Limit</td>
<td>RBL Limit</td>
<td>Predict LAeq</td>
</tr>
<tr>
<td></td>
<td>Predict LAeq</td>
<td>Set Limit</td>
<td>RBL Limit</td>
<td>Predict LAeq</td>
</tr>
<tr>
<td></td>
<td>Predict LAeq</td>
<td>Set Limit</td>
<td>RBL Limit</td>
<td>Predict LAeq</td>
</tr>
<tr>
<td></td>
<td>Predict LAeq</td>
<td>Set Limit</td>
<td>RBL Limit</td>
<td>Predict LAeq</td>
</tr>
<tr>
<td>Trumpeter Bay (Uses Peppermint Bay limits)</td>
<td>12.1</td>
<td>33.6</td>
<td>51</td>
<td>40</td>
</tr>
<tr>
<td>Variety Bay* (Uses Peppermint Bay data)</td>
<td>27.8</td>
<td>33.6</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Exceeds limit(s) and normal LAeq

*There are no residences at this location, so no relevant limits

Noise limits are not exceeded in any of these worst-case scenarios.

Vessel noise based on the expected vessel movement schedule was also modelled by Pitt & Sherry.

Other than the regulatory emission limit of 74 dB(A) at 25 m, there are no specific limits for environmental noise generated by vessels travelling to and from the lease. Vessel noise simply forms part of the general noise environment of the region and the EPP (Noise) acoustic indicator levels (Table 42) are therefore relevant.

To satisfy the EPP indicator levels, it is desirable for daytime and evening noise to be below 50 dB(A) over the 16-hour day/evening period and for night time noise (outside bedrooms) to be below 45 dB(A) over the 8-hour night period.

The passage time of a vessel past any particular point on its route is likely to be in the order of only tens of minutes and it is therefore very unlikely that vessel noise could cause these indicator levels to be exceeded over the reference time periods, which are many hours long, regardless of how high the existing noise levels are. Nevertheless, the indicator levels provide a means to assess the potential significance of vessel noise amongst the general noise environment.

A very conservative assessment could assume that the existing environmental noise levels are already at the acoustic indicator levels of 50 dB(A) during the daytime/evening and 45 dB(A) during the night time. Reference to the measured existing noise levels presented in Table 44 shows how conservatively high this assumption is – it is in fact not reached anywhere (although Dennes Point comes close due to it being adjacent to a sandy beach facing into prevailing winds). The very conservative approach could then also assume that vessel noise is always present.

Under these two assumptions, a target maximum level for vessel noise could then be the level of vessel noise that would need to be added to the existing noise environment to increase environmental noise levels by the minimum change perceptible to the
human ear, which is 1 dB(A) (actually more likely 2 or 3 dB(A) in field conditions but 1 dB(A) is used to be conservative).

Noise addition is logarithmic, so the vessel noise level needed to increase total noise from 50 to 51 dB(A) would be 45 dB(A) and the vessel noise level necessary to increase total noise from 45 to 46 dB(A) would be 39 dB(A).

Under these very conservative assumptions, if vessel noise at any sensitive receptor on land is less than 45 dB(A) during the daytime or evening or less than 39 dB(A) during the night time, the EPP acoustic indicator levels could not be compromised.

Figure 95 and Figure 96 respectively show the predicted daytime, evening and night time noise contours for average vessel passage noise expected along the travel routes, based on the likely vessel timetables and the measured noise emissions from the vessels that will be used.

None of these time periods have noise contours on land high enough to compromise the EPP acoustic indicator levels, regardless of what the existing noise levels are.
Figure 95 - Contour map for daytime average vessel passage noise for the route between the Huon River estuary and Storm Bay (source: Pitt & Sherry)
Figure 96 - Contour map for night time average vessel passage noise for the route between the Huon River estuary and Storm Bay (source: Pitt & Sherry)
6.2.6.5 Mitigation Measures

The conservative assumptions and worst case scenarios predict that noise emissions resulting from this proposed amendment will meet DPIPWE’s Requirements for the Control of Noise Emissions from Marine Farms (2001) in all scenarios in all time periods.

The Requirements explicitly relate only to noise generated from marine farms. They do not relate to noise from vessels travelling to and from the lease.

Vessel noise is regulated by the Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004. All vessels apart from one meet the regulatory limit of 74 dB(A) at 25 m. That vessel marginally exceeds this limit by 0.3 dB(A), an exceedance that would not be detectable by the human ear.

This exceedance is caused by the high tonal penalty (4.9 dB(A)) that this particular vessel attracts due to particular frequencies standing out from the others, which can cause annoyance. This vessel will be installed with selected noise insulation to reduce noise emissions to below the regulatory limit.

The area around Gunpowder Jetty is a sensitive area for noise and is subject to Special Management Control 3.14 in the D’Entrecasteaux Channel MFDP which states:

North West Bay Exclusion Zone

1.14.1 No person shall enter an exclusion zone located in North West Bay as defined by the following AGM coordinates, in any vessel used in connection with marine farming activities, or cause such vessel to enter that zone, except if authorised by the Director (Marine Resources), Department of Primary Industries Water and Environment.

Vessel noise is a distinctive sound, particularly at times when there are few other anthropogenic sources of noise. For a vessel approaching and leaving a receptor at its cruising speed, the noise will gradually increase and then diminish and is unlikely to cause annoyance unless a person is particularly sensitised to it. Care will therefore be taken to avoid sudden speed changes, as the sudden onset of noise would be more noticeable. Soft starts and finishes when leaving and approaching shore bases has been adopted and incorporated into the SOP’s for travel to and from the Gunpowder Jetty.

In addition Huon Aquaculture vessel traffic between Gunpowder jetty and Tinderbox will have to navigate round the Tassal Zone 1B (D’Entrecasteaux Channel MFDP). Therefore due to the exclusion zone and Tassals lease the route taken by the Huon Aquaculture vessels will follow an arc offshore when navigating around Gunpowder Jetty and Tinderbox and will then take a direct line out to Storm Bay taking vessels closer to the North Bruny shore and well out from that sensitive part of the shoreline (Figure 97). Notwithstanding these initiatives the company will also be transferring its larger operational vessels from Gunpowder to the industrial site at Electrona.
Further, the modelling and vessel noise assessments commissioned by Huon Aquaculture for the present EIS have provided the necessary tools to enable the company to monitor, assess and correct (insulate) noise levels from their vessels if and when required. In addition, the information will be used to guide the development of company standard operating procedures that consider potential impact on the community through noise generation.
Mitigation during start-up phase

To ensure Huon effectively manages any potential for noise nuisance, during the planning for start-up, consideration will be given to the timing of any towing movements likely to affect residents in the Huon/Channel or Storm Bay. All efforts will be made to utilise the well-boat to transfer fish to reduce the potential for slow towing.

Regulatory controls

Special Management control as described above.

Refer to Appendix E – Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

MC – 3.12.

6.2.6.7 Overall effect following implementation of mitigation measures

Noise from the lease operations will meet DPIPWE’s Requirements for the Control of Noise Emissions from Marine Farms (2001) and would not be audible from land.

Noise from vessels travelling to and from the lease is highly unlikely to compromise acoustic indicator levels for environmental noise established by Tasmania’s Environment Protection Policy (Noise) but there is a potential for localised short term impacts as they leave or approach shore bases. Soft starts and finishes and maintaining a good distance from shore in the vicinity of the shore bases (adopted as SOP’s) will mitigate this risk. The relocation of the larger operational vessels from the Gunpowder Jetty to the industrial site at Electrona will also minimise the potential for noise disturbance to the residents on the NW bay western shoreline.

6.2.7 Odour

6.2.7.1 Potential sources of odour emissions

There are various potential low level odour emission sources on the water such as rotting feed, mortalities and sullage from the feed barges. However:

- Presently, odour emissions from marine based farms have not been an issue for Huon Aquaculture at any of its leases;
- The management of all these sources will be improved as a result of the new operational systems design; and
- The distance between all potential odour emissions and the shore (nearest neighbours) will not decrease as a result of the amendment.

Therefore, odour is not regarded as a significant issue for the present amendment.

**6.2.7.2 Potential for emissions to cause environmental and health effects should be evaluated.**

There are no emissions that require evaluation.

**6.2.7.3 Mitigation Measures**

No mitigation is required.

**6.2.7.4 Overall effect following implementation of mitigation measures**

No impacts are anticipated.

**6.2.8 Commercial Fishing**

**6.2.8.1 Outcomes of consultation with commercial fishing stakeholders**

Huon has engaged with commercial fishers across a range of sectors, specifically, rock lobster, abalone and seine fishers. As a result of the consultation, Huon has already re-sited the proposed East of Yellow Bluff lease further north as well as further away from shore and out of Trumpeter Bay, and away from known reefs for rock lobster fishing. The amendments to SB 1-4 are not anticipated to have any

Feedback from the Abalone sector indicated that they were more comfortable with aquaculture further offshore and this is reflected in a minimum distance of 1.6km from the proposed lease area to shore. There is no abalone fishing in the immediate vicinity of the farms. Concern was expressed regarding potential effects from nutrients and attracting sharks to the area.

Feedback from one of the two seine fishers indicated that there was unlikely to be any interaction between the two operations as it was not currently an area (bottom) fished by them.
6.2.8.2 Effects on commercial fishing activities

Broad effects on commercial and indeed recreational fishing include (but are not restricted to): loss of the habitat for the target species, attraction of predators, loss of fishing grounds/area.

6.2.8.3 Mitigation Measures

Following consultation, Huon Aquaculture has moved the proposed Yellow Bluff lease area further east to provide for a minimum distance of 1.6km from the shoreline as shown in Figure 10. Further movement to the east is restricted by the need to maintain sufficient searoom for commercial shipping.

Navigation

Huon Aquaculture will conform to all navigational requirements of MAST. In addition, Huon Aquaculture has conducted a comprehensive risk assessment of the potential navigation issues and identified mitigation measures, referred to in Section 6.2.2 Navigation. and provided in Appendix F.

6.2.8.4 Overall effect following implementation of mitigation measures

No significant negative impact on commercial fishing activities is anticipated as a result of the proposed amendment.

6.2.9 Recreational Fishing

Refer also to the Navigation section above (Section 6.2.2)

As noted in Section 5.5.5, recreational fishing is a high-participation cultural pastime in southern Tasmania. The Trumpeter Bay region is a well-known area for recreational line fishing and maintaining the highest level of access to this public resource to recreational users has been a key feature in selecting the sites for the proposed amendment zones.

6.2.9.1 Outcome of consultation with recreational fishing stakeholders

A noted in section 4, the peak body for Tasmania’s recreational fishers (TARFish). Information regarding the proposed new site was provided to 99 members of the Bruny Island Boating club and no feedback had been received at the time of writing. There has been no specific feedback to date on the proposal.
TARFish also has a documented policy on Salmonid Farming.

Huon is of the view that the Company’s proposed lease East of Yellow Bluff and amended SB1-4 broadly complies with the “expectations” identified in the TARFish policy that relate specifically to this proposal including:

- **The salmonid marine farming industry to be ecologically sustainable.** “Australia’s National Strategy for Ecologically Sustainable Development (1992) defines ecologically sustainable development as: 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

- **The industry to fund independent research that underpins the continued operations of the industry and the potential impacts on the marine environment, endemic species and the ecosystem.**

- **Management of salmonid marine farming to be predicated on practical management plans based on decisions that are risk-based, transparent, informed, timely and with sufficient resources for implementation and future management and control.**

- **The industry to proactively self-report timely operational data transparently in the public domain.** Given the significant developments in recent times in individual site sensor technology there is an expectation that reporting of key performance indicators for each lease will be put into the public domain in real time, or as close as can be reasonably expected.

- **Marine farm infrastructure will not be placed/approved in close proximity to recreational boat ramps, jetties and busy navigation channels such that it creates an unacceptable risk to boaters and fishers or impedes recreational fishing activities unduly.**

- **Future salmonid marine farms will not be approved in estuarine waters**

Huon Aquaculture will continue to engage with TARFish and recreational waterway users throughout the amendment process.

**6.2.9.2 Effects on recreational fishing activities**

Commonly, most recreational fishing activities take place around the shoreline and/or around reefs especially abalone and cray diving.

The North-eastern tip of Bruny Island and the Eastern shore to around Bull Bay region is a well-known area for recreational line fishing and maintaining the highest level of access to this public resource to recreational users has been a key feature in selecting the sites for the proposed zones.

Fish farms can, through their occupation of water and therefore seafloor area, occupy good fishing spots thereby reducing the amenity value for recreational fishers. If we were to presume a total area of approx. 55,000 hectares for Storm Bay using
Huon Aquaculture Company

approximate boundaries between; Cape de la Sortie to Iron Pot, Cape Contrariety to NW head, and, Cape Raoul to Cape Queen Elizabeth, then the proposed amended zones would increase the area occupied by Huon Aquaculture by only 0.6% of that area.

Huon Aquaculture notes that fish farming can attract some fish species, both through uneaten feed and also due to the creation of mid-water ‘reefs’ known as “fish aggregations devices” (FAD’s). In New South Wales, FAD’s are proactively installed in some regions by the Government to develop areas for recreational fishing where previously they had low abundance due to the absence of any natural structure around which to aggregate. The presence of FAD’s adjacent to a known recreational fishing area may increase abundance and diversity in the area covered by this Draft Amendment.

### 6.2.9.3 Mitigation Measures

Initial consultation with TARfish indicated that the further north in Storm Bay leases progress, the greater potential to impact recreational fishing activities. On that basis, the preference would be for the original Trumpeter lease site to be retained. However, based on other considerations including the recommendation from MAST to form a clear channel between the leases and the shoreline, then moving the proposed zone further from the Bruny shoreline would be preferable.

To minimise the potential impact on the fishing grounds, Huon Aquaculture has sited the proposed East of Yellow Bluff lease as far south as possible without compromising important biosecurity separation of leases holding different year classes as well as applying the guidance of MAST and TASPorts to ensure safe navigation and sight-lines for both recreational and commercial boaters. On this basis, Huon notes that it would not be possible for the site to move any further north or south as a result of a range of considerations.

In addition, access to the preferred fishing grounds in Trumpeter Bay are retained. Huon Aquaculture notes anecdotal evidence from NSW use of FAD’s that abundance of fish may be increased near to the proposed zones as a result of their presence.

### 6.2.9.4 Overall effect following implementation of mitigation measures

Although restricting access to some fishing which may currently occur in the area, impacts are expected to minimal due to increased distance from shore and the retention of preferred fishing grounds in Trumpeter Bay.
6.2.10 Recreational Activities

As stated in Section 5.5.6 recreational activities in the area include; boating, diving, kayaking and marine wild-life viewing. For specific effects and mitigation measures on recreational fishing please see Section 6.2.9 on recreational fishing

6.2.10.1 Outcomes of consultation with recreational groups/clubs

Recreational boating and sailing are the most common pursuits near to the proposed East of Yellow Bluff lease. Recreational sailing and several sailing races follow the western side of Storm Bay also adjacent to Huon Aquaculture’s current SB 1-4 leases.

Huon Aquaculture distributed information via email pertaining to the Draft Amendment to all members of the Bruny Island Boat Club and local yacht clubs. One response was received from a member of the Bruny Island Boating Club. The response did not make any specific comment on any direct impact to recreational boating but rather expressed an opportunity for Huon Aquaculture to have an “on-island” presence and to participate jointly with other sectors, such as agriculture and tourism to examine ways to protect and enhance the coastal environment around the island.

Whilst engagement with local yacht clubs is ongoing, Huon notes that the Company has operated in Storm Bay through its original Trumpeter Bay lease and current SB 1-4 leases without any negative interactions with either recreational boaters or yachts and has no appreciable impact on local yacht races.

In addition, Huon Aquaculture has rendered assistance to recreational boaters in distress on a number of occasions as a result of the proximity of operations to Dru Point, a well-used boat ramp facility. For example, as recently as 23 April 2017, Huon Aquaculture responded to a distress call and rescued a recreational boater that had run out of fuel in Storm Bay. The Company responded and sent a vessel to the area and towed the boat and its occupants to safety at Dru Point.

6.2.10.2 Effects on recreational activities

The proposed lease East of Yellow Bluff will have an effect on visual amenity for sea-based recreational activities in the area whilst the amended SB 1-4 zones will not differ significantly in appearance to what was approved through Amendment No. 1 to the Storm Bay off Trumpeter Bay North Bruny Island MFDP. See Section 6.2.1 for a detailed explanation of visual effects and mitigation measures.

Safe navigation and navigation marking was raised by MAST and detailed explanation of navigation effects and mitigation measures is covered in Section 6.2.2.

There are no other predicted impacts for recreational diving or kayaking activities around the zones as they are at a minimum distance of 1.6 kilometres from the shore.
The wake characteristics of the well-boat are broadly equivalent to or less than those estimated for both the present Bruny Island Ferry and the Ebeneezer (the fish farm feed delivery boat operating out of Electrona) at the same speed, due to the well-boat’s considerably lower Froude Number. Advice provided by the well-boat designers (Rolls-Royce Marine AS) gives an expected trough-crest amplitude of approximately 0.5m at 10 knots (cruising speed) at the hull, dissipating to background 50m from the stern and 30-50m out from the sides.

The siting of the proposed East of Yellow Bluff lease will not restrict access to the shoreline or rocky reefs (commonly used for diving) in the region.

In addition, access to the relatively sheltered waters closer to shore is maintained providing a safer path for navigation in inclement weather.

### 6.2.10.3 Mitigation Measures

Detailed visual and navigation effects and mitigation measures are covered in previous section of this document.

Huon Aquaculture has responded to feedback during the consultation process by re-siting the proposed east of Yellow Bluff zone further offshore and in-line with SB 1-4 zones in order to maintain clear shoreline access, access to the nearby rocky reefs and clear sight-lines for safe navigation along the western side of Bruny Island.

Proposed management controls will prescribe that surface-located marine farming equipment and equipment less than 5m below the surface will occupy no more than 50 ha within each of zone 1, 2, 3 and 4.

The requirements for marking in Storm Bay may differ from what is in place in other marine farming areas around Tasmania, due to the exposed location. MaST and DPIPWE are expected to determine marking requirements with primary consideration given to safety of operations and safety of navigation for vessels transiting and using the proposed zone. The draft special management controls provide flexibility for marking requirements that maximise safety and also allow for public access where possible.

### Regulatory controls

Refer to Appendix E – Management controls in Amendment No 1, Storm Bay off Trumpeter Bay North Bruny Island MFDP (MC)

MC – 3.8, 3.9, 3.12.

The draft amendment proposes the following special management control;

**3.14 Zone 1, 2, 3 and 4 – (south of Trumpeter Bay)**
3.14.1 Within Zone 1, 2, 3, and 4, an area or areas that, in total, do not exceed 50 ha in each zone, are to be known as the farmed areas.

The farmed areas may be defined by coordinates, physical markers visible on the water surface or as otherwise specified in the relevant marine farming licence.

3.13.2 Within Zone 1, 2, 3 and 4, the lessee is to ensure that all marine farming equipment is contained within the farmed area(s), unless otherwise specified in the relevant marine farming licence.

Marine farming equipment is contained in the farmed area if:
- Equipment that is present on or above the water surface is only in the farmed area;
- Equipment that is less than 5 metres below the surface of the water is only in the farmed area.

3.13.3 The lessee must mark any area or marine farming equipment within Zone 1, 2, 3 and 4 in whatever manner is required by the Secretary and by the Marine and Safety Authority.

3.13.4 The leaseholder of any marine farming lease allocated within the Zone 1, 2, 3 and 4 shall provide unrestricted access to the public to that section of the lease that is not:
- the farmed area; and
- any other area specified in the relevant marine farming licence.

6.2.10.4 Overall effect following implementation of mitigation measures

The siting of the proposed East of Yellow Bluff lease, when compared to the Company’s original Trumpeter Bay lease (that was reallocated to SB 1-4 through Amendment1 to the Storm Bay off Trumpeter Bay MFPD), to further offshore through the consultation process are expected to mitigate any impact on access to shorelines and rocky reefs in the region and improves access to Trumpeter Bay and local anchorages. Use of the well-boat will greatly reduce potential fish farm boat traffic to and from the site and the wake caused from the vessel will have negligible effect on Kayakers.
6.2.11 Tourism

Tourism is a key industry for the southern Tasmania and the growth of the salmon industry has provided an added attraction to the region.

Section 5.7.2.1 indicates the marine and land based tourism offerings in the Bruny Island region.

6.2.11.1 Results of stakeholder consultation undertaken

As outlined in Section 5.7.2.1, Huon Aquaculture has undertaken informal consultation with Pennicott Wilderness Journeys and has provided information regarding the proposal to the Bruny Island Tourism Association.

Pennicott Wilderness journeys have indicated they have no specific objections with the proposal and would like to work cooperatively with the salmon farming industry in the area generally and Huon Aquaculture specifically. However, some concern was expressed regarding the expansion of the industry in the region and ensuring that the environmental regulations are sufficient to appropriately manage the expansion of the industry in the region. Specific concern was expressed in relation to biosecurity, wildlife interactions and impact of nutrients into the waterway.

Anecdotal feedback from some tourism operators in the south east of Tasmania, as well as Huon Aquaculture’s experience, suggests that interest in and a desire to visit and understand salmon farming operations in the south-east region is increasing. Tourism operators consulted indicated that there is potential benefit to operators through:

- Increased visitation to the area generally and potentially attracting visitors at off-peak periods
- Cross-promotion of products within the region to tourists and visitors
- Salmon-specific tourism experiences

Concerns expressed from the tourism operators consulted include;

- Marine debris from farms detracting from the tourism experience
- Long-term sustainability and overall perception of the industry

Huon Aquaculture will continue to work proactively and cooperatively with tourism operators for the benefit of both industries in the region.

6.2.11.2 Effects on tourism activities

Huon Aquaculture does not anticipate any significant negative effects on tourism operations in the area as a result of the proposed zones.
6.2.11.3 Mitigation Measures

In relation to marine debris, Huon Aquaculture;

- Has a marine debris policy (AQM0130.7) that sets out;
  - Huon Aquaculture’s commitments to reduce marine debris;
  - Describe the methods and actions Huon Aquaculture use to reduce marine debris at source and manage marine debris once in the water;
  - Organisational responsibility with respect to management and reduction of marine debris; and
  - Monitoring and reporting processes and procedures.

- An internal program to educate staff on how to reduce marine debris at the source, as well as practical measures like providing rope bins on all vessels.

- Will regularly undertake clean-ups as part of our commitment to reducing and removing marine debris. Huon Aquaculture proactively build clean-ups into the regular schedule of operations as well as responding to requests from the community. As an extension to its commitment to the TSIC ‘adopt-a–shoreline’ marine debris clean-up initiative the company will adopt that piece of shoreline between Cape Queen Elizabeth and Yellow Tooth to the north of Trumpeter Bay.

- Huon will continue to support the marine debris reporting hotline (as part of the Huon D’Entrecasteaux Collaboration) and extend the program to operations in Storm Bay.

- Will use rope that can be clearly identified as originating from Huon Aquaculture at the zones.

- Where ever possible, “Huon Aquaculture” has been stamped or otherwise marked on equipment to ensure that it can be identified and collected in the event it makes its way into the water. An example of a grid buoy with “HAC” identification tag is shown in Figure 98.

- Huon will also install GPS trackers on key equipment e.g. Mambas to ensure any large equipment that has the potential to break free can be easily located and retrieved to reduce the likelihood of negative interactions with Huon’s own vessels and equipment as well as other waterway users.
Notably, since Huon commenced farming in Storm Bay several years ago, there has only been one identified piece of marine debris known to have washed ashore as a result of local operations.

In relation to sustainability and reputation;

- Provides ongoing and current information in relation to sustainability and environmental performance via Huon Aquaculture’s web-based Sustainability Dashboard.

- Huon Aquacultures successful implementation of its Controlled Growth Strategy significantly reduces environmental impact through the use of new technology and farming methods as detailed in The Future of Fish Farming Brochure.

- Working consultatively with ENGO’s to improve relationships and deliver improved environmental outcomes.

- Proactively communicating with the local community, the wider-Tasmanian population as well as with consumers to protect and enhance Huon Aquaculture’s reputation as a sustainable farming operation producing premium salmon products.
In relation to tourism opportunities;

- Continue to engage with local tourism operators to identify and act on tourism and product opportunities

6.2.11.4 Overall effect following implementation of mitigation measures

The effect on tourism following consultation and the implementation of the above mitigation measures is expected to be positive.

Huon Aquaculture will continue to work proactively and cooperatively with tourism operators for the benefit of both industries the region.

6.2.12 Land Use and Development

6.2.12.1 Effects on existing or proposed tourist or recreation activities, such as camping areas, picnic areas, walking tracks, horse riding tracks, heritage trails

The proposed development will have no impact on existing or future land use adjacent to the development. There will be no changes to existing or future adjacent land zoning or land use.

6.2.12.2 Effects on residential activities

There will be no impacts on residential activities as the development is marine-based only.

6.2.12.3 Effects on industrial activities

There will be no impacts on industrial activities, as there are no known industrial activities adjacent to, or in the vicinity of, the development.

6.2.12.4 Effects on other commercial activities

There are considered to be no impacts on commercial activities in the area, as there are no known commercial activities within the vicinity of the development.

6.2.12.5 Mitigation Measures

No mitigation measures are required for surrounding land use as a result of the proposed development, as there will be no impacts on surrounding land uses.
6.2.12.6 Overall effect following implementation of mitigation measures

There will be no impacts on surrounding land uses.

6.2.13 Socio-Economic Aspects

The proposed new lease (Yellow Bluff) and amendments to SB1-4 will allow Huon Aquaculture to grow its offshore farming in the region. The following information is provided to indicate the social-economic benefits of farming the proposed zones;

- The new lease and increase in the MLA in Zone 1-4 will support an increase in production in the area of approximately 50%.
- Huon estimates the workforce at Storm Bay to grow to approximately 80 FTE's (in 2022) from 25 (2017) and that 56 FTE's will be drawn from regional and remote communities.
- Huon will continue to support the wider community through support of projects and initiatives as well as supporting its employees and their families to be active participants in the community.

6.2.13.1 Estimate of total capital investment for the proposal

As outlined in Section 3.1.4, the estimated establishment cost for the subleases is $53.8 million.

6.2.13.2 Effects on local and state labour markets for the construction and operational phases of the proposal

As discussed in Section 3.1.7, Huon estimates the workforce at Storm Bay to grow to approximately 80 FTE's (in 2022) from 25 (2017) and that 56 FTE's will be drawn from regional and remote communities.

Huon’s direct employment in Storm Bay currently generates a further 130 indirect FTE jobs. This increases to approximately 215 FTE jobs at full production on the proposed East of Yellow Bluff zone and SB zones 1-4. Importantly, the indirect employment is likely to impact in regional and remote areas particularly.

6.2.13.3 Effects on upstream/downstream industries, both locally and for the state

It is anticipated that the majority of the establishment costs for the zones will be expended in Tasmania and predominantly southern Tasmania.
Table 46 shows an estimate for those larger, more easily identified components of the total investment that is attributable to the development of the Strom Bay zones, and the names and locations of the suppliers. This estimate does not include on-going operational expenditure required for the site.

<table>
<thead>
<tr>
<th>Company</th>
<th>Company Location</th>
<th>Component(s)</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haywards</td>
<td>Electrona</td>
<td>Feed Barges</td>
<td>$15.2</td>
</tr>
<tr>
<td>Zetz</td>
<td>Wynyard</td>
<td>All HDPE pipe</td>
<td>$3.5</td>
</tr>
<tr>
<td>Rmax</td>
<td>Kings Meadows</td>
<td>Flotation foam</td>
<td>$0.2m</td>
</tr>
<tr>
<td>Mitchell Plastic</td>
<td>Castle Forbes Bay</td>
<td>Pen assembly</td>
<td>$2.0m</td>
</tr>
<tr>
<td>Rope N Chain</td>
<td>Launceston</td>
<td>Mooring supplies</td>
<td>$1.5m</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$22.4m</strong></td>
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</table>

6.2.13.4. Extent to which raw materials and services will be sourced locally

Wherever possible, Huon Aquaculture sources goods and services from local businesses. The company currently spends more than $20 million each year with local businesses in southern Tasmania.

Specific to this proposal, Huon Aquaculture is sourcing the major components required for the construction and installation of the new mooring grid systems and pens from Tasmania.

6.2.13.5 Effects on land values, and demand for land and housing

No significant effects on land or house values or demand are expected.

6.2.13.6 Effects on the local, regional, state and national economies

As described earlier (Section 3.3 Proposed Zone and Lease Details), demand for salmon has outpaced supply and we are seeing increased imports into the domestic market to meet that demand. At maximum, the new lease will help to ensure that the
Australian market is protected to some degree from the threat of imports. Similarly, the estimated revenue generated from the sale of the product will largely be distributed in Tasmania through wages and expenditure on operational and previously indicated establishment costs within Tasmania.

6.2.13.7 Mitigation Measures

No adverse social or economic effects are anticipated, so no mitigation is necessary.

6.2.13.8 Overall effect following implementation of mitigation measures

The anticipated social and economic effects are positive and beneficial.
7 SUMMARY OF EFFECTS AND THEIR MANAGEMENT

Potential effects, avoidance and mitigation measures and net effects are summarised in Table 47 below.
6.1.1 Water Quality

<table>
<thead>
<tr>
<th>RELEVANT SECTION</th>
<th>POTENTIAL EFFECT</th>
<th>AVOIDANCE AND MITIGATION</th>
<th>OVERALL EFFECT</th>
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<tbody>
<tr>
<td>Fish farming adds particulate organic matter (fish faeces and waste food) and dissolved nutrients (metabolic products) to the water column and underlying seabed. Waste production rates are dependent on stocking densities. The build-up of organic matter underneath pens can change the species composition and diversity of fauna living on or in the sediments within leases. Decomposition of organic matter by bacteria can deplete oxygen from the overlying waters, and dissolved nutrients particularly nitrogen can increase the likelihood and intensity of phytoplankton blooms. Decomposition of phytoplankton and/or bacteria (for example in Macquarie harbour) can similarly deplete dissolved oxygen concentrations. Oxygen depletion from faeces and waste food decomposition is typically localised to the seabed and bottom waters within moderately to well flushed leases (poorly flushed water bodies such as Macquarie harbour may be different). Depending on currents, oxygen depletion associated with phytoplankton or bacterial ‘blooms’ are more likely to be widely spread.</td>
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<td>At the core of the proposed amendment is the re-design and redevelopment of Huon Aquaculture’s operations to enable the company to farm salmon at offshore sites. Storm Bay is an offshore site, dominated by oceanic currents, winds and waves, with a prevailing mass flow offshore to the SE and strong wind-driven mixing, which will ensure adequate dissipation of nutrients and organic carbon in the proposed new and amended zones. Huon Aquaculture is committed to working with DPIW/EPA, research providers and the rest of industry to formulate a risk based monitoring plan suitable for the needs for farming fish in relatively more exposed conditions such as Storm Bay. In preparation for the monitoring programme baseline surveys have already been undertaken and include rocky reef assessments, sediment chemistry and biology, and, water column nutrients. Huon Aquaculture is also committed to extending the scope of near-field environmental research to subtidal reefs in Storm Bay, and is working with IMAS to facilitate both the review of the data already collected for rocky reefs and to also extend the collection of</td>
<td>There should be no long term net effect on water quality as:</td>
<td></td>
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</table>

- Storm Bay is an offshore site strongly influenced by oceanic currents that provide thorough mixing of the water body and dissipation of nutrients.
- The prevailing south-easterly flows in the Bay will tend to export nutrients out to the open ocean rather than to inshore areas.
- Given that the Storm Bay region is proposed to be restricted to a TPDNO level equivalent to that of the Huon and Channel MFDP’s, and that those areas have demonstrably poorer mixing and dissipating characteristics suggests that the risk to water quality in the area is therefore low to negligible.
- Management and ultimately stocking of fish farming in the region will be subject to a rigorous monitoring programme informed through hydrodynamic and biogeochemical modelling.
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<tr>
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| 6.1.2 Substrates and Fauna | The most important component of settling particulate wastes derived from finfish farms is organic carbon. Organic carbon settles on the seabed where it is often incorporated into the benthic environment and provides a food source for benthic organisms and bacteria. If waste accumulation is high, bacterial activity will increase accordingly. In fine sediments, where porewater flushing and oxygen exchange with the overlying water column is low or when sediment loading is extreme, the bacterial oxygen consumption may exceed replenishment rates and lead to anoxic sediments and an increase in sulphur reducing bacteria. Under these conditions, methane and sulphide may be released from the sediments (off-gassing). These gases are toxic to aquatic organisms, including the fish in the overlying pens (although reports of this having adverse effects on the fish are very rare). The detrimental effect to fish health is also exacerbated in pens sited in shallow waters. Another potential source of particulate material to the seafloor is in situ net cleaning, which removes organic carbon, shells/shell-grit and possibly flora and fauna from the nets. | The seafloor is composed of well mixed coarse sediments (and therefore well oxygenated) with signs of bioturbation across the whole area. This strongly suggests that all zones will have excellent recovery characteristics. Management responses arise through adapting both fallowing and monitoring strategies to the substrate deposition characteristics at the leases and the stocking requirements for individual year classes and pen sizes. Adjustments of these responses are initiated through the results of the regulatory annual and Huon Aquaculture internal video surveys. The lease areas formed and extended through the proposed amendment are to be used in an integrated manner with the new Trumpeter Bay lease ‘feeding’ the SB1-4 leases. This will ensure that each lease can be fallowed for 2 months out of 12, and each pen bay could be fallowed for up to 6 months on a regular basis. Huon Aquaculture therefore regards the proposed amendment zones to be ones that will continuously demonstrate good seafloor recovery characteristics. Huon Aquaculture will use the results of the FRDC project 2015/024 to validate the DEPOMOD model. | Huon Aquaculture does not anticipate any adverse long term consequences to the seafloor under the amended zones as it is composed of well mixed coarse substrates characterised by bioturbation and rippling suggesting strong scouring conditions. The current amendment proposal seeks to:-

1) Increase the leasable area at the new and amended zones thereby increasing the distance between the pen grids and lease boundaries. This will provide for a pen to compliance site distance of >110m in the Yellow Bluff zone and >175m at the more exposed SB 1–4 zones. Both distances are more than twice that suggested for detectable effects by using the current DEPOMOD model.

2) Ensure the proposed layout of the lease and the size of the grids at the East of Yellow Bluff zone results in a generous amount of space between the grids. Both initiatives allowing for great flexibility in the positioning of the fish pens relative to the lease boundaries should that be indicated through any future modelling work being undertaken by IMAS. The DEPOMOD modelling confirms that nutrient emissions associated with the proposed... |
At exposed, higher energy sites however, these effects are generally significantly reduced but the spread of effect can be extended due to re-suspension at the seafloor or entrainment higher in the water column. Further, the capacity for recovery is elevated due to the greater availability of oxygen at high energy sites.

Huon Aquaculture has recently significantly increased the size of the spade or ‘stingray’ type anchors thereby greatly reducing the total number of anchors required.

Huon Aquaculture feed staff are amongst the most experienced in the world. Waste is minimised by ensuring that fish are fed at the correct rate and until satiated. Further Huon Aquaculture inspects the seafloor (using ROV) below all pens at all sites every 1-2 months in order to assess feed wastage and collect information on seafloor health.

The amount of solids produced through in situ net cleaning is not significant compared to that produced by the fish themselves, and the shift of the operations away from high depositional sites will decrease overall deposition and accumulation of organic carbon.

Huon Aquaculture is also committed to extending the scope of near-field environmental research to subtidal reefs in Storm Bay, and is working with IMAS to facilitate both the review of the data already collected for rocky reefs and to also extend the collection of data along the Northern Bruny Island eastern shoreline into the future.

The location of zones/leases at least 1.5km offshore will reduce the potential for any effect on shoreline intertidal or subtidal rocky reef macroalgal vegetation. The expansion of the leases in the SB 1-4 zones will decrease the distance from the lease

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<tr>
<td>6.1.3 Marine Vegetation</td>
<td>The significance of the nutrient input depends on many factors which include: other nutrient inputs (e.g., from the open ocean or the Derwent River), the amount and availability of</td>
<td>In terms of near-field effects, the proposed amendment maintains the distance of the farming areas to intertidal and sub tidal rocky reefs to at least 1km for the SB zones, and ensures that the Yellow Bluff zone is at least 1.5km from any rocky reef area.</td>
<td>The location of zones/leases at least 1.5km offshore will reduce the potential for any effect on shoreline intertidal or subtidal rocky reef macroalgal vegetation. The expansion of the leases in the SB 1-4 zones will decrease the distance from the lease</td>
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| the farm derived nutrients, and the ability of Storm Bay to assimilate nutrients. Under certain conditions, nutrient increase can lead to the increased proliferation of some types of marine vegetation if those nutrients are limiting in that environment. There can be an increase in biomass of microalgae which is usually manifested through either: decreased biodiversity or domination of certain species over others, increased growth of algal slimes in enclosed or quiet waters, increased growth of epiphytes and choke weeds on seagrass beds, and/or phytoplankton blooms. The Huon-Channel region has been the subject of numerous studies of macrophytes (reef and intertidal) and phytoplankton (or its surrogate, Chlorophyll a). Oh (2009) found that the effect of fish farms on reef benthic communities extended to at least 100m from fish farms at both sheltered and exposed sites, where the macroalgal community was significantly different from reference sites. Although 400m sites were collectively not significantly different to reference sites, it is likely that effects extended to at least 400m in some areas but not others. This was indicated by the leave-one-out procedure in the CAP analysis, which revealed that 5 of the 400m sites showed characteristics akin to 100m sites, compared to none of the
| Further, significant effects have not been found beyond 400m from fish farms in the more sheltered and less well flushed Huon D'Entrecasteaux area. Huon Aquaculture has or is currently undertaking a comprehensive body of baseline surveys that will ensure the ability of any future EPA/DPIPWE directed monitoring plan for Storm Bay to detect significant change across the whole suite of marine vegetation related variables, in order to ensure that the industry does not have a significant effect on the vegetation in the region. Outcomes of the FRDC research project 2015/024 will assist in the development of monitoring framework consistent with regulatory management objectives. Huon Aquaculture's management strategy is to clean nets before the fouling gets to any significant size on the nets. This is expected to reduce the overall biomass of biofouling in the water column. The shift of farming effort further offshore, where there is greater mixing in the water column and therefore dispersion of the fouling organisms in the water column, will make it less likely that they can collect in significant numbers and recolonise other nets or individual embayments. | boundary to the offshore reefs to the east of the SB1 zone by only 75m and the minimum distance to the reef is at least 1km. Recent research suggests that this distance is well outside that where a significant effect might be expected, especially as the Storm Bay region is relatively exposed compared to the Huon/Channel. On the broadscale level, the overall nutrient loading to this part of Storm Bay will remain low due to the high mixing effects, influence of oceanic currents and the overall mass transport towards the southeast and out into the open ocean. Therefore the net effect for phytoplankton or Chlorophyll a production is not expected to change significantly. |
### 6.1.4 Birds

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<tr>
<td>5000m reference sites and only 2 of the 2000m sites. This suggests that variations in the detectable effects of fish farms can be anticipated at scales of hundreds of metres but these would rarely reach distances of more than a kilometre away from farming areas.</td>
<td>Huon Aquaculture will use its new Fortress pens at the lease. The Fortress Pen design includes higher, tauter nets that keep birds perched on the pens well above the water and therefore keeping the birds away from the fish and the fish feed pellets. Importantly, the fully enclosed net using the smaller mesh size (60mm) can keep out all birds, including the smaller cormorants that traditionally have been able to get through any mesh above 75mm. By denying birds the opportunity to perch and access to both fish and feed, they are discouraged from viewing our pens as a place to rest and as a source of food. Huon Aquaculture has resources, processes and procedures in place to ensure that the anti-predator nets on the pens are adequately maintained and that seals and birds have no means for net-pen entry. Data surrounding the circumstances of any collision events must be collated to assess if common elements are present (including lighting from feed-barges and work vessels) and if so, how they are actioned to address or remove the potential threat to albatrosses.</td>
<td>Although it is very difficult to predict that interactions with birds will be eliminated altogether, the combination of the net-pen design and the vigilance of all crews, will significantly reduce the potential for gulls and cormorants to be caught in the nets and remove the possibility for eagles to perch on and subsequently get trapped in the new net-pens. The net result will be the reduced likelihood, if not elimination of the risk of bird entrapment and entanglement, especially for threatened species such as wedge-tailed eagles and white bellied sea eagles. Use of the Fortress Pens also reduces the potential for marine debris which will further reduce the likelihood for interactions with birds.</td>
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6.1.4 Birds

Habitat loss through restricted access to intertidal feeding and shoreline habitat or feeding, roosting and nesting sites. Behavioural change - reliance on fish farms for food source. These birds can congregate at the farms and become ‘pest’ species and therefore become subject to harassment efforts. Entanglement - birds may be killed or injured by entanglement in bird netting. Marine debris - Any increase in marine debris from fish farms on foreshores may potentially reduce available habitat and/or habitat quality to birds. The debris poses additional risks to birds from entanglement and ingestion, again potentially resulting in increased mortalities.
<table>
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<th>OVERALL EFFECT</th>
</tr>
</thead>
</table>
| 6.1.5 Marine Mammals | Predation of farmed stock, causing stress in fish causing stress to fish and a concomitant reduction in feeding rates. Increases in the cost of production - seal defence systems such as predator netting and seal trapping/removal and damage to nets. Aggressive seals may cause injury to personnel employed on marine farms. Potential direct impacts on marine mammals may include:  
  • Local significant increases in predator numbers, affecting not only aquaculture, but other marine based industries and interests (fishing, boating and tourism).  
  • Behavioural management, trapping and relocation of seals from marine farming areas may cause stress to the animals.  
  • Modification of behaviour in seals that habituate to marine farms, which may alter, for example, foraging behaviours. | Huon Aquaculture’s new Fortress pen design has as its basis the intended complete exclusion of all predators. Only this new net-pen design will be used at these zones. Seal Management Framework 2012 for the appropriate management of all seal interactions. The provision of works and technical crews at all of Huon Aquaculture’s leases to both manage seal interactions and carry out regular inspection and repair of nets. These crews will also now benefit from the extension of the company’s training in these issues through the Marine Fauna Interaction Management Plan employed at the company’s NSW marine farm. | The new and amended zones allow Huon Aquaculture to make commercial and effective use of its Fortress net pen design. Company wide data collected over an 18-month period since the implementation of the Fortress Pens showed a significant reduction in mortality - in particular, seal-associated mortality. The most useful information available is from the dead fish collected from the pens that are examined for seal activity (either a seal strike or having been 'munched' by seals once dead and in the base of the net awaiting collection). This data covering the last 18 months shows reduced seal-associated mortality in the new Fortress Pens, with most of the seal-related mortality recorded associated with bathing of the fish from one pen to another where the fish are more susceptible to seal attack. The reduction in seal related mortality corresponds with observed reduction in seals present around Huon Aquaculture’s marine leases. There have also been no records of interactions of dolphins and or whales with this Fortress pen design. |
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</tr>
</thead>
<tbody>
<tr>
<td>6.1.6 Threatened Species</td>
<td>• Potential for dolphins and seals to become entangled in predator netting resulting in injury or death.</td>
<td>The new net-pen configuration will ensure that all nets are kept taught at all times and that there will be minimal tears or holes in the bird nets. Vessel operators will always keep a lookout for marine mammals, including whales, and will take avoidance action if and as necessary in accordance with the Parks &amp; Wildlife’s whale watching guidelines. For dolphins and seals, the use of a well-boat for bathing will stop the use of bathing liners thereby eliminating the risk for dolphin entrapment around bathing systems. Daily removal of mortalities from the pens will minimise any attraction the farm might have for sharks and to some extent seals.</td>
<td>Huon Aquaculture expects that any negative interactions with any threatened species will now be largely eliminated using its Fortress Pens and a well-boat for all bathing activities at the new and amended zones. There is some potential risk related to unexpected weather damage that might occur on occasion, and to the nets in particular. Even under such circumstances, Huon Aquaculture’s operational crews should now be able to make repairs before problems arise. The net result is that there should be no significant negative impacts on threatened species.</td>
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<td>6.1.7 Geo-conservation</td>
<td>There are no sites of geoconservation significance listed on the Tasmanian Geoconservation Database within or in close proximity to the site. Therefore there will be no impacts on geoconservation.</td>
<td>There are no mitigation measures required, as there are no impacts on geoconservation.</td>
<td>There are no impacts on geoconservation.</td>
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<td>6.1.8 Chemicals</td>
<td>Antibiotic residues in water, sediments, farmed salmon and wild species. Anti-foulings chemicals or active agents accumulating and or persisting in the</td>
<td>Huon Aquaculture strives for a proactive and preventative health strategy that maintains the highest standards of fish husbandry, nutrition and biosecurity as a basis for maximising fish performance and welfare. A culture of continuous review and</td>
<td>The implementation of a well thought through and structured approach to fish health and biosecurity assists in minimising subsequent need to use therapeutants and aids in achieving effective</td>
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<td>environment leading to chronic or acute effects on benthic and possibly pelagic flora and fauna. Public health risks through salmon consumption.</td>
<td>improvement is encouraged. The Huon Aquaculture Veterinary Health Plan is a key component of the Huon Aquaculture Fish Health Strategy. Written Protocols and “Standard Operating Procedures” (SOPs) are an important basis for “Best Practice Management”. Antibiotics are rarely needed to treat the common bacterial conditions experienced in SE Tasmania, but are used on occasion to protect animal welfare. Effectiveness of vaccination regimes and feed formulations are continuing to be investigated and implemented as improvements are established.</td>
<td>biosecurity with as little use of disinfectants as possible. It is probably not possible to eliminate all antibiotic use, but Huon Aquaculture strives, as a priority, to minimise the need for use. Further, the amendment will act to reduce any use of antibiotics, as the proposed East of Yellow Bluff lease will act as a smolt site which will enable the separation of year classes and or cohorts within year classes, thereby reducing the risk of disease in the MFDP area. The use of chemicals is not expected to increase above the already insignificant levels used in the presently at MF261.</td>
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<td>6.1.9 Species Escapes</td>
<td>Establishment of feral populations, impact on native fish populations through predation or competition for resources, and disease/parasite transfer from farmed fish to native fish populations.</td>
<td>The new net-pen design is intended to prevent seals tearing holes in the fish farm net systems. The operational management of the new 240m pens will allow for all pens and therefore nets to remain in the same grid position through any particular year class lifecycle at sea. These will eliminate both the presence of seals and the need for net tows, which cause more than 90% of all significant holes and tears in nets. SOP’s to include: • comprehensive diving regime to routinely monitor net integrity • all newly deployed nets should be dived prior to fish stocking</td>
<td>The levels of escapes in southeast Tasmania were already low on a worldwide scale prior to the design and rollout of the new net-pen design. Huon Aquaculture is confident that the new net-pen design will continue to minimise interactions between mammals and its stock, infrastructure and personnel. Although the increased intensity of fish farming in the Plan area might otherwise increase the risk of fish escapes, the combination of the new net-pen design, together with using the well-boat for all bathing operations and thereby eliminating towing of pens and nets will greatly reduce the risk of escape.</td>
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### Relevant Section

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| 6.1.10 Disease   | As in any livestock production, there are bacterial, viral and parasitic organisms that can impact the health of farmed salmon. The most important salmon disease in the south-east region of Tasmania is amoebic gill disease (AGD), present since the start of the Tasmanian industry, routinely controlled through regular freshwater bathing of affected salmon. Mortality is minimal, but the resources required for bathing are significant. Other diseases found in the south-east include the viral diseases: Pilchard Orthomyxovirus (POMV) and Tasmanian Aquareovirus (Reovirus), and the bacterial diseases: RLO, Yersinia ruckeri, Tenacibaculum maritimum and Flavobacterium. The impact of these diseases is Huon Aquaculture has a comprehensive approach to fish health and biosecurity, which is being managed by a full time qualified veterinarian (>25 years' experience in salmon farming) supported by approximately 10 technical staff (mostly university graduates). The health program is underpinned by Huon Aquaculture’s Veterinary Health Plan and the company’s commitment over many years to the Tasmanian Salmonid Health Surveillance Program. The overarching fish health and biosecurity issues which will be addressed in Storm Bay are: Effective Fallowing Period Between Year Classes Effective Fallowing Period Between Year Classes Huon Aquaculture’s commitment to the above mitigation strategies facilitates continual improvement on fish health and biosecurity. It also ensures that fish health and welfare maintains a high profile within the company. The company is currently addressing all of the fish health and biosecurity related “Farming Challenges in Storm Bay” and throughout the company’s marine operations. Huon Aquaculture is basing future fish health and biosecurity strategies on those lessons learnt overseas and seeks support from the Regulator in order to the minimise the risk of disease through both; planning adequate distances between fish farm companies in the region, and, ensuring that any other fish farm companies that
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<td>minimised through good quality nutrition, husbandry and biosecurity. Tenacibaculum maritimum and Flavobacterium are bacteria that can cause skin infections if the skin of fish is physically damaged (e.g. scale loss at handling). The incidence of Yersinia ruckeri infection and skin lesions is minimal through careful, low stress handling and use of healthy feed formulations. Viral infections sometimes occur when environmental conditions (e.g. phytoplankton blooms, warmer water conditions in summer) are stressful to fish. Again, the incidence of viral infections is usually minimised through good nutrition, husbandry and biosecurity. However, certain viral diseases e.g., POMV are potentially serious emerging issues for the industry. It is critical that appropriate biosecurity measures are incorporated into planning and farming practices to minimise the threat this poses. Viral infections are not treated with antibiotics. There is no evidence that any of the diseases that sometimes impact farmed salmon in Tasmania have any impact on wild stocks. In fact, evidence indicates that wild fish probably act as a reservoir for certain disease organisms which subsequently get transmitted to the salmon. For Effective Management of Wildlife Interactions (e.g., seals and birds) Effective Management of Disease Incidents through the: Capacity to isolate populations affected by infectious disease reserving existing lease as a contingency site, which can quarantine fish suspected of clinical disease, and, Capacity to remove mortalities in a timely manner through Mort retrieval (Lift-up) systems, as mortalities are a high risk vector for transmission of disease. Robust Characteristics and Effective Maintenance of Farm Infrastructure which must be robust enough to withstand the challenging environmental conditions in Storm Bay. Minimise Net Biofouling - regular in situ net cleaning Biosecure Movement of Live and Dead Fish and secure bathing of fish through the use of a well-boat - Huon believes a well-boat is integral for successful offshore farming and it is one of the most effective measures for reducing biosecurity risk. Low Stocking Densities, the Fortress net–pen design provides for an SD of approximately 8-10 kg/m³ at harvest.</td>
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<td>might farm the area are also adhering to best practice principles.</td>
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<td>In terms of the continued development of the company’s marine farming operations, the proposed new and amended zones will allow our most susceptible fish, the smolt, to be grown in better mixed and oxygenated waters than in the Huon River and Port Esperance and D’Entrecasteaux Channel MFDP’s.</td>
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example, Pilchard Orthomyxovirus (as the name suggests) is carried in pilchard populations.

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<td>6.1.11 Waste Streams Disposed on land</td>
<td>If dead fish are not removed from the cage on a regular basis potential impacts include: attraction of predators, spread of disease to wild fish, organic enrichment of the water column and the seabed from putrefying fish, odour issues affecting public amenity and aesthetics, changes in water quality, spread of disease and parasites within stock, lowering of DO (and impact on other water quality physico-chemical parameters) due to microbial degradation of putrefying fish, stress on existing populations, and potential health impacts.</td>
<td>Advanced preparation for Mass kills through the Industry Mass Mortality Strategy and the in-house Mass Mortality SOP's together with provision of in-house disposal (e.g., composting) facilities. For ongoing mortalities, seal exclusion measures in the form of the new net-pen design will be implemented across all pens at the proposed site and will have the greatest direct effect on reducing fish mortalities. Use of lift-up systems in the new net-pen design will prevent build-up of new carcasses on the floor of the pens. Diseases are managed by appropriate vaccinations and the employment of a veterinarian working with each of the companies. Ensiling of morts will provide for a more bio-secure and efficient operation.</td>
<td>Waste management imperatives and indeed opportunities are continually shifting and progressing. In large part bio-security drives many of these imperatives and Huon Aquaculture continues to adhere to Worlds Best Practice in order to ensure the safety of its stock. Presently through the VHP and associated industry government initiatives such as the mass mortality group, Huon Aquaculture is ensuring that all present and potential waste emissions are well controlled and subject to both within company and across the sector planning. The present amendment proposal will significantly improve the general disposal of fish waste through the use of both lift-up systems in all pens and their subsequent rapid ensiling either on the feed barges or at the Hideaway Bay facility. Cartage of ensiled waste instead of mortalities in sealed tanker trucks from the Huon Aquaculture shore bases will ensure that the risk of disease transfer due to spillage is eliminated. The overall effect of the waste management initiatives associated with the new net-pen operational systems and therefore the present amendment will act to reduce any impact that these waste streams might have on the environment and</td>
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There is a potential that some forms of rubbish may be found within the water column or on the shorelines of the Huon estuary or Lower Channel. Potential impacts on the natural and human environment include: entanglement of birds and marine mammals, loss of public amenity and aesthetics, and, hazards to navigation e.g. propeller entanglement.

The inappropriate discharge of black and grey water directly into the marine environment has the potential to cause environmental and human
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<td>health issues including; undesirable impacts on water quality, contamination of seawater with faecal coliforms, and, health related impacts for fish. Blood water from harvesting has the potential to organically enrich surrounding waters and potentially spread disease amongst fish stocks.</td>
<td>The movement of all gear and equipment is subject to strict biosecurity protocols. These protocols are regarded as more than adequate in also preventing the transfer of marine pests, as they are designed to prevent the spread of bacterial and viral disease between farming regions in Tasmania.</td>
<td>The biosecurity protocols as provided for in Huon Aquaculture’s VHP will provide adequate safeguards against the introduction of marine pests. As the amendment will result in relatively minor changes to vessel movements in the area due to; proximity to existing farm leases (SB zones 1–4), use of the well-boat, and remote feeding operations, there should be no net effect on introduced marine pests especially when compared with the broader industry standard for vessel movements attending farming operations. Therefore, no net increase in effect or risk is expected through the present amendment.</td>
<td>will improve the company’s ability to reduce, reuse and recycle waste.</td>
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6.1.12 Introduced Marine Pests

By far and away the greatest vector for the spread of IMS is through transport either in the holds or on the hull of marine vessels travelling between sites.

The potential environmental impacts include:
- introduction and establishment of non-indigenous species, diseases and parasites,
- changes to nutrient and energy cycles,
- changes to ecosystem stability,
- loss of biodiversity and abundance from predation and/or competition,
- competitive exclusion of native species, and,
- mortality from infection.

IMS also have the potential to impact on salmonid farming operations including:
- predation on stock,
- cause nuisance fouling on equipment, and,
- finfish stock mortalities e.g. from toxic algal blooms.
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<td>6.1.13 Marine and Coastal</td>
<td>No effects are expected.</td>
<td>No mitigation is required.</td>
<td>No effects are expected.</td>
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<p>| 6.1.14 Climate Change | Sea level rise is not expected to have any significant direct implications for the farming operations. The rate of rise is too slow relative to the life expectancy of equipment and structures (eg. moorings) to require any adjustments to be made within those time frames. Increase heat in the atmosphere is expected to lead to changes to atmospheric circulation and rainfall patterns. More energetic weather systems, with increased wind speeds and rainfall, could emerge although predicting changes at the scale of the Huon-Channel region is problematic. At the lease site surface summer temperatures do not reach above 19°C and with climate change are therefore unlikely to be above 22°C by 2030. As the temperature of water increases, its oxygen content decreases and lowered oxygen availability can exacerbate the temperature stress. At fish temperatures above their optimal, immunosuppression can also occur, increasing fish susceptibility to infectious diseases (such as through these programmes the company is future-proofing itself against increased water temperatures through the selection of fish that grow best under evolving Tasmanian conditions. The deeper, cooler oceanic waters that influence the water temperatures and quality in Storm Bay may help to buffer the effects of the southward moving East Australia Current. Venturation, which is the pumping of cooler mid-depth water up into pens, is unlikely to be necessary. | The potential changes in wind speeds due to climate change will be inconsequential for Huon Aquaculture's operations. Existing mooring systems and work practices are well adapted to a wide variety of conditions. Huon Aquaculture currently runs a mass selection breeding programme and is a partner in the TSGA Selective Breeding programme. Both programmes select for the best growing fish and/or those also demonstrating the best resistance to gill amoeba disease. | Huon Aquaculture already has management measures and systems in place to address the range of environmental stressors that climate change may exacerbate and the location of the Storm Bay off Trumpeter Bay zones provide additional security against climate change. Huon Aquaculture expects there to be a significant reduction in its risk exposure to climate change through the use of the lease. |</p>
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<td>amoebic gill disease, rickettsia-like organism, marine flexibacteriosis and yersiniosis).</td>
<td>The change or increase in greenhouse gas emissions from the proposed development should be considered in the context of the Huon Aquaculture's overall operations and the consolidation of several smaller lease areas into fewer larger areas. This has the potential to reduce greenhouse gas emissions through reducing fuel usage, by reducing the number of service and maintenance trips to separate zones.</td>
<td>Although the Storm Bay off Trumpeter Bay zones will require longer travel distances by vessels, considerable fuel reductions will be achieved through the permanent mooring of the new feed barge at the site. The barge has its own feed storage and can deliver feed to pens through pipelines, minimising vessel movements at the zones. The new well-boat will provide for very efficient transport of fish compared with the current systems, which would require pens to be towed at very slow, energy inefficient speeds.</td>
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<td>6.1.15 Greenhouse Gases and ozone depleting substances</td>
<td>The proposed development will generate greenhouse gases. No ozone depleting substances will be generated as part of the proposed development.</td>
<td>Covered by an in-depth company EMP.</td>
<td>Responsible management of the environment is directed by a comprehensive and adaptive company EMP. This ensures the future sustainability of the company. Management and ultimately stocking of fish farming in the region will be subject to a rigorous monitoring programme informed through hydrodynamic and biogeochemical modelling.</td>
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<td>6.1.16 Environmental Management</td>
<td>Poor overall Environmental Management leading to unsustainable practices and lack of social licence to operate.</td>
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<td>6.2.1 Visual</td>
<td>On water fish farming structures can impact on the visual amenity of an area, especially areas regarded as pristine, and/or worthy of conservation status, or if they impact tourist visual amenities, or simply if they affect the view</td>
<td>Siting of the lease approximately 1.6km from the shore reduces the visibility of the fish farm. Management controls contained within the Storm Bay off Trumpeter Bay MFDP 1998 (Appendix E) aim to</td>
<td>The existing lease has limited visibility from settlements and roads in the surrounding region. The lease will have low visibility to vessels greater than approximately 1km away.</td>
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<td>from coastal residences. This effect may be felt either from land or on the water. Photographs of the Zuidpool lease in the Channel, used as an example, from various distances show that lease infrastructure is discernible on the water horizon from 0.5 km away but visibility is much reduced at greater distances, and the pens are barely visible approximately 1.5km or more away. People on vessels passing by inside these distances will probably notice the pens but they occupy only a very small proportion of the viewfield. Their visibility is only likely to be considered intrusive by those who find artificial structures on the sea in general to be intrusive or at elevation.</td>
<td>reduce the level of visual impact caused by marine farming operations.</td>
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6.2.2 Navigation

Concerns include, positioning of fish farms can affect transit lines and anchorages. shipping lanes, safe navigation at night-time (lighting/marking issues) and ensuring that charts and GPS information is current.

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<th>IN RESPONSE TO THE CONCERNS RAISED DURING STAKEHOLDER CONSULTATION AND IN PARTICULAR MAST AND TASPorts AS WELL AS THE RA (APPENDIX F), HUON AQUACULTURE HAS SELECTED A PROPOSED LEASE SITE THAT MAXIMISES NAVIGATIONAL SAFETY BY:</th>
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<td>• Maintaining sufficient “sea-room” between the shore and leases with a minimum distance to shore of 1.6km.</td>
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<td>• Maintaining a direct line of sight for all 5 proposed zones.</td>
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Given the results of the consultation with regulatory authorities and RA there are not expected to be any unacceptable significant impacts on recreational boating activities or commercial shipping as a result of the changes proposed in this amendment.
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<td>• Maintaining straight line access to known anchorages</td>
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<td>• Maintaining sufficient clearance for commercial vessels (outside of commercial shipping channel).</td>
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<td>• Form a working group including: Huon Aquaculture, MAST and Boating Club representatives to investigate if there are any issues with lighting associated with the proposed amendment.</td>
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<td>• Provide MAST with detailed maps of lease changes to ensure all maps and information provided to recreational users of the waterway are current.</td>
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<td>6.2.3 European and Other Heritage</td>
<td>The proposed amendment will have no impacts on European or other cultural heritage sites as there are no historic heritage sites or areas within or in close proximity to the project area.</td>
<td>There are no mitigation measures required, as there are no impacts on historic or cultural heritage sites or areas as a result of the project.</td>
<td>There will be no impacts on European or other cultural heritage sites.</td>
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<td>6.2.4 Aboriginal heritage</td>
<td>There are no potential impacts on Aboriginal heritage sites, as there are no known sites or places present in and around the zones themselves.</td>
<td>Huon Aquaculture is taking a precautionary approach to mitigate potential impact on, the Northern Bruny Island eastern shoreline. Huon Aquaculture has also agreed to notify Murrayfield station staff prior to performing any marine debris clean-ups in the area.</td>
<td>As there are no known Aboriginal Heritage sites then there will be negligible impact on those areas. Huon Aquaculture will manage its operations so as to minimise all impact on the adjacent shoreline.</td>
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<td>6.2.5 Reservations</td>
<td>Marine debris may wash up on the cliffs and shore at or near to potential sites of interest, if not identified Aboriginal Heritage sites.</td>
<td>There are no mitigation measures proposed for Reservations, as there will be no impact on any Reservations as a result of the proposed development.</td>
<td>There will be no impact on Reservations.</td>
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<td>6.2.6 Noise</td>
<td>The lease areas will be over 1.5km from land and the centre of the lease, where operations will be focused, is approximately 3km from the nearest house. The risk of adverse noise impacts for land based receptors is negligible. Vessel noise is a distinctive sound, particularly at times when there are few other anthropogenic sources of noise. For a vessel approaching and leaving a receptor at its cruising speed, the noise will gradually increase and then diminish and is unlikely to cause annoyance unless a person is particularly sensitised to it.</td>
<td>The conservative assumptions and worst case scenarios predict that noise emissions from the Storm Bay off Trumpeter Bay zones will meet DPIPWE’s Requirements for the Control of Noise Emissions from Marine Farms (2001) in all scenarios in all time periods. For a vessel approaching and leaving a receptor care will be taken to avoid sudden speed changes, as the sudden onset of noise would be more noticeable. A soft start and finish when leaving and approaching bases will be adopted. The modelling and vessel noise assessments commissioned by Huon Aquaculture for the present EIS have provided the necessary tools to enable the company to monitor, assess and correct (insulate) noise levels from their vessels if and when required.</td>
<td>Noise from the lease operations will meet DPIPWE’s Requirements for the Control of Noise Emissions from Marine Farms (2001) and would not be audible from land. Noise from vessels travelling to and from the lease is highly unlikely to compromise acoustic indicator levels for environmental noise established by Tasmania’s Environment Protection Policy (Noise) but there is a potential for localised short term impacts as they leave or approach shore bases. Soft starts and finishes and maintaining a good distance from shore in the vicinity of the shore bases (adopted as SOP’s) will mitigate this risk.</td>
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<td>6.2.7 Odour</td>
<td>There are various potential low level odour emission sources on the water such as rotting feed, mortalities and sullage from the feed barges.</td>
<td>Presently odour emissions from marine based farms have not been an issue for Huon Aquaculture at any of its leases; The distance between all potential odour emissions and the shore (nearest neighbours) will increase as a result of the amendment.</td>
<td>No impacts are anticipated.</td>
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<td>6.2.8 Commercial Fishing</td>
<td>Broad effects on commercial and indeed recreational fishing includes (but is not restricted to): loss of the habitat for the target species, attraction of predators, loss of fishing grounds/area and navigation related concerns.</td>
<td>Following consultation, Huon Aquaculture has moved its original planned zones further east to provide for a minimum distance of 1.5km from the shoreline. Further movement to the east is restricted by the presence of a small rocky reef a further 1.5-2kms beyond the lease area in proposed amendment Zone 1. Huon Aquaculture will conform to all navigational requirements of MAST. In addition, Huon Aquaculture has conducted a comprehensive risk assessment of the potential navigation issues and identified mitigation measures, referred to in Section 6.2.2 and provided in Appendix F.</td>
<td>No significant negative impact on Commercial fishing is anticipated as a result of the proposed amendment.</td>
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<td>6.2.9 Recreational Fishing</td>
<td>Fish farms can through their occupation of water and therefore seafloor area occupy good fishing spots thereby reducing the amenity value for recreational fishermen. Recreational fishers would also have navigation related concerns. Fish farming can attract some fish species, both through uneaten feed and also due to the</td>
<td>Consultation with TARfish as the main representative body for recreational fishers, has indicated that the proposed lease sites is in the vicinity of well-used fishing grounds. To minimise the potential impact on the fishing grounds, Huon Aquaculture agreed to re-site the planned sub-lease locations further to the east</td>
<td>Although restricting access to some fishing which may currently occur in the area, impacts are expected to be minimal due to increased distance from shore and the retention of preferred fishing grounds in Trumpeter Bay.</td>
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<td>creation of mid-water ‘reefs’, thereby providing improved fishing grounds adjacent to the zones/leases.</td>
<td>maintaining a minimum distance from shore of 1.5 kilometres. In addition, by amending the current lease site, access to the preferred fishing grounds in Trumpeter Bay are retained. Huon Aquaculture will conform to all navigational requirements of MAST. In addition, Huon Aquaculture has conducted a comprehensive risk assessment of the potential navigation issues and identified mitigation measures, referred to in Section 6.2.2 and provided in Appendix F.</td>
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<td>6.2.10 Recreational Activities</td>
<td>The proposed zones could have an effect on: • Visual amenity for sea-based recreational activities in the area. • Safe navigation • Disturbance from work vessels, e.g., for kayakers • Restricted access to the shoreline or rocky reefs (commonly used for diving) in the region.</td>
<td>Visual impacts mitigated by Management controls and using dark grey/black coloured equipment Siting of the proposed Yellow Bluff lease will improve straight line navigation and sightlines as well as maintaining significant sea-room for recreational water-way users. Engagement with commercial fishing sectors has also influenced the siting of the proposed Yellow Bluff lease to ensure there is minimal chance for interaction. The proposed lease and amended zones represents only 0.6% of available water in Storm Bay, in that context the impact on recreational fishing is expected to be minimal.</td>
<td>The siting of the lease approximately 1.6km from shore are expected to mitigate any impact on access to shorelines and rocky reefs in the region. Use of the well-boat will greatly reduce potential fish farm boat traffic to and from the site and the wake caused from the vessel will have negligible effect on Kayakers. Visual amenity impacts are expected to be minimal for waterway users given the colour of equipment and there is expected to be no impact at sea level at greater than 1km. There is expected to be minimal impact on navigational safety however, Huon will continue to engage with regulators and the boating community to make improvements wherever possible. Huon notes that having a presence in an area has also</td>
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### RELEVANT SECTION | POTENTIAL EFFECT | AVOIDANCE AND MITIGATION | OVERALL EFFECT
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**6.2.1.11 Tourism**

Tourism is a key industry for the southern Tasmanian region and the growth of the salmon industry has provided an added attraction to the region. Huon Aquaculture regularly receives ‘drop-in’ tourists at its Hideaway Bay Farm site.

Concerns expressed from the tourism operators consulted include:
- Marine debris from farms detracting from the tourism experience
- Long-term sustainability and overall perception of the industry
- The potential for a lack of integration of the industry with local tourism initiatives

In relation to marine debris, Huon Aquaculture; has:
- A marine debris policy (AQMO130.7) that includes commitments to reduce marine debris at source and manage marine debris once in the water;
- An internal program to educate staff on how to reduce marine debris at the source, as well as practical measures like providing rope bins on all vessels.
- Will regularly undertake clean-ups as part of our commitment to reducing and removing marine debris. As an extension to its commitment to the TSIC ‘adopt-a-shoreline’ marine debris clean-up initiative the company has adopted that piece of shoreline between Cape Queen Elizabeth and Yellow Tooth to the north of Trumpeter Bay.
- Will use rope that can be clearly identified as originating from Huon Aquaculture at the zones.

In relation to sustainability and reputation Huon Aquaculture:
- Provides ongoing and current information in relation to sustainability and environmental performance via Huon Aquaculture’s web-based *Sustainability Dashboard*.

The effect on tourism following consultation and the implementation of the above mitigation measures is expected to be positive.

Huon Aquaculture will continue to work proactively and cooperatively with tourism operators for the benefit of both industries the region.

allowed the Company to actively participate in rescues of recreational boaters on a regular basis.
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<td>6.2.12 Land use and Development</td>
<td>The proposed development will have no impact on existing or future land use adjacent to the development. There will be no changes to existing or future adjacent land zoning.</td>
<td>There will be no impacts on residential activities as the development is marine based only. There will be no impacts on industrial activities, as there are no known industrial activities, adjacent to, or in the vicinity of the development. There are considered to be no impacts on commercial activities in the area, as there are no known commercial activities within the vicinity of the development. No mitigation measures are required for surrounding land use as a result of the proposed development, as there will be no impacts on surrounding land uses.</td>
<td>There will be no impacts on surrounding land uses.</td>
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Is undertaking a controlled growth strategy that will significantly reduce environmental impact through the use of new technology and farming methods as detailed in *The Future of Fish Farming Brochure.*

Is working consultatively with ENGO’s to improve relationships and deliver improved environmental outcomes.

Is proactively communicating with the local community, the wider-Tasmanian population as well as with consumers to protect and enhance Huon Aquaculture’s reputation as a sustainable farming operation producing premium salmon products.

In relation to tourism opportunities the company will continue to engage with local tourism operators to identify and act on tourism and product opportunities.
### Socio-Economic Aspects

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<td>6.2.13</td>
<td>All positive effects including:</td>
<td>No mitigation required as there are no adverse effects.</td>
<td>No adverse social or economic effects are anticipated, so no mitigation is necessary.</td>
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<td>• increased employment in the southern Tasmania area and at the Processing facilities in the north of the state</td>
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<td>• additional demand for local goods and services</td>
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<td>• filling the demand for salmon in the Australian marketplace.</td>
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8 CONCLUSION

The amendment sought will provide the basic marine farming zone and lease characteristics required to ensure the continued success and sustainable expansion of Huon Aquaculture’s operations, while minimising any significant negative effects for stakeholders or the broader public. It provides for the ongoing commercial expansion by Huon Aquaculture to exposed, more offshore sites ensuring for long term environmental and commercial sustainability through commitment to worlds best biosecurity and environmental standards. The amendment will provide for an increase of 330 hectares in Huon Aquaculture’s maximum leasable area under the Storm Bay off Trumpeter Bay MFDP, allowing the company to significantly increase production in the area.
9 REFERENCES


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