ENVIRONMENTAL IMPACT STATEMENT

TO ACCOMPANY DRAFT AMENDMENT NO.5 TO THE TASMAN PENINSULA AND NORFOLK BAY MARINE FARMING DEVELOPMENT PLAN NOVEMBER 2005

Prepared by:

tassal®
QUICK & HEALTHY TASMANIAN SALMON

GLOSSARY

ADCP	Acoustic Doppler Current Profiler
AGD	Amoebic Gill Disease
ASC	Aquaculture Stewardship Council Salmon Aquaculture Standard
CAMBA	China-Australia Migratory Bird Agreement
DPIW	Department of Primary Industries and Water
EIS	Environmental Impact Statement
EPBCA	Environmental Protection and Biodiversity Conservation Act 1999
FCR	Feed Conversion Rate
GDA	Geocentric Datum of Australia
GPS	Global Positioning System
HAB	Harmful Algal Bloom
IMAS	Institute of Marine and Antarctic Studies
JAMBA	Japan-Australia Migratory Bird Agreement
MaST	Marine and Safety Tasmania
MFDP	Marine Farming Development Plan
MFPA	Marine Farming Planning Act 1995
MFPRP	Marine Farming Planning Review Panel
PA	Planning Authority
PS	Proposal Summary
PSEG	Proposal Specific Environmental Impact Statement Guidelines
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SCUBA	Self Contained Underwater Breathing Apparatus
TSPA	Threatened Species Protection Act

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Introduction

This executive summary focuses on the most material items contained in the following Environmental Impact Statement (EIS) document; it is not a comprehensive summary of all sections of the EIS and should not be a substitute for reviewing the entire document.

Tassal is a vertically integrated company that includes freshwater hatcheries, saltwater aquaculture, processing, value adding, and retail outlets. Tassal is considered as an industry leader in sustainable aquaculture production in Australia and currently farms approximately 24 000 T of Atlantic salmon (*Salmo salar*) per annum, with all of the stock produced in Tasmania. Tassal is the largest producer of Atlantic salmon in Australia and is a publicly listed company on the Australian Stock Exchange.

As part of Tassal's ongoing commitment to environmental and social best practice, the company has gained Aquaculture Stewardship Council certification for all of its Marine Farming Operations and was recently benchmarked in the top three for sustainability reporting world-wide by Seafood Intelligence.

Tassal is in the fifth year of a partnership with WWF Australia (World Wildlife Fund for Nature). This partnership underpins Tassal's mission to sustain and improve responsible environmental practices.

2.1 Proposed Development Description

For the past six years, Tassal has been undertaking a 'South East Optimisation' plan to improve the use and management of current leases. The optimisation process aims to increase animal health and welfare, enhance fish performance and support improved environmental management and biosecurity measures. The project involves Tassal marine farms within southeast Tasmanian waterways and includes amendments to existing marine leases as well as new site developments. Over the past three years, Tassal has publically identified an area west of Wedge Island in Storm Bay for a new lease development as part of the Tasman Peninsula and Norfolk Bay Marine Farm Development Plan (MFDP) area. This proposal in Storm Bay plays a key role in the South East Optimisation Plan allowing offshore development and growth for the business to meet consumer demands in conjunction with economic benefits for one of the state's expanding industries.

This proposal aims to establish a new farming zone approximately 1.8 km west of Wedge Island. The proposed farming zone would be approximately 863 Ha containing four leases of approximately 90 Ha each. Within each 90 Ha lease, surface located marine farming equipment will be restricted to 45 Ha. Any equipment outside this 45 Ha would be at least 5 metres below the surface, as is required at the lease boundary. These dimensions allow for the establishment of a grid mooring system in exposed offshore waters with the capacity to house 16 pen bays on each of the four leases (a total of 64 pen bays).

The development of a new marine farming zone and corresponding lease areas would further complement Tassal's existing leases (MF190, MF193, MF194, MF55) within the Tasman Peninsula and Norfolk Bay MFDP and assist with meeting future projected product demands.

2.2 Stakeholder Consultation

Tassal has liaised with a number of stakeholders regarding this proposal, including (but not limited to) Tasman council, Marine and Safety Tasmania (MaST, Tasmanian Abalone Council,

Tasmanian Seafood Industry Council and Tasmanian Association for Recreational Fishing (TARFish). In addition, Tassal has conducted two separate Tasman Peninsula open day events where the public were informed of potential future plans for the area in relation to lease changes, employment, social benefits and a general overview of farming and the environment. Engagement for the proposed West of Wedge development commenced in 2014 and is an ongoing process that will not end with the completion of this Environmental Impact Statement (EIS).

2.3 Existing Environment

Storm Bay forms the entrance to the River Derwent and is bordered by Bruny Island to the west and the Tasman Peninsula to the east. Approximately 95% of Storm Bay ranges in depth from 30-85 metres. The bay is dominated by saline oceanic waters with some freshwater influences from the River Derwent, as well as intrusions of subtropical and subantarctic waters originating from the Tasman Sea and Southern Ocean respectively.

The proposed new zone for development is located in Storm Bay, approximately 1.8 km west of Wedge Island. In these exposed offshore waters, the effects of severe weather from the south are not moderated by land. The seabed is typically flat with a gentle slope towards the south and east with a general rippling effect extending across most of the substrate. Sediments are mainly sand, gravel and shell grit. The nature of these sediment types suggests that high seabed current velocities occur frequently.

Benthic infauna within the sediments is consistent with other assemblages found in south east Tasmanian waters, comprising of a diverse range of molluscs, crustaceans, polychaete worms and echinoderms. A range of epibenthic macrofaunal species (such as hermit crabs and heart urchins) also occupy areas on the seabed.

A number of listed threatened and migratory species (under the Environmental Protection and Biodiversity Conservation Act and Threatened Species Protection Act) are known to occur in and around Storm Bay. An assessment of the known risks to these species has determined that development of this new zone would not pose any significant impact to these species or require additional mitigation measures to be implemented (other than those outlined in this EIS).

There are no marine reserves within the region and the area is mainly used by larger commercial shipping and fishing vessels and intermittently during ocean yacht racing events.

2.4 Potential Effects and Their Management

The proposed West of Wedge development intends to build upon Tassal's record of environmental best practice, certification and global best practice for fish health management. The proposed development will incur an initial capital investment of $30.8 million with an additional $156 million in revenue once operations commence. 73 new operational jobs will be required to service the proposed development.

In February 2014, Tassal commissioned an independent voluntary water quality monitoring program in eastern Storm Bay, and established sampling stations in the vicinity of existing lease areas i.e. Parsons Bay and Creeses Mistake, along with a site located in the sheltered waters of White Beach and a more distant, exposed location west of Wedge Island. This provides sufficient baseline information with which to compare any potential effects from finfish farming and ensure that impacts are managed within the assimilative capacity of the surrounding environment. Tassal has engaged in discussions with regulatory and research bodies in relation to additional monitoring locations in the Storm Bay vicinity and is committed to a broadscale monitoring approach. In addition, Tassal will routinely monitor benthic health as a part of regulatory

framework and to maximise the effectiveness of sediment recovery through systematic fallowing programs.

The proposed West of Wedge development is considered to be an expansion of the Tasman Peninsula and Norfolk Bay MFDP and as such, the amended MFDP would extend further into Storm Bay than the existing MFDP boundary. Tassal has been the sole salmonid company farming in this region for many years and has substantively invested in the existing supportive infrastructure and has a deep understanding of the local community, weather patterns and ecosystem. However, no system works in isolation and Tassal recognises the future need to consider any cumulative environmental effects that may result from the development of other salmonid farming proposals in the vicinity of Storm Bay.

Tassal will comply with a staged approach to construction and operations at the proposed West of Wedge development. This is a precautionary tool to confirm the physical environment is capable of supporting operations within this exposed area, allow for personnel safety to be assessed, and ensure the environmental effects from salmon farming are not negatively impacting upon the broader marine ecosystem of Storm Bay. This also allows for the facilitation of adaptive management strategies and liaison with the regulatory authorities as further phases are considered.

Tassal will participate in any larger scale environmental monitoring by sharing their long-term monitoring water quality data, baseline survey findings, historic reef and threatened species monitoring work. The company will also make available both near and far field soluble and depositional modelling work for any future collaborative use. In addition, Tassal is committed to the development of a biogeochemical model for the Storm Bay area and will provide both information and financial support in its development.

Marine vegetation communities are relatively abundant in south eastern Tasmania however, the potential for the proposed West of Wedge development to significantly impact on marine plant communities within the area is considered low. The proposed development area is considered to be located far enough away from these communities to not adversely or significantly impact on their ecological structure and function. Tassal will continue to monitor marine vegetation assemblages in and around the Tasman Peninsula area as part of the environmental monitoring program.

With the company's transition to K-Grid design nets across a number of farming zones, Tassal has been able to reduce net cleaning activities on a scale of 3:1 when compared to the cleaning of traditional net types. Cages are now cleaned approximately 10 times per production cycle. Tassal will be utilising K-Grid design nets at the proposed West of Wedge development.

Operating in a location with high-energy conditions such as the proposed West of Wedge development site requires specifically configured feed barges, different to the 'box-type' feed barges Tassal currently uses at its leases. Two types of feed barge configurations are planned for proposed development (converted Wallaby-class lighters and a new specifically designed barge). Both of these configurations will have 'v-shaped' hulls allowing them to be reliable and stable enough to withstand the wind and wave/swell action known to occur in Storm Bay.

Amoebic Gill Disease is the main fish health issue associated with salmon farming and is an industry wide issue. It is proactively managed by continuous surveillance and freshwater bathing practices. Due to an effective selective breeding program, the number of freshwater bathes over a production cycle has significantly decreased (20%) and are expected to reduce further over the upcoming years.

Microalgal communities and jellyfish presence are continuously monitored through daily algal trawls and associated observational work on site.

Depositional modelling was undertaken as part of this EIS to assess the potential depositional zone of effect for the proposed development over a full production cycle. The results of this modelling suggest benthic impacts will be within acceptable levels allowing for nutrient assimilation.

In addition, hydrodynamic modelling was undertaken by IMAS to describe the dispersion patterns of soluble emissions from the three proposed developments – Tassal, Huon Aquaculture and Petuna. This work provides an initial assessment of the spatial extent of soluble emissions based on a particle dispersion model. This modelling will be used as a tool for the determination of regulatory broadscale monitoring locations.

Storm Bay provides a range of important habitat types for a variety of listed threatened and migratory species as well as one threatened ecological community – Giant Kelp Marine Forests. Due to the level of exposure to oceanic conditions and proximity to remote islands, seabirds, coastal shorebirds and scavengers are the dominant species. These birds use this habitat to forage and feed, or as part of their seasonal migration route. In addition, migratory seabird species are known to use the broader Storm Bay area as breeding sites.

Marine farms can have general impacts on birds ranging from habitat modification to entanglement. Tassal has stringent bird protocols with the aim of mitigating interactions with birds around marine operations. Additionally, it is expected that seal interactions will occur at the proposed leases and will be managed through active exclusion measures and approved deterrents.

Tassal's Wildlife Interaction Plan encompasses bird and marine mammal management strategies for all marine operations.

Relatively few chemicals are used at Tassal's marine sites and procedures have been implemented to manage the use of chemicals, prevent spills and respond to incidents should they occur, including effective use of on-site spill kits.

The introduction of fish cages and marine farming infrastructure will create a visual impact. A full visual assessment has been conducted by an independent expert as part of the amendment process and is included in this document. All structures and nets will comply with marine farming licence conditions in order to minimise impacts to the visual amenity within the surrounding landscape. Following discussions with MaST and Tasports, navigation impacts will be managed by regulatory compliant markers and lighting on site. Additional consultation may be required for specific yachting events.

Noise and light emissions are not expected to be a significant issue as a result of this proposed offshore development and will be maintained within regulatory limits. Tassal has established a mitigation program in conjunction with an independent expert to determine suitable equipment specifications for noise and light emissions, farm site modelling and stakeholder response management.

2.5 Conclusions

Tassal is a company committed to environmental, social and sustainable best practices in finfish aquaculture. The proposed West of Wedge development supports the sustainable ongoing operation of Tassal's existing marine farming footprint at the Tasman Peninsula and complements the transition to offshore aquaculture in more exposed locations.

The proposed development creates fish health and welfare benefits with the high-energy conditions at the site leading to the possibility of better quality products and disease reduction. The high-energy conditions also allows for better dispersion of farm emissions leading to a

smaller impact footprint on the benthic environment. Under this proposal there will be the added benefits of year class segregation, rotation of fallowing and stocking regimes and improved biosecurity across the entire Tasman Peninsula farming region (Eastern Farming Zone).

An adaptive management framework will be adopted for the proposed development, which will encompass all current monitoring requirements and management practices in conjunction with continued environmental monitoring and any new regulations. Tassal is also committed to the development of a biogeochemical model for the Storm Bay area and will provide both environmental information and financial support in its development.

Tassal's goal is to remain a long term, sustainable and reputable company in Tasmania. The company has a recognised ability to work with stakeholders and has invested heavily in its people, environmental management and compliance as well as third party certification processes in order to gain the confidence of the State and the Tasmanian public.

3 Proposed Amendment Description

3.1 Proposal Overview

Tassal proposes a draft amendment to the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan (MFDP) November 2005 to establish a new marine farming zone approximately 1.8 km west of Wedge Island (WOW). The proposed zone would be approximately 863 Ha containing four marine farming leases of approximately 90 Ha each. Within each 90 Ha lease, surface located marine farming equipment would be restricted to 45 Ha.

The draft amendment also proposes to amend the plan area of the MFDP, to allow the proposed plan area to wholly contain the proposed zone.

The development of a new marine farming zone and corresponding lease areas would further complement Tassal's existing leases located at Nubeena and Port Arthur within the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan and assist with meeting future projected product demands.

The planning process being undertaken with this draft amendment is one of three marine farming developments that is currently proposed for Storm Bay. Storm Bay is identified in the Government's draft Sustainable Industry Growth Plan for the Salmonid Industry as a priority area for expansion of salmonid farming. Opportunities in this area are also being explored by the other major Tasmanian salmonid producers: Huon Aquaculture Company Pty Ltd and Petuna Aquaculture Pty Ltd.

The Government has indicated an initial combined maximum level of production of approximately 40,000 tonnes per annum for all existing and proposed salmon farming developments within Storm Bay, and the potential environmental effects of approximately 40,000 tonnes per annum is being considered in the environmental impact statements that support these planning processes.

The Environment Protection Authority (EPA), which is the environmental regulator for finfish, has indicated that, should the proposed developments proceed, feed inputs will initially be limited to provide for approximately 30,000 tonnes of production annually. This staged approach towards 40,000 tonnes of annual production would provide the opportunity for assessment of environmental responses.

The primary management tool proposed by the EPA to control the amount of salmon produced within the existing Nubeena farming region and the proposed WOW development, is through a Total Permissible Dissolved Nitrogen Output (TPDNO). Tassal's proposed TPDNO allocation (688.5 tonnes) represents 30% of the total industry-wide TPDNO allocation considered for all proposed finfish developments within Storm Bay.

Tassal is committed to adopting a staged approach to salmon production at the proposed WOW development (in consultation with the DPIPWE and EPA) to ensure there is evidence that the physical environment is capable of supporting operations within the region. As such, Tassal proposes to operate at a production capacity which reflects a more conservative approach within the existing Nubeena and proposed WOW development sites. Tassal will undertake a range of environmental monitoring and modelling studies prior to any consideration of operating at its full TPDNO allocation.

Initially, Tassal will maintain production for the existing Nubeena sites and proposed WOW development site at approximately 75% of its total TPDNO allocation (i.e. 516.4 tonnes of

nitrogen). This is in line with the initial proposed industry-wide expansion limit of 30,000 tonnes salmon production (per year) prior to any EPA process in the future that may consider and approve utilisation of the full TPDNO allocation (based on 40,000 tonnes of production) within Storm Bay.

Stocking at the proposed WOW development site will occur gradually, accounting for approximately 30, 60 and 75 percent of the total production across the existing Nubeena sites and the proposed WOW site in the first three years (see Table 1).

Table 1 Indicative staged stocking at the West of Wedge (WOW) development site in Storm Bay

Year	Smolt Input WOW*	Approximate Production (t HOG) WOW	Dissolved N (t) WOW	Total Dissolved N (t) Existing Nubeena & Proposed WOW	Assumed TPDNO (t)
1	550,000 – 625,000	2600	150	≤516.4	516.4
2	900,000 – 1,300,00	5200	300	≤516.4	516.4
3	1,400,000 – 1,700,000	7000	400	≤516.4	516.4

*The exact smolt input numbers may vary depending on growth rates, production scheduling and environmental conditions. However, Tassal will comply with its TPDNO allocation for the proposed West of Wedge development and existing leases at Nubeena.

This EIS presents the proposed development as functioning at full operational capacity, should formal approval be given by the regulatory authorities (EPA / DPIPWE) based on the results from the environmental monitoring and modelling studies undertaken as part of the staged development approach. This approach provides the reader with a clearer understanding of the potential scale of operations that Tassal considers would represent a sustainable long-term proposition for production with the region.

3.1.1 Proponent Details

Tassal Operations Pty Ltd., 30 Waterworth Rd, Margate TAS 7054.

Tassal is a vertically integrated company that includes freshwater hatcheries, saltwater aquaculture, processing, value adding, protein rendering, product sales and marketing. Tassal is the largest producer of Atlantic salmon (*Salmo salar*) in Australia and is a publicly listed company on the Australian Stock Exchange.

Tassal was established in 1986 with the installation of marine infrastructure in Port Esperance and a hatchery in Tasmania's Central Highlands. The company's first harvest was 53 tonnes of Atlantic salmon. Over the most recent 10 years of trading, Tassal has demonstrated strong financial performance and has steadily grown the value of its business. Annual harvest yields are now approximately 24,000 tonnes and staff employment numbers are over 1,100 people, 90% of whom are based in Tasmania.

Tassal is committed to transparency for the benefit of all its stakeholders and the community, and has voluntarily released five sustainability reports to communicate linkages between the environmental, social and economic elements of its business activities. This will continue on

an annual basis; Tassal's fifth sustainability report has been made publicly available on the Tassal website and as Appendix I.

Tassal has been in partnership with WWF Australia (World Wildlife Fund for Nature Australia) since 2012. This partnership underpins Tassal's mission to continually improve environmental practices throughout its operations. This partnership agreement has been renewed until 2020, demonstrating a long-term commitment by both partners to continue to set the benchmark for world's best practice aquaculture and maintaining environmental stewardship as a key component in the company's future success.

In 2014, Tassal achieved full certification for all of their Marine Farms in Tasmania to the Aquaculture Stewardship Council (ASC) Salmon standard. Tassal will continue to meet and exceed the ASC standards for international best practice which addresses the following seven principles:

- Legal compliance
- Preservation of the natural environment and biodiversity
- Preservation of water resources and water quality
- Preservation of diversity of species and wild populations
- Monitored and responsible use of animal feed and other resources
- Animal health and welfare
- Social responsibility

Tassal has also achieved ASC Chain of Custody certification across their primary and value add processing facilities.

Tassal holds current marine farming licences in four different Marine Farming Development Plan (MFDP) areas throughout Tasmania (D'Entrecasteaux Channel, Huon Estuary and Port Esperance, Tasman Peninsula and Norfolk Bay and Macquarie Harbour). Tassal's marine farming operations are incorporated into four farming zones: Southern, Channel, Eastern and Western. The Southern Farming Zone includes the marine leases in the Dover and Huon farming regions; Channel Farming Zone includes leases in North West Bay and Bruny farming regions; Eastern Farming Zone includes leases in Tasman and East Coast farming regions; and Western Farming Zone includes all leases in Macquarie Harbour.

3.1.2 Proposed Development

This proposal is to establish a new farming zone approximately 1.8 km west of Wedge Island and amend the Tasman Peninsula and Norfolk Bay MFDP area to encompass this development. The proposed farming zone area would be approximately 863 Ha containing four leases of approximately 90 Ha each of which surface located marine farming equipment will be restricted to 45 Ha (see Figure 3.1). These dimensions allow for the establishment of a grid mooring system with the capacity to house 16 pen bays on each of the four leases (a total of 64 pen bays).

The development of a new marine farming zone and corresponding lease areas would further optimise Tassal's existing leases (MF190, MF193, MF194, MF55) within the Tasman Peninsula and Norfolk Bay MFDP and assist with meeting future projected product demands.

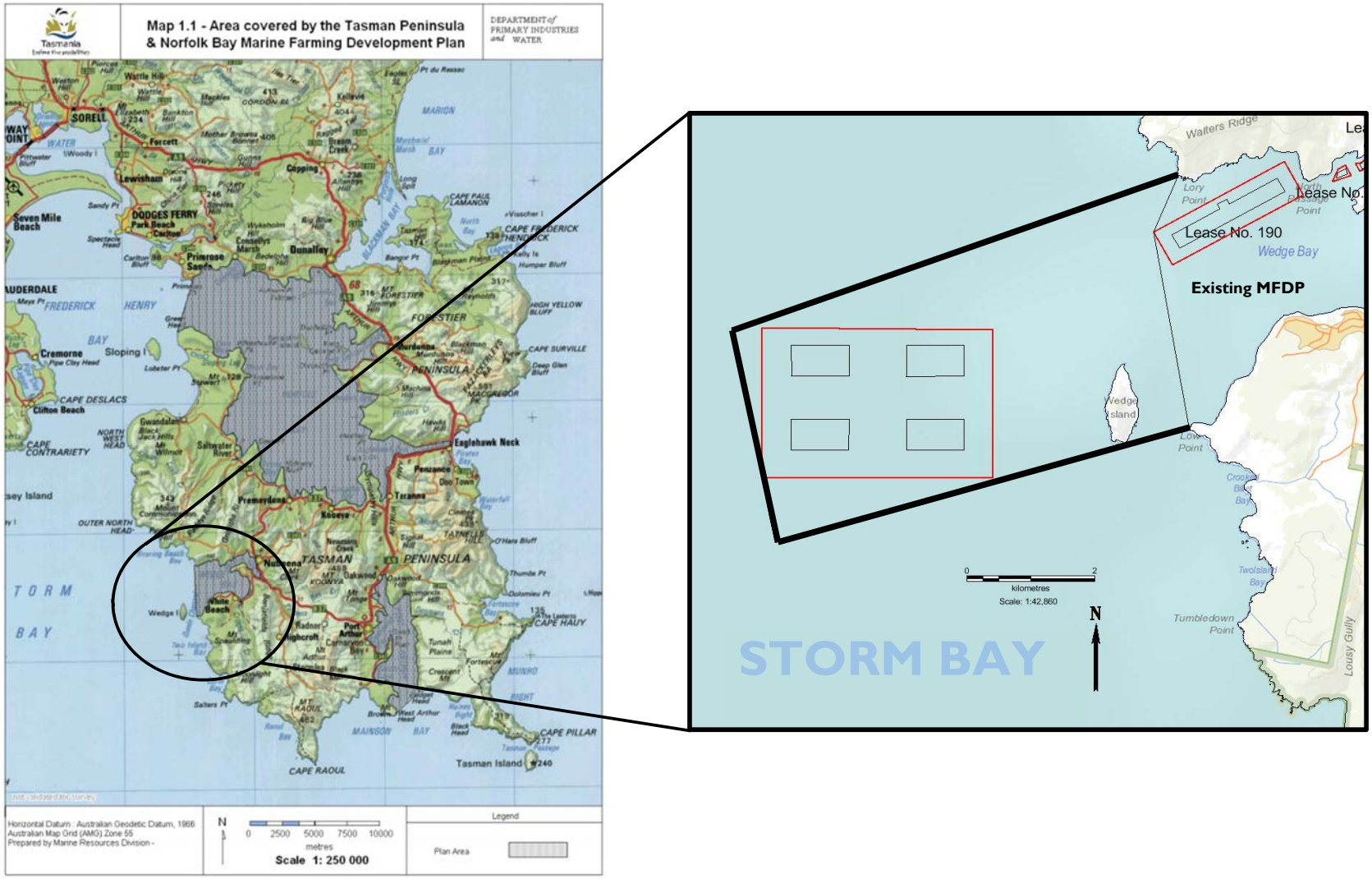


Figure 3.1 Tassal's existing Eastern Farming Zone and proposed West of Wedge development with proposed amendment to Tasman Peninsula and Norfolk Bay MFDP area (outlined by thick black line), the red line depicts the marine farming zone and the thin black line depicts the 45 hectare areas that may contain surface infrastructure.

3.1.3 Rationale / Need for the Proposal

To meet Tassal's development targets based on the projected demand for product into the future and to mitigate biosecurity risks through increased geographical separation, Tassal must explore the potential for developing additional lease areas around the State. The Huon Estuary and D'Entrecasteaux Channel MFDPs are already subject to management controls on dissolved nitrogen introduction from salmonid farming operations which limits their production to current farming levels.

Tassal is therefore seeking to formalise offshore/exposed salmonid production at a site approximately 1.8 km to the west of Wedge Island in Storm Bay. It is intended that these marine leases form part of Tassal's Eastern Farming Zone, and as such, the leases would be serviced from the existing Nubeena land base at Badger Cove.

3.1.4 Anticipated Establishment Costs

Tassal will be required to purchase mooring and other farming infrastructure (including newly built vessels) for the proposed West of Wedge development (Table 2). As Tassal will be implementing infrastructure and operations in a staged approach, the estimated initial costs are expected to be approximately $30.8 million.

Table 2 Approximate costs predicted with the proposed West of Wedge development

Item/Infrastructure	**Cost** **(*note: these costs are approximations for initial phase operations and infrastructure)**
Cage/farm infrastructure	$ 17.5 million
Nets	$ 8.8 million
Vessels	$ 4.5 million

3.1.5 Existing and Likely Markets for Product

Demand for seafood and farmed salmon consumption has been growing globally and nationally for over a decade. The majority of Tassal's production is sold domestically and internationally exported (see Figure 3.2). Growth in these markets, particularly the Australian domestic market, has resulted in opportunities for increased production. These opportunities on the domestic market have also been enhanced by a decreasing supply of seafood sourced from wild capture fisheries.

Tassal Atlantic salmon is available in fresh and frozen whole, fillets, sliced hot and cold smoked salmon portions, value added portions and canned. Tassal products can be found in fresh fish shops and supermarkets throughout Australia and internationally.

Tassal has an experienced sales and marketing department located in Melbourne and operates two successful, dedicated salmon shops in both Hobart and Melbourne. In 2015, Tassal acquired De Costi Seafoods, providing direct access to wholesale markets and a direct market link to supply chains and a more extensive network of seafood distribution domain.

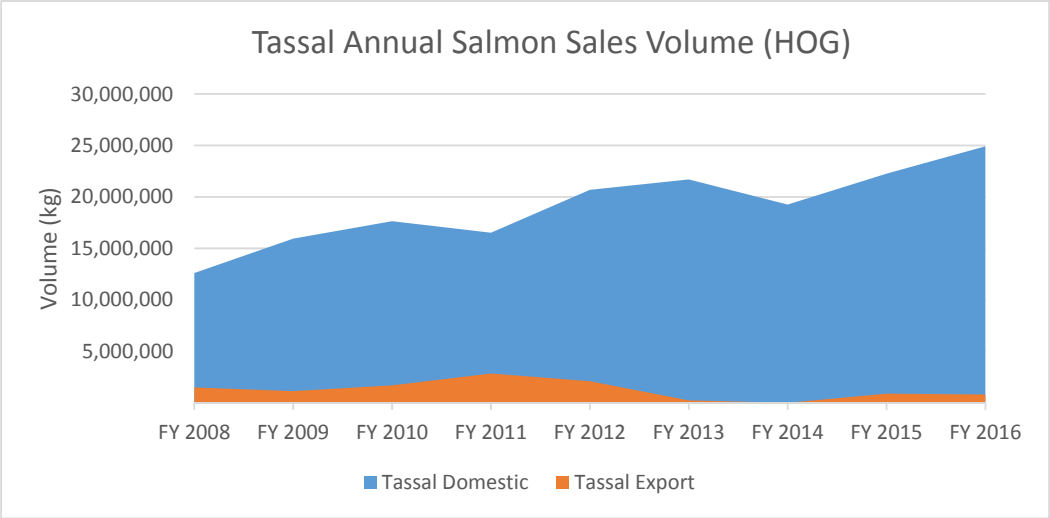


Figure 3.2 Tassal's annual salmon sales volume ('000 Head on Gutted [HOG] kg)

3.1.6 Relationship to other Proposals/Developments

This proposal is to establish a new farming area west of Wedge Island with an amendment to the Tasman Peninsula and Norfolk Bay MFDP boundary to include this new farming area.

Tassal has been working to optimise their existing leases and explore opportunities for new farming areas in the south east of the state through Tassal's South East Optimisation Project. This project has brought together research bodies, industry and external consultants to examine the potential realignment and reconfiguration of existing leases. This larger project primarily aims to:

- optimise fish health and welfare
- optimise growth and survivorship
- mitigate environmental impacts by correct siting of marine farming operations
- allow for future biomass increases with improved farming and environmental performance

Tassal has successfully completed the majority of this optimisation project, however the next phase involves a natural progression to develop in higher energy sites.

As part of the South East Optimisation Project, Tassal has recently had an amendment approved to MF190 Creeses Mistake. This amendment was in relation to removal of Management Control 3.14.9 in order to align with best practice broadscale monitoring. This modernised approach to regulation supports Tassal's ASC certification and allows Tassal the added flexibility to stock more fish within the Tasmanian south east region based on continual improvement in farming performance and the use of sound ecological management principles.

Tassal's Eastern Farming Zone (encompassing the Tasman and East Coast farming regions) has been identified to stakeholders as the 'growth zone' for the company. The Eastern Zone includes both offshore and existing site amendment opportunities for expansion and company growth within the state.

Tassal's strategic plan for growing farmed salmon in Storm Bay is also benefited by an extensive local land base and infrastructure within the Tasman Peninsula area. This supporting infrastructure includes

access to fresh water assets, additional smolt capacity from the development of Rookwood II hatchery, and importantly access to 82% of the selective breeding program which allows for 100% of commercial production to enjoy the benefits of selected amoebic gill disease (AGD) resistance. This increased resistance has resulted in a 20% decrease in freshwater baths to date which is expected to decrease further by the time salmon are placed into these offshore waters for the grow-out phase.

Tassal has also recently invested in a new feed delivery vessel and a separate harvest vessel which can easily accommodate the proposed site in Storm Bay. The increased volumes of the Storm Bay development at Wedge Island will be marketed and sold through Tassal's well developed and accomplished sales and marketing team. Tassal's marketing efforts combined with their sustainability and certification initiatives continues to promote increased domestic consumption and international demand for product.

Tassal currently has marine lease 55 (MF55) Long Bay within Port Arthur on the Tasman Peninsula. This existing marine lease is currently active and was stocked with smolt in 2017. This lease was last actively farmed 10 years ago.

As stated previously, the modernisation of water quality regulation within growing areas around the state will allow the added flexibility to stock fish within a farming zone based on sustainable management principles.

Tassal has been undertaking broadscale water quality and macroalgal/rocky reef monitoring within the Eastern Farming Zone since 2014. It is Tassal's intent to continue with this type of broadscale monitoring for the entire Eastern Farming Zone, including the Port Arthur lease and the developing West of Wedge proposal.

Monitoring performance of the surrounding marine environment (i.e. water quality, nutrients, phytoplankton and rocky reef communities) at the broadscale level represents best practice environmental management and aligns with the Aquaculture Stewardship Council (ASC) accreditation requirements for certification to the ASC Salmon standard.

This form of monitoring provides a more effective and flexible means of managing and understanding the environmental impacts from finfish farming. Tassal is considering the use of trigger values for key environmental indicators as the most appropriate means for managing and understanding the nature and extent of these impacts.

3.1.7 Socio-Economic Benefits

The proposed West of Wedge development will produce benefits in the socio-economic sphere during both construction and operational phases. During the construction phase there will be a $30.24 million increase in outputs across all Tasmanian industries with a Gross State Product boost of $9.7 million. There will be potential for 101 jobs across industries (71 of which will be full-time) representing $5.3 million in wages.

During the operational phase, there will be a $246 million increase in output across all Tasmanian industries, with a $103 million boost to the Gross State Product. 907 jobs (661 full-time) will be generated across industries representing $33 million in wages.

The proposed development will incur an initial capital investment of $30.8 million and will generate a total of 73 new operational jobs to service the proposed development.

3.2 Proposed Plan Area

3.2.1 Proposed changes to Plan Area

The proposed West of Wedge development would require an amendment to the Tasman Peninsula and Norfolk Bay MFDP area (see Figure 3.1). The proposed amendment would extend south westerly in direction from Lory Point to a point to the west of the proposed farming zone (E548579.77, N5225229.02, Zone 55 GDA94), from here the proposed area would then extend to a southern point(E549241.73, N5221792.42, Zone 55 GDA94), before extending in a north-easterly direction to Low Point.

3.3 Proposed Zone and Lease Details

3.3.1 Location of Proposed Zone

The proposed zone is approximately 1.8 km to the shoreline west of Wedge Island at its closest point. The location of the proposed zone is shown in Figure 3.1 and Appendix 2.

The closest finfish lease is MF190 Creeses Mistake which is approximately 3.3 km to the northeast of the proposed zone and operated by Tassal Group.

Tassal's land-based infrastructure at Nubeena is 7 km by water from the proposed zone.

3.3.2 Proposed Zone Area

The proposed Zone is 2.4 by 3.6 km (approximately 863 Ha) with a maximum leasable area of 360 hectares of which surface located marine farming equipment will be restricted to 180 Ha (four leases of approximately 90 hectares of which surface located marine farming equipment will be restricted to 45 Ha).

The total zone area is necessary to install the mooring infrastructure in water of this depth (approximately 40-50 m). The scope in the mooring system is designed to accommodate the wave action and exposure within Storm Bay. This determination was made through the work Tassal commissioned for the site in conjunction with research conducted at the site over the past three years and historic datasets.

3.3.3 Location of Proposed Lease

The proposed leases will have an orientation of east/west, running parallel to the shoreline of Wedge Island as shown in Figure 3.1 and Appendix 2.

The proposed zone may comprise of four leases approximately 90 hectares of which surface located marine farming equipment will be restricted to 45 Ha with a total lease area of approximately 360 hectares which surface located marine farming equipment will be restricted to 180 Ha. Each of the four 45 hectare areas will have dimensions of 500 m in width and 900 m in length for the location of marine farming equipment on the surface. These dimensions are required to house the proposed 16 pen bay grid mooring system in each of the four leases (total of 64 pen bays).

3.4 Infrastructure and Servicing

3.4.1 Mooring and Grid system

The proposed mooring arrangement will be individual grid mooring systems on each of the four leases to cater for the 168 m circumference polar circle cages and feed barges (Appendix 12).

A local Tasmanian company will install the 16 bay grid system at each of the four proposed leases. Independent mooring configurations will be used to secure the feed barges on each of the four leases. The proposed system has undergone engineering design based on a technical report by Aquastructures in accordance with NS 9416:2003, an internationally recognised standard for mooring system infrastructure design. There was also a secondary engineering report completed by Aqualine through their Norwegian based research facility.

As previously mentioned, the proposed zone dimensions will be 2.4 km by 3.6 km, and the four 45 hectare areas within this zone will be 500 m by 900 m each for the location of marine farming equipment on the surface.

Coordinates for all lease and zone area boundaries are shown in Appendix 2.

All specifications for the four mooring grid systems have been developed as part of the research Tassal has conducted at the proposed site over the past 2-3 years. This includes specifications for mooring block, chain and rope rated to the conditions at the site. Tassal supplied environmental data for the site including:

- wave history throughout Storm Bay and wave data specific to the site
- ADCP current flow data from the site and other areas within the region
- wind forcings and related information
- depth and bathymetry information at the site
- sediment characteristics and other information to support engineering modelling concepts

The Table 3 summarises the environmental variables relevant to the proposed West of Wedge development.

Table 3 Summary of environmental variables relevant to the proposed West of Wedge development

Environmental variable	West of Wedge
Wave height	Max. significant = 6.18 m
Combined sea/swell wave height	Excess of 12 m
Wind forcing/speed	N through to W/SW; small portion from E. Average – 20-40 km/h
Current speed (peak)	1.2 m/sec
Current direction	Bi-directional – NW/SE
Depth	40-50 m
Substrate habitat	Ridged sand with shell grit

*For more detailed information regarding these parameters, refer to section 5.1 of the EIS.

From this information an international expert team has configured the recommended grid systems for the proposed leases. With the progression into more exposed and offshore waters, this comprehensive assessment was required to satisfy the company risk profile associated with a significant investment in this area.

3.4.2 Size and Configuration of Sea Pens/Netting

The cages will be 168 m circumference plastic cages. The nets will have a side wall of 10 m, with the deepest part of the net, reaching approximately 20 m, giving a total volume of approximately 30 000 m^3.

Wildlife exclusion is a critical aspect of contemporary marine farming practice within south east Tasmania. Tassal's exclusion technology of choice includes a combination of seal proof bird nets and K-Grid nets. In addition, all cage netting is heavily weighted to strengthen the configuration to provide protection against seal predation. The above water surface portion of each cage is covered by a bird net with a mesh size of less than 115 mm and high tensile makeup to prevent seals entering cages through this area of the structure.

Net technology utilised at the proposed West of Wedge development will be K-Grid nets, constructed by the local company Nets Tasmania, from the internationally manufactured K-Grid netting technology. Tassal installed the first K-Grid net in October 2014, and currently has 31 nets deployed. No seal breaches have occurred with the use of this netting. Appendix 3 shows a photograph of K-Grid netting.

The netting is made of a high tenacity knotless resin treated weave that is heat treated providing a smooth strong surface. Robust and stiff in construction, the nets provide advanced predator exclusion measures.

Cage nets at the site will be inspected by divers at least once a week and above surface inspections of structures including bird and fish nets are inspected daily when weather permits. Moorings will be subject to periodic inspection by divers and/or ROV, and additional inspections of all above mentioned may be instigated following storm events. Tassal is also in discussions with the Australian Maritime College (AMC) in relation to the deployment of Automated Underwater Vehicle (AUV) technology for structural integrity inspections on a routine basis. This customised operation is looking at the potential to be launched from the shore base in at Badger Cove on a predefined Global Positioning System (GPS) grid track of the proposed zone. This form of technology will have the potential to collect water quality data, inspect net and cage structure configurations with mooring array information - all GPS corrected to ensure positioning, alignment and functionality of equipment. This information and data from emerging technologies will be used to assess the offshore site without compromising staff safety in unfavourable weather conditions.

3.4.3 Construction Aspects

Construction associated with the installation of the four mooring grids into the proposed lease areas is expected to take approximately four months, weather permitting. The proposed plan is for the West of Wedge moorings to begin installation in autumn 2019.

During the installation of the mooring system, buoyed trip lines marking mooring blocks would be deployed in the buffer area between the lease and zone boundaries. A Notice to Mariners would be issued to advise of the potential hazard associated with this activity and corner markers would be temporarily deployed to mark the zone corners with adequate spacing of intermediate markers in line with requirements from consultation with Marine and Safety Tasmania (MaST) and Tasports.

Mooring deployment would require the use of large workboats with cranes to lift and deploy mooring blocks and anchors. Constructed cages would be towed to the site once mooring infrastructure used to house this equipment is established.

Cages are constructed by Plastic Fabrications, Prince of Wales Bay, or Mitchell Plastic Welding, Port Huon. After construction they will be towed to the proposed Leases. Biosecurity and introduced marine species risks will be managed through existing company protocols during the construction phase and movement of cages, as discussed in section 3.4.5.1.

3.4.4 Servicing the Proposed Zone

Servicing of the proposed West of Wedge development would follow the same pattern as other sites across the south-east of the state. Work crews would access the site from the land base at Badger Cove and existing Eastern Farming Zone leases. On a typical day the lease would be accessed by up to eight vessels, including work barges, a dive vessel, and general purpose/works crew vessels. The type of vessels accessing the site is generally depicted by the work scheduled at the site on a given day. It is very unlikely that all vessels used at the newly developed leases would be at any one site simultaneously.

The number of trips and types of vessels to be used are detailed in Table 4.

Table 4 Vessels to be used by Tassal to service the Eastern Farming Zone

Vessel	Activity	Frequency
Royal Whistler	Farm Works	5 trips per week
Royal Wedge	Farm Works	5 trips per week
Persistence	Farm Works	7 trips per week
Jack Sparrow	Dive Tender	Up to 4 trips per week
Royal Pusher	Works Barge	3-5 trips per week
Endeavour Two	Farm Works	5 trips per week
Royal Pillar	Farm Works	5 trips per week
Dynamic	In situ net cleaning	3-4 trips per week
Stealth	Wildlife Management	1 trip per week
The Ebenezer	Feed Delivery	1 trip per week

- It should be noted that this is indicative and existing fleet vessels are named here for simplicity. In reality there will be a requirement for approximately 12 newly built vessels to be built within the state to service this newly developed farming area. The vessels will be identical to those listed here in make and design.

Working hours at the site will be between 0600 to 1900 in the summer and 0700 to 1700 in the winter. Security patrols may visit the site outside of these hours and spot lights may be used intermittently during these patrols. With any patrols that may occur all noise and light disturbance protocols will be followed.

The equipment and infrastructure required to support this proposal will be the same as at other actively farmed Tassal leases. The size and specifications of infrastructure does differ for site to site, but generally one feed barge, coupled with feeding infrastructure and cages are deployed within a lease area.

Feed barges

For feeding operations to the proposed West of Wedge leases, Tassal will use permanently moored feed barges within the lease areas. To allow for fallowing practices, only three leases will be stocked at any one time meaning only three barges will need to be located within the proposed development (Note: for the purposes of the EIS Appendix 12 illustrates four barges, one at each lease).

Due to the high-energy conditions likely to be experienced at the proposed location from time to time, the barge configurations will require to be slightly different in dimensions to the 'box-type' configurations that Tassal commonly use at other leases, they are however, of similar size (length) to the existing barge at Tassal's Sheppards lease in the D'Entrecasteaux Channel. Two feed barge configurations are planned for the proposed development:

Converted lighter vessel

Tassal has procured two Wallaby-class lighters that could be converted into permanently moored feed barges. These vessels are between 38-40m long; 9-10m wide; and 8-9m high. They have 'v-shaped' hulls making them reliable and stable to withstand the swell/wave action at the proposed West of Wedge location.

Specifically designed West of Wedge barge

Tassal will also commission the construction of new specifically designed barge in conjunction with the converted lighters to service the proposed West of Wedge development. Principal dimensions for this vessel would be 35-36m long; 10m wide; and 8-9m high. This vessel would also have a 'v-shaped' hull to accommodate for the high-energy conditions at the proposed development.

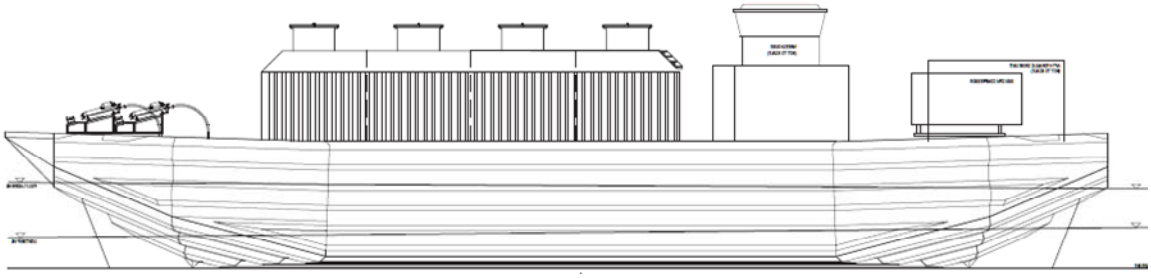
Conceptual diagrams of the two planned feed barge configurations can be seen in Figure 3.3. The colour of the feed barges for the proposed West of Wedge leases are yet to be determined, but will be in line with licence requirements for the offshore site. Traditionally, Tassal feed barges are grey in colour.

All three barges would be moored in a north-south orientation (bows of barges would face south) in order to withstand the prominent wind and wave/swell action (Appendix 12). Each barge will contain a centralised feed system, feed storage, generators and amenities for the work crew. Facilities would consist of an operator station and mess area, with kitchen and toilet facilities. Each barge would normally operate in daylight hours; i.e. working hours as stated previously when each lease is in operation. The position of barges will be central to the mooring and feeding systems. Waste from the amenities will be pumped to a holding tank on each barge, and then collected by the service vessel for approved disposal on-shore.

Each feed barge will be customised with additional sound proofing to mitigate noise emissions from the generators and feeding system. Noise mitigation apparatus is designed and built to exceed marine farming licence conditions, lessening the level of noise reaching receptors within the surrounding areas. With any application for the deployment of a newly constructed feed barge in a marine farming lease, the Department of Primary Industries, Parks, Water and Environment (DPIPWE) requires noise modelling to be undertaken to ensure compliance with regulatory provisions prior to deployment.

Feed barges may also house a venturation compressor that is used to improve water circulation within pens during low dissolved oxygen events as well as to address issues with harmful jellyfish and algae. These systems are in place to mitigate the risks associated with these naturally occurring events.

a) Converted Wallaby-class lighter



b) Specifically-designed feed West of Wedge feed barge

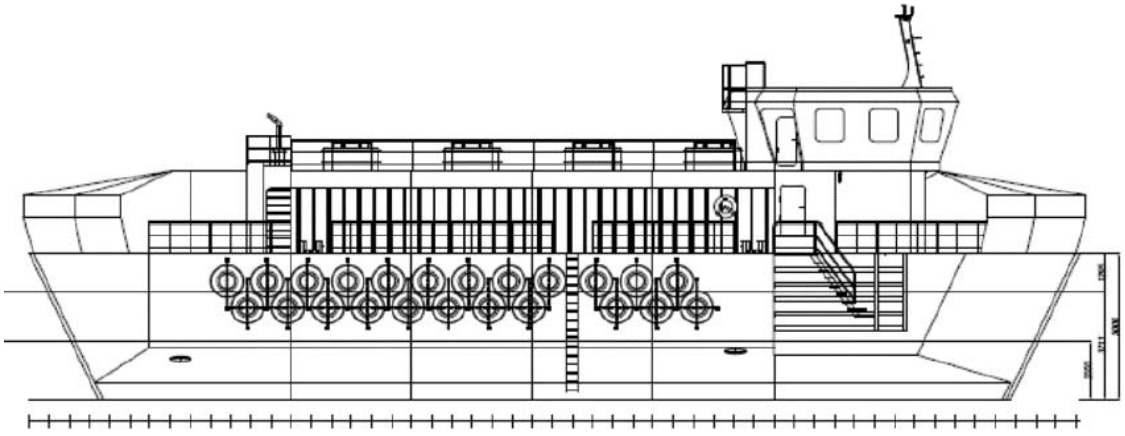


Figure 3.3 Conceptual feed barge configurations for the two designs planned for the proposed West of Wedge development; a) converted Wallaby-class lighter – top image is before conversion; bottom image is concept schematic of converted vessel; b) conceptual schematic of specifically designed feed barge.

Tassal has engaged a third party consultant to undertake an independent noise level survey of proposed operations at the site and has determined that all equipment utilised in day to day activities within their leases have an average L_{eq} (sound pressure level) >55 dBA at 30 m. Noise levels, in a worst case scenario, are modelled to be 34 dBA at the nearest residences which is within the Environmental Protection Authority (EPA) night time noise requirement of 35 dBA. A more detailed assessment of noise impacts from the proposed West of Wedge development is described in section 6.2.6 and Appendix 4.

Marine farming equipment will be marked in accordance with regulatory requirements and as required by DPIPWE and Marine and Safety Tasmania (MaST). Generally, boundary markers are IALA special markers, which and deployed as at all operational Tassal leases as boundary corner markers. Tassal is also in discussions with commercial operators and MaST in relation to increasing the height of the special markers at this site. This was raised during consultation with other waters users as increasing the safety of navigation around the proposed offshore site and increasing overall visibility of the proposed farming development.

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 to the proposed zone where possible.

As with all Tassal marine leases in southeast Tasmania, salmon stock on the lease will periodically require bathing in freshwater to control gill amoeba. Bathing involves towing a cage filled with freshwater contained in a tarpaulin liner from the fill station to the lease area. The freshwater used to service the proposed West of Wedge development will depend on water availability with the most likely resource being the existing company dam infrastructure for the Eastern Farming Zone at Badger Cove.

Typically each year class of salmon requires bathing approximately eight times during its seawater growth. This figure is reducing due to advances in the selective breeding program; the bathing frequency has been reduced by 20% in the latest year class across the company, with a target of five bathes by 2018. To support this goal, Tassal has developed internal business intelligence functions to closely monitor bathing frequency as well as supporting collaborative research programs with the CSIRO on ways to reduce exposure to amoebic gill disease.

The salmon stock for grow out will be entered over a period of time via a barge vessel. Normal fallowing regimes would be maintained subject to the range of environmental factors present at the site.

Harvesting of the lease would be by direct harvest onto Tassal's dedicated harvest vessel. The fish are killed humanely using an automatic percussive stunning system, and immediately chilled in refrigerated sea water. The system is designed to minimise stress during the harvesting process and optimise the quality of the product. This harvest system is in line with animal ethics, environmental and food quality and safety certifications and regulation. For a list of certifications refer to page 99 of Tassal's Sustainability Report (Appendix 1).

3.4.5 Infrastructure Maintenance

Major net maintenance is carried out on land at Dover and Port Huon, with minor repairs (such as bird net maintenance or sub-surface holes in-situ) being carried out by divers in the farming zone.

Routine vessel maintenance would be undertaken at Badger Cove with larger projects resourced through Tassal's marine operations head office at North West Bay.

The average lifespan of farming infrastructure is summarised as;

Moorings 5 - 6 year replacement

Nets 5 - 6 year replacement

Cages 8 - 9 year replacement

As Tassal now uses in situ net washer technology on a routine basis, much of the pressure has been relieved from the land base used for net maintenance. Routine in-situ maintenance is also regularly used for net and rigging inspections. Bird nets and other surface infrastructure are inspected daily when weather permits.

Cage nets are inspected by divers at least once a week and during routine in-situ net cleaning operations. Moorings are subject to periodic inspection by works crews and subsurface inspection by divers and/or remotely operated vehicle (ROV) with additional inspections instigated following storm events.

Tassal's third-party certification of systems and operations (ASC) includes maintenance/storage and disposal of farm supplies. Certification and auditing such as this ensures that the highest standard is met regarding the storage and disposal of farm supplies (fuels, chemicals and lubricants included). This also requires that waste is disposed of in a responsible manner including development of company-wide recycling programs and waste reduction plans.

3.4.5.1 Disease management and equipment translocation

The Tasmanian Salmon industry have a biosecurity agreement – Tasmanian Salmonid Growers Association (TSGA) Biosecurity Program (Appendix 19) – which is signed by all Tasmanian salmon companies.

The TSGA Biosecurity Program addresses the aims of prevention, detection, control and response to disease through a management systems approach. The individual companies support this program through company-specific biosecurity and fish health management procedures, guidelines and protocols.

Tassal has implemented a Farm Disease and Biosecurity Protocol, covering all aspects of marine operations for the company. The protocol introduces two biosecurity statuses: normal and red. Red is full damage control in response to a major fish loss due to infectious disease. A red status results in all resources being utilised to produce a coordinated response to minimise fish fatality and control the associated problems of disease spread to naïve stocks or regions. This is characterised by timely mitigation and mortality disposal and encompasses legislative requirements to notify government agencies as defined in the Australian Aquatic Veterinary Emergency Plan (AQUAVETPLAN).

As prescribed in the Tassal Farm Disease Management and Biosecurity Protocol, all hand and cage nets, cages, feeding barges, harvesting and farm equipment are to be disinfected before translocating to another biosecurity zone. This disinfection can be through the use of proprietary branded disinfection products and/or thorough cleaning of all equipment. Cross-contamination in transit and storage must also be considered when moving or storing equipment from different biosecurity zones.

Tassal has also worked with the shellfish industry in relation to preventing the spread of Pacific Oyster Mortality Syndrome (POMS) through their operations state-wide.

3.5 Stock Husbandry Aspects

3.5.1 Fish Size / Stocking Density

The species to be cultivated within the proposed zone west of Wedge Island will continue to be Atlantic salmon. Stocking controls will comply with the provisions described in the Tasman Peninsula and Norfolk Bay MFDP as well as specific licence conditions relating to this proposed development as stipulated by the regulatory authority.

As part of the proposed staged approach to developing the proposed leases at West of Wedge, Tassal will gradually allocate increasing amounts of its existing TPDNO allocation (516.4 tonnes) to the new sites at West of Wedge.

Tassal's initial production at the proposed West of Wedge site will be based on the following emission levels (soluble nitrogen) to support this staged development:

Year 1 – 150 tonnes

Year 2 – 300 tonnes

Year 3 – 400 tonnes

This approach will be adopted to provide a preliminary assessment of how the physical conditions of such a remote site impacts upon farming infrastructure and fish performance. In addition, a lower, conservative approach to stock input will also enable an assessment of how the environment responds to the impacts of fish farming at a reduced scale of farming.

When fully operational, and should the results of the initial monitoring and modelling studies suggest that the physical and environmental conditions are considered suitable for an increased level of production, additional fish may be introduced annually for each growing cycle. The proposed zone will only ever support two consecutive growing cycles within the four lease areas. Any increase in production over the proposed initial industry-wide cap of 30,000 tonnes per year will require formal approval from the regulatory authority.

Tassal manages fish inputs within the broader south east regional requirements for meeting the Zero Harm to Fish Program - an internal management system for best practice husbandry, fish health and welfare. This program combines the results of environmental monitoring and the performance of key farm management indicators to optimise fish health and survivorship for the duration of the grow-out period.

Stocking and fallowing would follow a rotational pattern, and be based on environmental performance supported by water quality and an assessment of benthic health within the lease areas.

Maximum permitted stocking density under the Tasman Peninsula and Norfolk Bay MFDP is 15 kg/m^3. This is also consistent with Tassal's internal stocking policy.

3.5.2 Fish Feeding

All stock are fed commercially extruded and manufactured salmon diets. As this proposed development is a new marine farm the projected monthly feed amounts will vary depending on conditions at this exposed location. Tassal will continue to report out monthly feed amounts to the

regulation authority as prescribed in licence conditions in line with other farming locations within the state.

Projected biological Feed Conversion Ratio (FCR) for the grow-out cycle is 1.35.

Tassal uses monitoring equipment within each cage to ameliorate nitrogenous emissions due to uneaten fish feed. Staff are trained in recognising changes in feeding behaviour and are able to adapt to dynamic changes in demand. Live feed video cameras and dissolved oxygen probes are used throughout feeding operations to determine optimum feed input. Other management practices to optimise feed intake include daily algal tows, visual stock assessments by dive crews and predator interaction history records from wildlife officers. Feed staff take all of the above management principals into consideration before feeding commences.

Cameras at the proposed development will be set up at a depth of approximately 5 m, facing towards the feed input source. Feeding is immediately ceased if a pellet is seen to fall below the camera's field of view. Cameras are intentionally set well above the base of the net as this allows for a further 15 m where fish can access feed before it sinks through the net. Dissolved oxygen probes are also used as a supplement to video monitoring, and have set thresholds determined by the metabolic capability of stock.

Fish are fed strictly during daylight hours:

Feeding	**Summer:** Feeding occurs between **0700** and **1900** **Winter:** Feeding occurs between **0700** and **1700**

The benthic environment has been identified as a significant environmental aspect within the Tassal Environmental Risk Profile Matrix. A range of compliance measures are included in the form of marine farming licence conditions to ensure that farm emissions do not adversely impact upon the benthic environment outside of lease areas. There have been recent concerns related to adverse benthic impacts at Macquarie Harbour, on Tasmania's west coast. These issues relate specifically to the estuarine nature, the naturally low levels of dissolved oxygen and the high background levels of organic matter experienced in this unique system. The well mixed and oxygenated oceanic waters off south east Tasmania allow for the assimilation of solid emissions meaning the issues experienced in Macquarie Harbour are not comparable to the south-east, hence Tassal's record of environmental compliance within the south east region is extremely sound.

It is a requirement that ROV surveys are conducted annually under pens that receive highest feed input. If impacts are perceived as high, stocking of these sites is restricted and a follow up survey may be sought at the discretion of the EPA. However, Tassal's fallowing management strategy applied to all of the farming regions in south east Tasmania continues to maintain the environmental integrity of lease areas and provide opportunities for remediation of sediments following the completion of production cycles.

The independent third party audits of Tassal's systems and processes (ASC) incorporates marine operations and compliance reporting on the environmental effects of salmon farming on substrates and fauna within and outside of lease areas.

3.5.3 Fish Health

Tassal maintains a focus on proactive fish health management that has directed the need to improve the biophysical characteristics of Tassal's existing marine leases and more effective utilization of all of Tassal's appropriate, existing marine space. Maximising the utility of all Tassal marine sites within the

Eastern Farming Zone will allow the operational flexibility required to support best practice year class stocking without compromising fish volumes, the marine environment or Tassal's markets.

In the Eastern Farming Zone, AGD is an important fish health challenge however, it is well managed. Tassal does not use chemicals or antiparasitics to manage AGD. Tassal began participating in a selective breeding program in 2006, based on the need for preferential selection of more robust fish exhibiting resistance to the attachment of the amoeba to the gills. With each year, there are gains made in reducing the impact of AGD and the necessity for freshwater bathing. Currently bath targets are 8 per year class, which is a reduction from 12-13 baths in 2011.

Tassal's future AGD management strategy is focused on reducing the use of freshwater bathing by application of new technologies, coupled with the gains from the selective breeding program. Tassal has research collaborations with the CSIRO to support this work.

Historically, diseases found before 2010 included: Enteric Vibriosis (also known as Summer Gut Syndrome [SGS]), Yersiniosis and Rickettsiosis. These diseases have not been detected in the Eastern Farming Zone since 2010.

Pilchard Ortho-myxoviurus (POMV) was found to be synonymous with Salmon Orthomyxovirus (SOMV) from genetic testing performed by DPIPWE/Aquatic Animal Health & Vaccine Centre of Excellence (AAHVCoE). At Badger Cove lease, POMV was isolated in the 2013 year class of fish; and again in the 2015 year class. Both occasions had associated mortalities. This is considered an industry-wide disease issue, and development of a vaccine is underway and will be available in 2017. Disease management strategies (on-farm) are also required to control the disease and its effects on farming. There has been subclinical detection in older year classes located at Creeses Mistake. The industry funded diagnostic test development has increased industry's ability for early detection of POMV and hence, disease risk management.

Harmful algal blooms (HAB) and jellyfish presence are regularly monitored by daily algal trawls and associated observational on-ground work. Tassal organises both in-house and external training covering identification of harmful algal species and jellyfish. Tassal employs an algologist to manage the Algal Monitoring Program. Algal monitoring is an important component of environmental surveillance, since soluble emissions from salmon farming are known to influence the spatial and temporal dynamics of phytoplankton communities. Increased concentrations of phytoplankton in Tasmanian waters generally occur in late Autumn/early Spring, and depending on the particular species of algae, increased concentrations of harmful phytoplankton species can cause increased mortality to farmed salmon. Tassal routinely maintains venturation systems across all of its south east regions to mitigate against mortality events should harmful species be detected through the Algal Monitoring Program.

Antibiotic use

The use of medication for Tassal's farmed fish has largely decreased due to increased focus and knowledge regarding fish health and welfare. Since 2009, there has been no medication usage in the Eastern Farming Zone. Medication was used to treat Enteric Vibriosis when the disease was a major problem for the industry during the summer months from 2007 to 2009. Improved diet formulations are now utilised throughout the higher risk summer months alleviating the need for medication use to treat Enteric Vibriosis.

Future use of medication will be in line with Tassal's internal policy - antibiotics are never used prophylactically or for growth promotion. In the rare event that salmon were to be treated with antibiotics, stock would go through a lengthy withdrawal period of 1500 degree days to ensure all active metabolites are no longer present. Prior to harvest, any groups of salmon that have been treated with an antibiotic, and are still within their prescribed withdrawal period are tested for residue. This complies with the Australia New Zealand Food Standards Code for residue levels (FSANZ 2013).

Tassal communicates total antibiotic use annually in their Sustainability Report (see Appendix 1) and also in real time on their ASC Dashboard (see Figure 3.4) within 30 days of treatment. If a pen has been treated with antibiotics, signage is clearly displayed on the individual pen and feed silo.

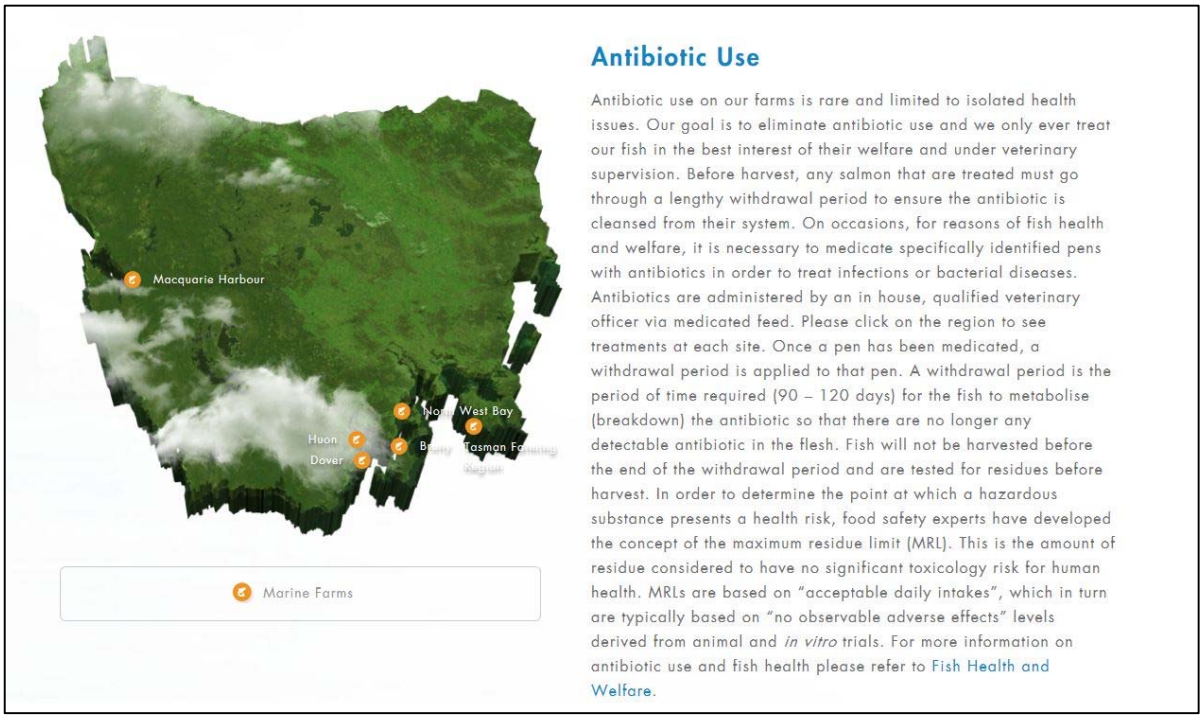


Figure 3.4 Screenshot of Tassal ASC real-time Dashboard (the dashboard can be accessed through http://www.tassal.com.au/sustainability/asc-dashboard/

Internal systems to support fish health

Zero Harm to Fish is an internal Tassal program that has been implemented since 2014. The Zero Harm to Fish program audits the functioning of the health management plan as well as other husbandry factors that can cause disease. The Zero Harm scorecard drives a culture of continual improvement that aims for a target of 91% survival. This program is a comprehensive roadmap to better fish health and welfare built around best-practice health and welfare principles. It is also an important platform to drive standardisation of operations and the sharing of best practice husbandry and systems. Feeding into this internal auditing tool is the ASC Salmon standard; OIE Aquatic animal health code; National aquatic animal health schemes; RSPCA UK and RSPCA AUS guidelines.

Tassal's Farm Disease Management and Biosecurity Protocol is designed to limit the incursion and transmission of existing or exotic pathogens between or within control regions as well as develop a proactive 'biosecurity culture'. The protocol is based on a two-tiered system of alert depending on the disease status of individual pens, leases or regions, with changing actions and monitoring processes throughout the steps.

Tassal has also implemented a South East Tasmania Fish Health Management Plan (FHMP) which is a combination of compliance, best practice, and regulation through management controls and marine Farming licence conditions. The FHMP addresses detailed, standard operating procedures to prevent disease from entering the region, to prevent the spread and impact of disease in farming regions and to respond to emergency disease situations. The FHMP is scheduled to be reviewed annually; however this will occur more frequently if required. This sits as a backbone to Zero Harm to Fish program.

Tassal's focus on disease monitoring and early detection places a high importance on incorporating stock inspections into routine farming activities such as mortality collection, weight checks and

harvests. Tassal is also actively involved in the Tasmanian Salmonid Health Surveillance Program, which is a joint program between the Tasmanian Salmonid Industry and the Tasmanian Government. This program provides passive and active disease surveillance through regular submission of fish diagnostic samples and testing for specific disease agents of concern.

Through the Zero Harm to Fish program, Tassal conducts training for their technical staff on disease investigations, sampling and fish physiology/behaviour.

3.5.4 Predator Control

Australian and Long-Nosed Fur Seals are prime predators of fish in their natural environment. They also attempt to prey on salmon stocked in cages on marine farm leases throughout Tasmania. Effective exclusion methods continue to be the focus for managing interactions with seals and all other potential predators of farmed salmon.

Effective management of seal interactions is a matter of critical importance for Tassal as it has the potential to impact on employee safety, environmental management practices, and seal and fish welfare. Tassal is committed to passive seal deterrents and continues to investigate and trial new exclusion and deterrent techniques. Where a seal poses unacceptable risk to worker safety it will be managed in accordance with DPIPWE's seal management protocols.

Tassal continues to deploy K-Grid net technology to prevent seals from breaching the structural integrity of salmon cages. The material used to manufacture K-Grid netting is exceptionally resistant to UV light, more biofouling resistant than other forms of netting and resists deterioration caused by sea water. Trials have proved this form of netting to be effective against seal predation. The use of K-Grid nets dramatically reduces the need for rigging rope, with these net cage types requiring 1,440 m less rope than the equivalent monofilament net configuration. This equates to an average decrease of approximately 92 160 m in rope usage per lease. Seal fences are also used on all Tassal cages to further inhibit seals from accessing salmon stock.

Birds also have the potential to impact fish health directly through predation, or intercepting feed pellets. K-Grid nets are used in conjunction with seal proof bird nets (SPBN). The SPBN, developed by Tassal, have proven successful in preventing seals from entering a sea pen by means of an over-the-pen collar entry, whilst providing continued exclusion and welfare of birds.

Tassal has implemented a Wildlife Interaction Plan (WIP), covering all of their marine operations. The WIP not only meets the industry's code of best practice, but also incorporates the relevant regulations contained within EMPCA 1994, LUPA 1993, NCA 2002, EPBCA 1999, and the Aquatic Animal Welfare Guidelines, National Aquaculture Council 2004.

Tassal is committed to reducing wildlife interactions at their salmon farms through a high standard of wildlife management and implementation of best practice exclusion technologies. When wildlife interactions occur, Tassal has an obligation to make information publically available through both their annual sustainability report and the Aquaculture Stewardship Council (ASC) certification program. Tassal makes any lethal interactions publically available on their ASC Dashboard (which can be accessed at http://www.tassal.com.au/sustainability/asc-dashboard/) within 30 days of occurrence.

3.6 Waste Management

3.6.1 Solid Waste

3.6.1.1 Harvest Waste

Solid waste and bloodwater from the harvest process is contained in the harvest vessel during harvest operations and delivered to the primary processing plant in Dover. Bloodwater is treated at Tassal's Dover waste water treatment plant (WWTP) with fish gut and frames sent to Tassal's approved land-based rendering facility at Triabunna on Tasmania's east coast.

The rendering facility at Triabunna is a commissioned operation. The plant produces fish oil and fish meal, currently of an industrial grade, however, this will be refined to food grade over the next year. This product is initially destined for the domestic market but will eventually enter the international market as well.

3.6.1.2 Fish Mortalities

Mortalities from the proposed leases would be collected in sealed fish bins and returned to the shore base at Badger Cove where they will be held in a refrigerated container until they are collected, at least twice a week, for removal to the approved land-based rendering facility at Triabunna.

3.6.1.3 Feed Waste

Uneaten feed is minimised through the use of video camera feedback systems and additional tools such as pellet catching panels. Direct feed input monitoring allows Tassal to further reduce nutrient loading into the surrounding marine environment (Price and Morris, 2013). Any pellets falling through the cages are detected in Tassal's routine video surveys and the information is used to continuously improve feed management. Feed wastage (uneaten feed, fines, chippage and dust) at the proposed leases are forecasted to be approximately 1.5% of the total feed input. This has been determined from feed waste calculations obtained for similar operations in the Eastern Farming Zone and through third party audit requirements from manufacturer of fish feed.

3.6.1.4 Fish Waste

Fish faeces fall through the bottom of the cages and are deposited on the sea bed below. Video survey work coupled with depositional modelling enables Tassal to demonstrate that there is very little spread beyond the immediate vicinity of the cage (see section 6.1.2.3). The cage locations are routinely fallowed during normal production cycles. This allows for biological processes in the sediment to assimilate organic matter and for the sediments to regenerate and recover to a more balanced natural equilibrium.

3.6.1.5 Net Waste

Tassal now uses in-situ Marine Inspection Cleaner (MIC) technology for washing of nets. This technology is also utilised for net and rigging inspections on a regular basis.

Copper antifoulant is no longer applied to nets used by Tassal and will therefore not be used on cage nets deployed at the proposed leases.

The introduction of K-Grid and Kikko nets across the State has resulted in a $^{2}/_{3}$ decrease of in-situ net washing. This has also reduced the need for land based net maintenance as these nets remain in the water for the entirety of their serviceable life.

As previously stated, the proposed West of Wedge development will utilise K-Grid nets.

Land based cleaning will take place on the decommissioning of the K-Grid nets prior to entering into a planned plastics recycling program through a locally based company. As the biofouling from the nets will be uncontaminated, it will also be recycled for agricultural use where possible.

Additional information on the levels of solid waste derived from net cleaning activities is provided in Section 6.1.2.2.2.

3.6.2 Liquid Waste

3.6.2.1 On-Farm Generated Wastewater

Black and grey water from amenities on the feed barges will be collected in a waste tank which is routinely emptied by the service vessel. Typically the barge would be emptied of 600 L on a monthly basis. The waste is stored on the service vessel until a bulk load can be removed on-shore. Veolia Environmental Services collect and transport the waste to an approved waste water treatment plant (WWTP).

3.6.2.2 Harvest Bloodwater

Bloodwater combined with ice water and rinse water is retained on the harvest vessel and discharged during delivery of the harvest to the Dover processing plant where it is treated by the plant's approved WWTP. The quantity can be between 10,000 L and 20,000 L per harvest.

3.6.2.3 In-Situ Net Cleaning Waste

In-situ net cleaning is carried out in line with Net Cleaning Best Practice Guidelines (Appendix 5) and waste from this is deposited below the cages; any impact is monitored as part of routine video monitoring. The volume of waste produced during in-situ cleaning is highly dependent on the location, season and frequency of cleaning.

3.6.2.4 On-Shore Net Cleaning Waste

As K-Grid nets are only cleaned on-shore at the end of their serviceable life, the generation of net wash waste water will be minimal, particularly given that the nets can be cleaned in-situ prior to being brought ashore. Tassal maintains a land based operation at Dover for net cleaning that treats all associated water solids prior to further treatment at the Dover WWTP.

Marine biofouling removed from the K-Grid nets at the end of their serviceable life will be segregated and made available for land spreading and composting.

Minimal water is used during the net washing operation as several nets are washed at the same time in recycled water. Nutrient rich net wash water and rainwater from the net washing operation will be treated at the net cleaning facility to remove high solid content before being discharge to the Dover WWTP.

3.6.3 Environmental Monitoring

Tassal's non-regulatory water quality monitoring is primarily conducted to benefit fish health and includes daily measuring of temperature, dissolved oxygen, salinity and turbidity. Jellyfish and harmful algal monitoring is also conducted at least daily. Tassal has initiated a microalgae response protocol, which includes the implementation of on-site microscope cameras, allowing unknown or potentially harmful microalgal species to be digitally imaged and emailed to recognised taxonomic experts for identification and verification purposes.

Tassal's Quality Control Department also conducts a bimonthly water sampling and program testing for thermotolerant coliforms, an accepted indicator of potential faecal contamination, and thus water quality (ANZECC 2000).

The environmental monitoring program in place for Tassal's marine operations will be implemented for the proposed West of Wedge development, and include:

- Annual benthic video monitoring will be required for the proposed leases under Schedule 3V of the Marine Farming Licence.
- In-house video monitoring additional to that required by Schedule 3V carried out as part of Tassal's lease management and fallowing program.
- Daily environmental monitoring for fish health.
- Quality control bi-monthly water quality sampling.
- Continuation of broadscale environmental monitoring program (with possible inclusion of more sites.
- Continuation of macroalgae monitoring sites.

Additional, or more frequent monitoring of specific environmental parameters may, at any time, be required by the EPA.

Rotational stocking and fallowing will occur under normal production cycles in relation to biomass splits, harvest schedules and year class fish movements. Pen bay positions will be fallowed following these transactions to allow sediments to periodically rest. This method of stocking and fallowing is used around the State at many Tassal sites and is in line with best practice farming techniques.

Tassal has conducted Acoustic Doppler Current Profiler (ADCP) flow data recordings in a location adjacent to the Creeses Mistake lease and at the proposed West of Wedge development site. These locations are considered to be indicative of water movements within these areas of Storm Bay.

Tassal also has dissolved oxygen logging devices installed at the Eastern Farming Zone to collect data for future use in relation to trend analysis and development of a decision support system. Tassal has recently formed a business intelligence department that works closely with environmental and operations staff in order to develop these management systems for use in the future.

Furthermore, Tassal has undertaken voluntary environmental monitoring for water quality, nutrients and phytoplankton communities within the Eastern Farming Zone. This monitoring program commenced in February 2014 and has continued on a monthly basis. The program mirrors the BEMP water quality sampling regime in the D'Entrecasteaux Channel and Huon Estuary. The monthly sampling events and the water quality and nutrient data from the four monitoring sites has undergone preliminary analysis to characterise ecosystem health of the water column and compare the performance of individual sites. From this existing monitoring data an environmental baseline has been established that will enable a comparison of water quality and nutrient parameters once the proposed marine operations were to commence.

Tassal has also commissioned independent scientists to undertake desktop and field studies of EPBC listed threatened species and communities within the Eastern Farming Zone. As part of the study, a

number of subtidal monitoring sites were established to monitor Giant Kelp populations adjacent to Wedge Island. Surveys were undertaken in 2013 and 2015. A selection of subtidal monitoring sites in the Eastern Farming Zone are also included as reference sites for the current FRDC Project entitled "*Understanding broadscale impacts of salmonid farming on rocky reef communities*" (For the full report of this project see Appendix 6). This project, which is focused on reef communities in south east Tasmania, was completed in 2016 and it is anticipated that monitoring of these sites will continue as part of Tassal's environmental monitoring program in the Eastern Farming Zone.

The extensive range of environmental monitoring activities undertaken within the Eastern Farming Zone (both regulatory and voluntary) has supported sustainable farm management within the region, as evident by Tassal's compliance record for the Eastern Farming Zone.

Data obtained from Tassal's environmental monitoring programs have be used to develop key environmental indicators to support this proposed development. These data and initial hydrodynamic modelling of the dispersion of potential emissions have been used to develop a comprehensive environmental monitoring program for Storm Bay (Appendix 20).

3.7 Decommissioning and Rehabilitation

When the proposed leases are no longer in use, Tassal will remove all mooring and associated subsurface infrastructure to allow any organic enrichment existing in the retired lease space to be metabolised by biological assimilative processes. Any impacts from farming would be remediated by these means.

The costs and timeframes associated with this work are difficult to predict. However, Tassal is committed to its responsibilities and obligations in respect to decommissioning and rehabilitation in line with marine farming licence conditions.

4 Stakeholder Consultation

Tassal has identified social sustainability as a key operational pillar for the company and places an extremely high priority on stakeholder consultation, which is built into strategic planning processes at the executive level within the company. Tassal's stakeholder engagement model is benchmarked against national and international salmon and other food industry producers, retailers and various Australian resource industries. The company has adopted its overarching, adaptive stakeholder engagement plan to underpin consultation regarding this proposed development.

Fundamental to communication and engagement is the transparency of operations, an area where Tassal has steadily improved over the past five years. Tassal has recently released its fifth Sustainability Report (Appendix 1) encompassing the entire scope of operations from hatchery through to processing. Tassal's Sustainability Report reports under the Global Reporting Initiative (GRI) and Tassal's 2015 Report follows the G4 Sustainability Reporting Guidelines (https://www.globalreporting.org/standards/g4/Pages/default.aspx). As part of these guidelines, a rigorous Stakeholder Materiality[1] Assessment was undertaken. Figure 4.1 illustrates the breadth of material aspects.

Tassal also embarked on a major upgrade of its website in 2014 to improve access to information, current and historical, for interested parties. In particular the ASC dashboard on Tassal's website is a recent initiative updated monthly.

In 2015 and 2016, Tassal was benchmarked as the world's top seafood company for sustainability reporting and transparency. Tassal was the only Australian Company listed in the 2015 Seafood Intelligence report achieving a Corporate, Social and Environmental Responsibility rating of Excellent – one of only four companies in the top 100 to achieve this level.

Environmental certification is also an important tool for the transparency and accountability of operations. This expert-based independent audit process ensures that the company is achieving best practice and exhibiting continual improvement. All of Tassal's marine farming zones in Tasmania's south east have been certified to the Aquaculture Stewardship Council (ASC) Salmon Standard. This international certification scheme is renowned for its comprehensive social audit component and the facilitation of coordinated stakeholder consultation. The transparency of audit findings is a unique feature of the ASC Standard. The rigorous framework of the ASC Salmon Standard requires annual surveillance audits at each farming zone to ensure continual improvement on all aspects of the Standard.

Unexpected changes in ecological and physical conditions within Macquarie Harbour on Tasmania's west coast lead to unexpected non-compliant environmental survey results. This affected Tassal's ASC certification status for its Macquarie Harbour leases. In late 2016, Tassal reported non-compliant environmental survey results to the EPA which contradict some of the ASC requirements for environmental management of benthic ecosystems. Tassal took a range of immediate steps (including more frequent environmental monitoring and benthic remediation studies) to assist in the natural recovery of benthic ecosystems within its Macquarie Harbour leases. Tassal also engineered and began

[1] *Material topics for a reporting organization include those topics that have a direct or indirect impact on an organization's ability to create, preserve or erode economic, environmental and social value for itself, its stakeholders and society at large. See https://www.globalreporting.org/standards/G3andG3-1/guidelines-online/TechnicalProtocol/Pages/MaterialityInTheContextOfTheGRIReportingFramework.aspx for further information on materiality in the context of the GRI Reporting framework.*

the implementation of waste capture systems to its stocked pens. In September 2017, after a long review process, Tassal received back full ASC certification status for all its Macquarie Harbour leases.

Social criteria which Tassal is audited against includes:

- community engagement
- respect for indigenous and aboriginal cultures and traditional territories
- maintaining access to vital community resources

At a local level, Tassal is actively engaged in the communities in which it operates. Tassal has a dedicated Community Engagement Officer, a role that invests time in the community, coordinates community activities, partnerships and research collaborations and liaises with non-government organisations and advisory forums. Community and stakeholder engagement is an overarching and ongoing activity within Tassal. Fostering an engagement culture in the company supports transparency and allows freedom for all employees to engage on issues important to them. Community engagement activities occur regularly throughout the year and are not necessarily tied to any specific project or proposal.

For the proposed West of Wedge development, Tassal has undertaken an integrated approach to stakeholder and community engagement to enhance and support communication linkages. Through identification of various potential stakeholder sectors, a stakeholder engagement plan (SEP) was established in relation to the proposed development (see page 26-30, 2015 Sustainability Report (Appendix 1)).

Informal discussions with major stakeholders commenced in 2014.

An ongoing program continues to provide a coordinated approach to stakeholder engagement. This approach assists in the management of emerging issues, keeping stakeholders informed and maintaining relationships and open dialogues. The SEP continues to be a dynamic document; being updated or modified based on stakeholder interactions and feedback as new information emerges. It has provided an opportunity for individuals and organisations to be notified of the proposed development, understand the potential impacts and how it may affect them. Ongoing engagement will occur following the submission of this EIS. Tassal has informed stakeholders of the statutory processes associated with the proposed development, including timelines and opportunities to provide formal representations during the public comment periods of the EIS. All information gathered during these consultations has been used in the development of this EIS.

Some aspects of stakeholder consultation have also been coordinated through the Marine Farming Branch of DPIPWE. This includes consultation with MaST, TasPorts and IMAS.

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

- Tasman Council (incl. regional Councils)
- MaST
- TasPorts
- Tasmanian Seafood Industries Council
- TARFish
- Aboriginal Heritage Tasmania
- Aboriginal Heritage Council
- boat and yacht clubs
- Peak Sailing Body – Sailing Australia
- Sydney to Hobart and Melbourne to Hobart yacht race organisers

- local boating community
- land and water-based recreational groups/clubs
- tourism operators

In developing the stakeholder engagement strategy for the proposed West of Wedge development, Tassal initiated contact with a range of key interest groups and stakeholders well in advance of the statutory requirements for public consultation. This allowed Tassal to consult often in order to:

1. provide stakeholders with adequate time to understand the proposal
2. provide stakeholders with the opportunity to work with Tassal to modify/adapt the proposal to minimise negative impact
3. inform stakeholders about Tassal's farming practices
4. advise stakeholders about the environmental impacts of salmon aquaculture practices in general

All engagement was managed by Tassal staff, and external consultants were employed to assist and provide independent expertise based advice and assistance on specialist areas.

Specific engagement activities appear in Table 5. The evolution of engagement activities involved identification of opportunities to link with established networks on specific issues and provide information through these additional channels.

There was provision of project information to ensure accurate information was available and that stakeholders understood the nature of the proposed development (in response to individual enquiries resulting from widespread availability of information regarding the proposal).

Figure 4.1 Material aspects for Tassal

4.1 Stakeholder Engagement Activities

Informal stakeholder discussions regarding the proposed West of Wedge development began in 2014. Table 5 details the specific engagement activities in chronological order.

Table 5 Summary of specific engagement undertaken by Tassal in chronological order including stakeholder groups engaged

Date	Engagement Method	Stakeholder Group
31/7/2013	Presentation	Tasman Council
April 2014	Meeting (Tassal strategic plan for offshore)	Tasmanian Abalone Council
27/10/2014	Presentation	Tasmanian Rock Lobster Fishermen's Association (Board)
March 2015	FY 2014 Sustainability Report (page 30) – see Appendix 7	All
5/5/2015	Presentation	Cruising Yacht Club of Tasmania
28/10/2015	Presentation	Tasman Council
16/12/2015	Face to face boat trip - environmental sampling	Tasman Council representative
4/4/2016	Q & A	Tasmanian Seafood Industry Council Sector Group Meeting
15/4/2016	Nubeena Information day and boat trips	Local community
28/4/2016	Phone call	Derwent Sailing Squadron
11/5/2016	Meeting (with Executive Officers)	Tasmanian Seafood Industry Council and Tasmanian Rock Lobster Fishermen's Association (Exec. Officers)
20/5/2016 - present	Website – Proposal Summary for Stakeholders	All interested stakeholders
6/6/2016	Meeting – Proposal Summary for Stakeholders	Pennicott Wilderness Journeys - tourism
9/6/2016 to 24/6/2016	Community Survey – Australia Post - mail & digital	Local Community (Tasman Peninsula & others)
16/6/2016	Email complete business proposal (West of Wedge Proposal Summary)	Tasman Council
18/6/2016	Informal conversation	Danish Seine fisher
18/6/2016	Informal conversation	Tasmanian Abalone Council

20/6/2016	Radio interview – Linda Sams	Broad Tasmanian Community
22/6/2016	Informal conversation	2nd Danish Seine fisher
22/6/2016	Presentation & meeting	Tasmanian Association of Recreational Fishing
23/6/2016	News Article – Hobart Mercury	Southern Tasmanian Community
30/6/2016	Email proposal summary for stakeholders	Tasman Council
30/6/2016	Presentation and Q&A	East Coast Regional Tourism Association
22/7/2016	Meeting	Derwent Sailing Squadron (DSS) and Bellerive Yacht Club
27/7/2016	Presentation/Tour/Meeting	Tasman Council
Unknown	Marine Farming Branch consultation	MaST & TasPorts
12/08/2016	Meeting In-person	Sailing Australia
26/08/2016	Phone call/email	RYCT, DSS, Bellerive Yacht Club, Sailing Australia
28/09/2016	Phone call/email	TARFish
18/10/2016	Phone call/email	Sailing groups, TARFish
28/10/2016	In-person Meeting/Presentation	TRLFA AGM
7/11/2016	Presentation and Q&A	Sailing Tasmania, RYCT, Bellerive YC, DSS, Kettering YC, others
17/11/2016	In-person display/presentation - Education & Careers Expo, Triabunna	East Coast and south-east Tasmanian Communities
06/02/2017	Meeting – Storm Bay update regarding navigation outcomes from sailing group feedback	MaST & Marine Farming Branch of DPIPWE
14/08/2017	In-person meeting to discuss the Port Arthur lease (MF55) and Storm Bay plans	TARFish
09/10/2017	In –person meeting to discuss proposed West of Wedge development regarding feed barges, moorings and navigation	MaST & Marine Farming Branch of DPIPWE

4.1.1 Local Residents/Community Members

Table 6 Summary of specific community based engagement undertaken by Tassal in chronological order

Date	Engagement method	Stakeholder Group
31/07/2013	Presentation	Tasman Council
28/10/2015	Presentation	Tasman Council
16/12/2015	Face to face boat trip - environmental sampling	Tasman Council - Councillor
15/05/2016	Community Information Session	Community
9/6/2016 to 24/6/2016	Community Survey – Australia Post - mail & digital (survey monkey)	Local Community (Tasman Peninsula & others)
16/06/2016	Email complete business proposal	Tasman Council
30/07/2016	Email Proposal Summary for Stakeholders	Tasman Council
27/07/2016	Presentation & tour of facilities	Tasman Council
5/12/2016	In-person Meeting	Regional Councils (incl. Tasman); EC Tourism
12/12/2016	In-person Meeting	MP Brian Mitchell (Labor) – Tour of Nubeena operations and WoW proposal
17/02/2017	In-person Meeting	Tasman Council and local stakeholder meeting
15/06/2017	In-person Meeting	Tasman Community Stakeholder Meeting – Tasman Council Chambers
Various	In-person Meeting	State political reps farm tour

4.1.1.1 Nubeena Information Day

A community information day held at Nubeena on 15 May 2016 attracted approximately 100 people, around 70 of whom were from the local area. The purpose was to provide interested community members and stakeholders the opportunity to learn more about the proposed West of Wedge development and salmon aquaculture in general. Dedicated charter vessels were made available for interested parties to observe the existing leases and farm operations as well as learn about the environmental monitoring program. The Information Day was promoted in the following ways:

- Tasman Council community Facebook page
- school newsletter
- posters in local shops
- word of mouth
- Dunalley Tasman Neighbourhood House e-newsletter
- email to Council Community Development Officer contacts
- Rotary and Lions Club networks
- Community Health networks

Tassal employees present at the Information Day were:

- Depha Miedecke (Senior Manager, Eastern Zone)
- Linda Sams (Head of Sustainability and Fish Health)
- Fiona Ewing (Community Engagement Officer)
- Matt Barrenger (Senior Manager Environment)
- Jessica Widdison (Environmental Officer)
- Andrew Barwick (Maintenance Manager, Nubeena)
- Andrew Little (Operations Coordinator, Nubeena)

Additionally, Sean Riley of Aquenal attended the information day and was available to answer questions regarding the environmental monitoring program conducted by Aquenal, Marine Solutions and Tassal within the broader region.

Information provided at the display included the following:

- map of proposed West of Wedge development location
- proposal summary document (Appendix 8)
- environmental monitoring
    - in and out of lease underwater ROV video footage
    - water sampling
    - benthic sampling
- Marine Farming Development Plan (Tasman Peninsula and Norfolk Bay MFDP)

The information session at Nubeena included vessel-based tours of the Creeses Mistake lease and the newly installed feed barge (the Evolution) to provide members of the community with a more intimate understanding of a working farm. A range of Tassal personnel and an independent marine consultant were available to answer questions on marine farming operations and the range of environmental impacts associated with farming emissions.

An opportunity to provide written feedback was extended to all those who attended the Information Day.

4.1.1.2 Community Survey

A community survey (Appendix 9) was distributed via mail to all property addresses and property owners within the Tasman Peninsula Local Government Area (LGA) (a total of 3487) (

Figure 4.2). The survey was mailed out on 9 June 2016 and responses closed on 24 June 2016. The survey was also made available online and promoted through the similar networks (listed above) to those contacted previously for the Information Day. It is worth noting that the online survey was also independently promoted via various special interest groups, not necessarily based on the Tasman Peninsula.

The survey consisted of 14 questions comprising three Likert scale, four multiple response, four yes/no and three open response questions.

Since the community survey was completed the proposed lease arrangement within the West of Wedge zone has altered, the updated proposal is four 90 Ha lease areas of which surface located marine farming equipment will be restricted to 45 hectares of each lease area. The area of exclusion is expected to be restricted to 45 hectares of each lease area, in which case the net effect on community access to this area of Storm Bay is not significantly different from what was outlined in the survey. However, any marking requirements will be determined to ensure safety of navigation and of marine farming operations.

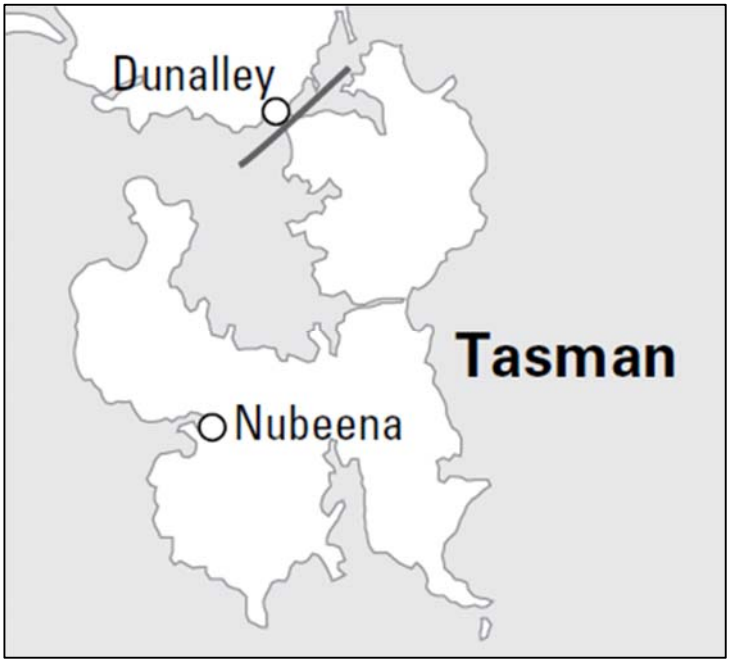


Figure 4.2 Geographic coverage of posted survey (whole area down from black line at Dunalley)

4.1.2 Consultation with yacht and boating clubs

On 28 May 2016, Tassal commenced consultation with the yachting community by contacting the Derwent Sailing Squadron (DSS). The DSS was provided with the Proposal Summary for Stakeholders and a meeting was scheduled. The meeting was postponed to allow for formal consultation between MaST, TasPorts & the Marine Farming Branch of DPIPWE, a critical step in providing a more coordinated approach to navigational management in Storm Bay. Tassal's final proposed location was made available to these parties 17 July 2016.

On 22 July 2016, senior Tassal staff met with the DSS and the Bellerive Yacht Club. Both organisations were advised of the proposed West of Wedge development and provided with a copy of the proposal summary for wider distribution to their members.

On 12 August 2016, a meeting with Sailing Australia senior staff provided further engagement with the peak body of sailing in Australia to enable transparent discussion across all levels of sailing groups within Tasmania.

On 26 August 2016, Tassal provided updated coordinates and location maps to yachting organisations – RYCT, DSS, Bellerive Yacht Club and Sailing Australia – to reflect the shift of the proposed development location 400 m northwards.

On 7 November 2016, Tassal provided a presentation to yachting organisations in collaboration with Sailing Tasmania and hosted by RYCT. Clubs who attended include Bellerive Yacht Club, Derwent Sailing Squadron, Kettering YC, Spring Bay Boat Club, Bruny Is. Boat Club, Huon YC, and Cruising YC Tasmania – to further discuss development in the Storm Bay area relating to specific interests in navigational matters. An overview of development proposals was also provided by Tassal and Petuna.

Navigational outcomes from the meeting with sailing groups on 7 November 2016, have been discussed with MaST and Marine Farming Branch of DPIPWE. This meeting was to inform the relevant

departments of Tassal's intention to implement various navigational infrastructure and procedures to mitigate potential impacts from the proposed West of Wedge development.

4.1.2.1 Sydney to Hobart & Melbourne to Hobart yacht race organisers

On 25 July 2016, senior Tassal staff met with the Royal Yacht Club of Tasmania and Australian Sailing to address issues in relation to major sail racing events and safe navigation. Both organisations were advised of the proposed West of Wedge development and provided with a copy of the proposal summary for wider distribution to their members.

4.1.3 Fishing Groups Consultation

Tassal appreciates the full range of seafood producers that contribute economic, social and sustainable growth to Tasmania and is committed to working cooperatively with industry stakeholders towards maintaining access to important natural resources.

4.1.3.1 Tasmanian Seafood Industry Council (TSIC)

Since 2014, Tassal has continued to liaise with the TSIC on the West of Wedge development. Tassal formally met with the TSIC Executive Officer on 11 May 2016 to provide more specific details on the proposed development.

Tassal attended the 2017 Wooden Boat Festival coordinated via TSIC and provided in-person public consultation through Q&A sessions at an industry display regarding Storm Bay proposals.

4.1.3.2 Tasmanian Rock Lobster Fishermen's Association (TRLFA)

Tassal formally met with the TRLFA Executive Officer on 11 May 2016 to outline the proposed West of Wedge development.

Tassal accepted an invitation along with other salmon companies to present on Storm Bay proposed developments at the AGM meeting on 28 October 2016. A general presentation was provided by Senior Environment Manager & Community Engagement Officer, followed by a Q&A session by members.

4.1.3.3 Tasmanian Abalone Council (TAC)

Tassal has liaised with the Tasmanian Abalone Council on a number of occasions in 2014/2015. At these meetings Tassal's intentions regarding the proposed West of Wedge development were clearly articulated. Tassal did not received any formal response regarding TAC position on the proposed development.

4.1.3.4 Tasmanian Association of Recreational Fishing (TARFish)

Tassal has informally discussed the proposed West of Wedge development with the TARFish committee at earlier meetings held with the Committee and one on one meetings with the TARFish Executive Officer.

Tassal formally met with the TARFish Committee on 22 June 2016. Tassal staff conducted a presentation regarding the proposed development and were available to answer questions regarding the proposal.

Tassal invited TARFish to attend at RYCT on 7 November 2016, regarding a Sailing and Recreational Fishing presentation and discussion on Storm Bay proposed developments. Unfortunately, TARFish representatives were unable to attend. Follow-up correspondence with TARFish CEO indicated the group were satisfied with Tassal's prior consultation and presentation to the group on 22 June 2016.

4.1.3.5 Other Tasmanian Commercial Seafood Industry Sector Groups

A copy of the Proposal Summary for Stakeholders was distributed to Tasmanian commercial seafood industry sector groups (by TSIC) ahead of a Sector Group meeting on 28 July 2016.

4.1.3.5.1 *Danish Seine Fishery*

Two Danish Seine fishermen operate in Storm Bay waters and target flathead for commercial purposes. Tassal engaged in informal conversations with both fishermen in June 2016 to ensure they were made aware of the proposed West of Wedge development. Specific information regarding the location of the proposed lease areas was provided to both fishermen.

Since initial conversations in June 2016, correspondence via email concerning the Danish seine fishers overlapping trawl grounds and the proposed lease locations has occurred. Both fishermen provided Tassal with maps of their trawl pathways in Storm Bay, which suggested there would be no direct interference with proposed lease locations.

As a result of this consultation, along with consideration of feedback from MaST, Marine Farming Branch, sailing groups, as well as other stakeholders, the proposed development area was shifted 400 m northwards.

4.1.4 Tourism Operator Consultation

4.1.4.1 East Coast Regional Tourism Organisation

Tassal formally met with the Board of the East Coast Regional Tourism Organisation on 30 June 2016 to present information regarding the proposed Tassal development at Okehampton Bay and the proposed West of Wedge development. The meeting included a presentation on the proposed developments and an opportunity for questions and answers.

Tassal has also engaged with local tourism operators on the Tasman Peninsula, including Port Arthur Historical Site Authority, Port Arthur Lavender Farm, local B&B business operators and a helicopter charter business. There has been positive feedback on associated tourism partnerships, both on-water and land, educating the public on salmon farming in the region.

4.1.4.2 Tasmanian Tourism Association

Tassal formally met with Tasmanian Tourism Association Executive on 24 May 2016 and presented information regarding the proposed development. On 22 July 2016, they were provided with a copy of the proposal summary for stakeholders.

4.1.4.3 Pennicott Wilderness Journeys

On 6 July 2016, Tassal met with Pennicott Wilderness Journeys to discuss the proposed West of Wedge development. They were provided with a copy of the proposal summary for stakeholders.

4.1.5 MaST and TasPorts Consultations

Consultations with Marine & Safety Tasmania (MaST) and TasPorts were undertaken by the Marine Farming Branch of the DPIPWE.

On 6th February 2017, Tassal met with MaST and the Marine Farming Branch. Specific to the proposed development, Tassal informed representatives of the discussions and support from Sailing Tasmania and other sailing groups regarding the shift of the proposed West of Wedge development 400m northwards.

Furthermore, on 9th October 2017, Tassal met with MaST and Marine Farming Branch to discuss feed barge specifications, related mooring systems and navigation around the proposed development.

4.1.6 Other Consultation

4.1.6.1 Aboriginal Heritage Tasmania

Email correspondence was exchanged with the Aboriginal Heritage Tasmania (AHT) and Tassal on 15/16 June 2016 regarding the proposed West of Wedge development. AHT informed Tassal that a search of the Aboriginal Heritage Register had been completed and advised that no Aboriginal heritage sites were recorded in the area of the proposed development. Accordingly there was no requirement for an Aboriginal heritage investigation and AHT had no objection to the project proceeding.

4.1.6.2 Aboriginal Heritage Council

Tassal informed the Aboriginal Heritage Council of the proposed West of Wedge development on 18 July 2016 via email correspondence. Further meetings are planned with Tasmanian Aboriginal Land Council on these and other collaborative project matters.

4.1.6.3 Environment Tasmania

Executive staff from Tassal, Mark Ryan (Tassal CEO), Linda Sams (Head of Sustainability), and Fiona Ewing (Community Engagement Officer), met with Environment Tasmania's Rebecca Hubbard and Laura Kelly on 26 July 2016 to review Tassal's strategic and development plans. In addition, the proposed West of Wedge development and Tassal's farming site at Okehampton Bay was also discussed.

4.2 Major outcomes of Stakeholder Engagement

Tassal commenced engagement with stakeholders immediately after the proposed development area was approved internally by the company. This approach was adopted to allow stakeholders the opportunity to express their views and concerns at multiple points throughout the consultation process.

A community-wide survey was prepared to collect feedback on local issues regarding the proposed development and provide Tassal with an improved understanding of how the local community perceives salmon aquaculture within the region.

Following discussions with stakeholders (specifically yachting groups and Danish seine fishers), Tassal has chosen to move the location of the proposed West of Wedge development 400 m northwards from the position initially outlined in proposal summaries. This decision was made to ease concerns

communicated to Tassal by stakeholders regarding displacement of fishing grounds and navigation paths used in yachting races and by other recreational boaters.

4.2.1 Local Residents/Community Members

Ongoing engagement throughout the development of the EIS, along with the Tasman community survey has provided opportunities to gather feedback from residents and shack owners from across the Tasman Peninsula. A full list of local community stakeholder engagement activities is outlined in Table 6.

Tassal's decision to engage early and openly alongside a gathering campaign against salmon farming in a separate location on the East Coast has meant that this proposal has attracted significant attention on social and mainstream media. The process of engagement has thus been iterative and flexible, and Tassal continues to conduct pro-active outreach with existing and new stakeholder groups as required.

The following are the main issues raised during consultation with local residents and community members:

- marine debris
- location and size of proposed development
- localised and broadscale effects of salmon aquaculture on the marine environment
- impact of salmon farming on the tourism industry
- visual and noise impacts

4.2.1.1 Tasman Council

Tasman Council is supportive of the proposed West of Wedge development and wishes to be actively engaged and informed of significant changes as they occur. The Council advised that they appreciate Tassal's support of the community and that Tassal is encouraged to work with Tasman High School and Sorell Trade Training Centre in order to maximise employment opportunities for young people in the area.

4.2.2 Feedback from Information Day

4.2.2.1 Nubeena Information Day

The community information day held at Nubeena on 15 May 2016 attracted approximately 100 people, around 70 of whom were from the local area.

Six attendees from the local area completed the feedback form and a further four attendees left written comments.

Of the completed feedback forms, most were supportive of the proposed development. Written comments were as follows:

- "It's better to have a lease further out than close in shore."
- "Tassal offering jobs for our community."
- "Inspection of farms and barge very interesting and informative. Staff very good."
- "Do you rescue seabirds?"

- "Curious on the visual impact of the new proposed lease from Roaring Beach." (refer to visual impact assessment in section 6.2.1)
- "Why not explore Hemp seed oil to feed fish?"

Further verbal feedback received from attendees local to the area expressed concern regarding:

- marine debris
- potential impact on recreational fishing
- environmental impact of farm
- physical impact on Roaring Beach (this was from a recreational surfer who had concerns around how cages could affect wave action)

Positive feedback was also associated with the proposed development being positioned offshore.

4.2.2.2 Community Survey

The community survey conducted was unable to establish the level of support (or otherwise) within the local community for the proposed development. The questions included in the community survey were framed in order to understand the community based issues and concerns regarding the proposed development.

There was a high written response rate to the paper survey reflecting the importance of this proposal to the Tasman Peninsula. The complete report is available in Appendix 10.

In the following discussion of the results of the community survey, it is important to recognise the value and the limitation of this type of survey. The survey results cannot be considered to be statistically representative of the views of the population of the Tasman Peninsula due to the following reasons:

- non response bias (where individuals in a selected population are unwilling or unable to participate in a survey, non-response bias may be introduced to the results)
- extreme response bias (an individual is more likely to be vocal where extreme views are held on a given issue)
- potential for multiple surveys to be completed by one person
- concurrent social media campaign against a separate proposed Tassal development at Okehampton Bay is likely to have influenced the on-line survey component
- this report adopts the assumption that duplication of respondents has not occurred

Due to the concurrent social media campaign and promotion of the survey by some special interest groups from outside the Tasman Peninsula, it is likely that not all of the online survey results are from the local area.

A total of 595 surveys were completed, representing a total of 17% of the total potential survey pool. The survey received a total of 595 responses (with the actual number of responses varying for each question). 462 paper surveys were returned via reply paid mail and 133 conducted via the online link.

As Tassal does not wish to invalidate the views of the local community and others who did respond to the online survey, the results of both the paper (local to the Tasman Peninsula respondents) and online (unknown mixture of local and non-local respondents) were amalgamated for the purposes of the results discussion below.

4.2.2.2.1 *Analysis of response to questions from community survey*

Figure 4.3 is a compilation of the non-random sample of responses to opinions of the aquaculture industry, the salmon industry and Tassal's proposed West of Wedge development and referred to in the discussion of Questions 1, 2 and 4 below.

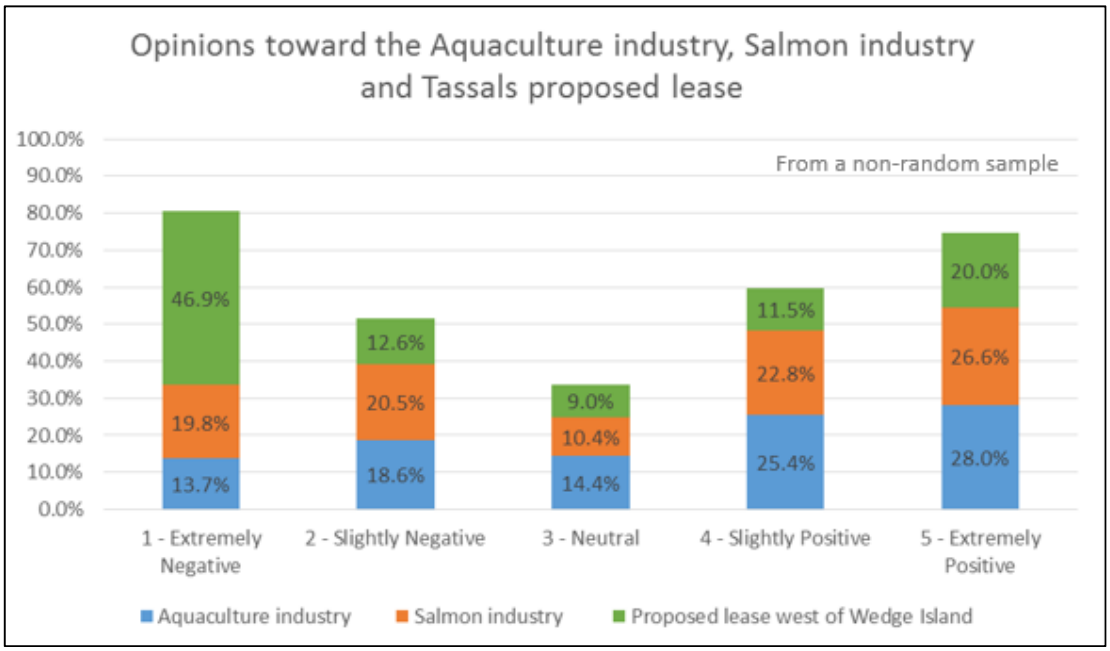


Figure 4.3 A compilation of the non-random sample of responses to opinions of the aquaculture industry, the salmon industry and Tassal's proposed lease west of Wedge Island

Question 1: On a scale of 1-5, what is your opinion of the aquaculture industry?

The first question of the survey was intended to gain an understanding of how the survey respondents viewed the aquaculture industry as a whole. 564 respondents answered this question. The results show a trend toward a positive opinion of the aquaculture industry (Figure 4.3).

Question 2: On a scale of 1-5, what is your opinion of the salmon aquaculture industry?

The second question of the survey was intended to gain an understanding of how the survey respondents viewed the salmon aquaculture industry. 567 respondents answered this question. The results show a slight trend toward a positive opinion of the salmon aquaculture industry (Figure 4.3)

Question 4: On a scale of 1-5, what is your first impression about Tassal's plan to grow salmon west of Wedge Island in Storm Bay?

The fourth question of the survey was intended to understand the respondent's attitude toward the proposed lease West of Wedge Island. 565 respondents answered this question with results showing that nearly 47% of respondents have an extremely negative opinion regarding the proposed development. Just under one third (31.5%) of those who responded to question 4 had a positive opinion with just under two thirds (59.5%) having a negative opinion regarding the proposed development.

When comparing the opinions toward the aquaculture industry (Q1), the salmon industry (Q2) and Tassal's proposed West of Wedge development (Q4) it is clear that overall attitudes toward aquaculture and salmon aquaculture in general are fairly balanced amongst respondents across negative and positive. However, there is an obvious negative trend amongst survey respondents toward the proposed West of Wedge development (Figure 4.3).

Question 3: Before this survey, were you aware of Tassal's proposal to farm salmon west of Wedge Island in Storm Bay?

The third question of the survey was intended to see if the survey respondents were aware of Tassal's proposal prior to receiving the survey or not. 527 respondents answered this question with results showing over two thirds of respondents were unaware of the proposed development before receiving the survey (Figure 4.4).

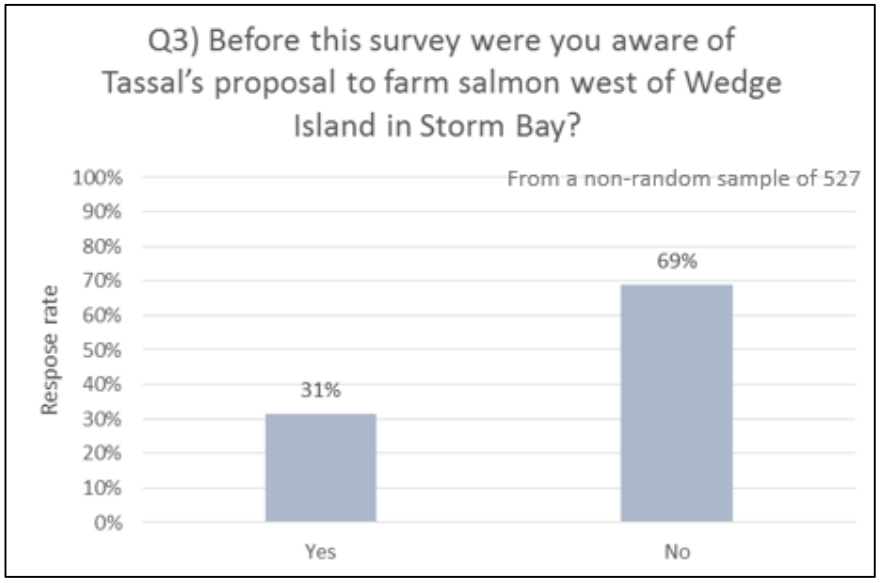


Figure 4.4 The non-random sample of 527 responses to Question 3 in the community survey

A major outcome of the community survey is that every stakeholder on the Tasman Peninsula now knows about the proposed West of Wedge development. This fact enables a meaningful statutory process.

Open Response Questions: Questions 5, 6 and 14

Questions 5, 6 and 14 are open response questions for which the respondent is prompted to write a response rather than tick a box.

Questions 5, 6 and 14 are;

- *Question 5: Why have you chosen the score in question 4? E.g. what do you like most, what do you like least, do you have any feedback, concerns or questions?*
- *Question 6: If you have a chance what would you change and why?*
- *Question 14: Any other comments?*

Due to the nature of open response questions, multiple ideas can be communicated in a single response, therefore, categories are not mutually exclusive. Responses across Questions 5, 6 and 14 were coded to the following broad response categories:

- Environmental
- Social
- Economic
- Location and Amendment
- Corporate activity

Table 7 illustrates the importance of each broad response category expressed as a percentage of total survey respondents. The broad category of most significance to survey respondents is environmental concern regarding the proposed development. The next two most significant categories are social impacts and the location and amendment. Whilst the economic impacts, both positive and negative are of least significance.

Table 7 Open response (to questions 5, 6 and 14) by broad response category expressed as a percentage of total respondents to the survey

Important note: categories are not mutually exclusive;

- ***a number of categories may be present in one individual response and/or***
- ***the same response may be expressed in 1, 2 or all of the open ended questions within an individual survey***

Question number	Q5	Q6	Q14
Category	% of total survey respondents		
Social	29	16	9
Environmental	42	15	12
Economic	23	4	7
Location and Amendment	19	25	10
Corporate Activity	9	6	7

The response category 'corporate activity' is not included in this discussion. Whilst responses within this broad category are of interest to Tassal, it is not specifically relevant to the proposed development.

Environmental sub-categories

Survey respondents expressed environmental material issues regarding the proposed development within the following subcategories:

- impact of unspecified environmental concerns
- impact of unspecified pollution
- impact of effluent into waterways

- impact to sea bed below pens
- impacts to biodiversity
- rubbish (marine debris)
- environmental sustainability
- impact on native fish
- wild fishery input in feed
- animal welfare
- freshwater use
- low impact/sustainable

Social sub-categories

Survey respondents expressed social material issues regarding the proposed development within the following subcategories:

- visual amenity
- recreational fishing
- recreational boating
- health and safety (of farm staff)
- unspecified concerns
- unspecified benefits

Economic sub-categories

Survey respondents expressed economic material issues regarding the proposed development within the following subcategories:

- local employment
- unspecified benefits
- other commercial fishing
- tourism/Tasmania's clean green image
- unspecified concerns

Of these perceived impacts on the economy of the Tasman Peninsula, unspecified benefits and local employment gains were the highest ranked (by number of responses) material economic issues.

Location and amendment sub-categories

Survey respondents expressed location and amendment material issues regarding the proposed development within the following subcategories:

- number and size of leases
- anxiety over unknown future developments
- bad location
- offshore location is good
- should be further offshore
- general supportive of amendment
- should be land based/closed loop
- salmon farming should be stopped

Of these responses, the number of leases and size of zone was the highest ranked (by number of responses) material issue regarding this category.

Question 7: Please tick the description that most accurately describes your situation

Of the 577 respondents who answered this question, half (50%) owned a shack or frequently spent holiday time in the region with 40% of respondents permanently residing in the region.

Question 8: What marine recreational activities, if any, do you participate in?

Of the 524 respondents who answered this question 86% participate in recreational fishing, 59% in water sports (surfing, diving, kayaking, etc.) and 66% participate in recreational boating. A further 15% participate in other activities, some of which include beach walking and swimming (respondents to this question could tick more than one category).

Question 12: Where do you currently obtain information regarding Tassal operations?

Figure 4.5 shows that most respondents to the community survey obtain information regarding Tassal's operations from mainstream media (e.g. news, radio, etc.) or by word of mouth. A significant proportion also obtain this information from social media and 22% receive information from directly from Tassal via website or open days.

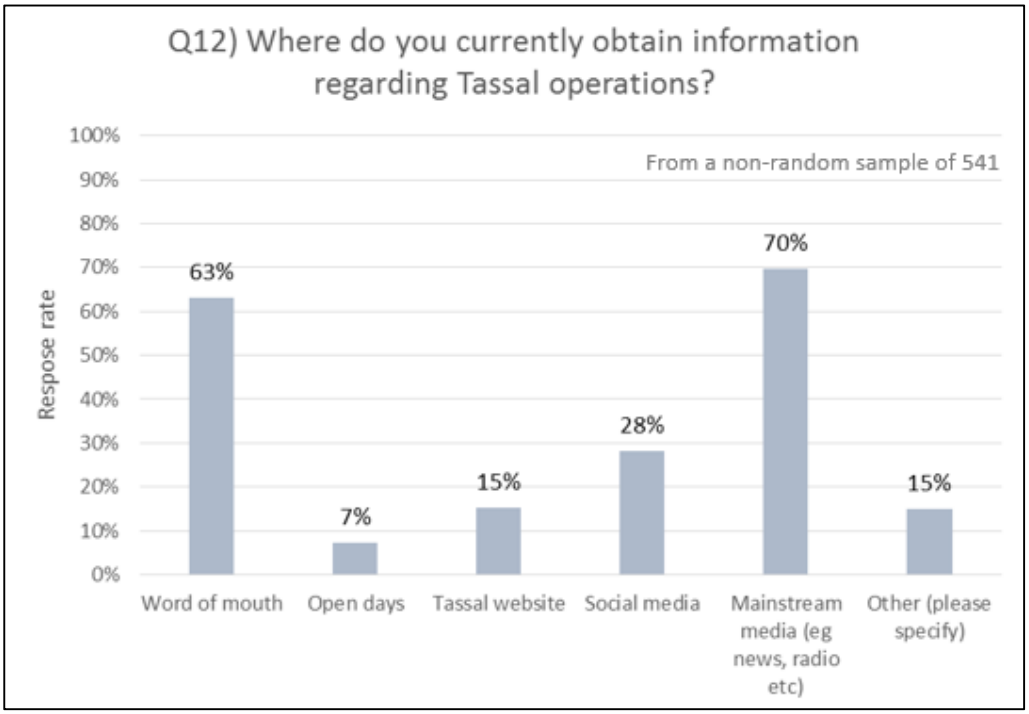


Figure 4.5 The non-random sample of 541 responses to Question 12 – Where do you currently obtain information regarding Tassal operations? Note: categories are not mutually exclusive

Of the 221 respondents who answered this question, 135 said via newsletter and 86 are happy to receive information via the Tassal website. The non-response of the remaining 374 respondents to the survey can be assumed to be content with their current methods of gaining information regarding this proposed development and salmon aquaculture.

4.2.2.3 Discussion

As a direct result of the community survey alone, all residents and ratepayers of the Tasman Peninsula are now aware of Tassal's proposed West of Wedge development. Tassal has also gained a comprehensive list of stakeholder views regarding the proposed development and a means of directly contacting a number of community stakeholders who indicated they would like to receive regular updates from Tassal.

The community survey, as conducted, was not able to ascertain the level of support (or otherwise) within the local community for the proposed development. The questions in the community survey were framed to invite respondents to raise the community based issues that are of concern to them. Statistically, the relative response rates to various issues cannot be considered to be representative of the views of the population as a whole for reasons discussed earlier in this section.

They do however, provide insight into the community based issues and concerns that exist in regard to the proposed development. Many of these community concerns will be addressed within this EIS.

Responses to Q12 indicated a clear majority of respondents felt they received information regarding Tassal operations from mainstream and social media as well as word of mouth. As a result of this information Tassal is committed towards implementing appropriate ways to better communicate to the community how their concerns are being mitigated outside just formal documents such as the EIS, for example regular updates provided on the Tassal website.

4.2.2.3.1 *Community feedback –other*

Additional community feedback was provided to Tassal independent of the survey and at the Nubeena Information Day.

This feedback was as follows - not in favour of this proposal for various reasons which are listed below:

- Chemicals.
- The look.
- Monoculture – I don't think this is healthy
- Visibility – will be able to see them – and existing lease is ugly.
- Will try to be engaging people against it.
- As a resident of White Beach, I and many others that engage in fishing would be very disappointed at the placement of this zone as it is directly above the most productive fishing area for king flathead accessible from White Beach/ Nubeena.

4.2.3 Yachting and Boating Clubs

4.2.3.1 Yachting Consultations

There are 4 significant yacht races which utilise Storm Bay. They are:

- Sydney to Hobart
- Melbourne to Hobart (east & west coast)
- Launceston to Hobart
- Maria Island Race

All races listed, except the Maria Island yacht race, operate during the Christmas/New Year period. The relevant responsibilities of the various clubs involved in this consultation process appear in Table 8.

Table 8 Responsibilities of various clubs

Club	**Race**	**Notes**
Cruising Yacht Club of Australia (CYCA)	Sydney to Hobart	Sydney end of Sydney to Hobart race
Royal Yacht Club of Australia (RYCT)	Sydney to Hobart Maria Island yacht race	Hobart end of Sydney to Hobart race
Derwent Sailing Squadron (DSS)	Melbourne to Hobart Wedge Island Race	 Not currently running, but the club would like to re-instate

Bellerive Yacht Club	Launceston to Hobart	
Australian Sailing	Peak body for sailing	

The RYCT is the largest of the Tasmanian based clubs listed above. Currently, the RYCT is apolitical and have no official position regarding the proposed development. This organisation has communicated that they have commissioned a member survey of the Tassal proposed West of Wedge development, seeking feedback and comment on a range of questions perceived as being important to the recreational yachting community. Results of this survey were reviewed by the RYCT board at the end of August 2016, and discussed with the salmon-farming industry (including Tassal and Petuna) on 7th November 2016. Results indicated that major sailing groups were satisfied with the alteration of shifting the proposed West of Wedge development 400 m northwards and as such are generally supportive of the proposal.

Tassal also supports sailing clubs and events within the Channel and Storm Bay annually, including Sandy Bay Regatta, Tasman Regatta, Living Boat Trust sailing raid, Kettering Sailing Club, Derwent Sailing Squadron, Bellerive Sailing Club and RYCT, among others. Tassal has also engaged with Sailing Tasmania to discuss opportunities to support a national sailing program via Australian Sailing.

4.2.4 Fishing Groups

One local (to Nubeena) commercial fisherman has requested that Tassal ensure that the corner markers of the proposed leases are visible in all weather and sea state conditions.

4.2.4.1 Tasmanian Seafood Industry Council

The TSIC supports the sustainable expansion of the Tasmanian seafood industry. In supporting the expansion of finfish farming, they acknowledge that ongoing adaptive management of farming operations is required to ensure that the potential for any negative impacts on the wider marine environment are mitigated. It is also essential that the monitoring of the marine environment both adjacent to where marine farming activities are being conducted, and in the wider marine environment meets world's best practice.

4.2.4.2 Tasmanian Rock Lobster Fishermen's Association

The Tasmanian Rock Lobster Fishermen's Association is, at this time, generally supportive of the continued expansion of finfish farming in Tasmania, This support is conditional on the understanding that the proposed expansion it is conducted in a sustainable manner and does not impact negatively on other fishing industry sectors.

4.2.4.3 Tasmanian Seafood Industry Sector Group

4.2.4.3.1 *Danish Seine Fishery*

Two Danish Seine fishers have existing fishing grounds in Storm Bay with some trawl lines passing through the proposed zone.

As Danish Seine gear travels along the bottom, portions of this fishery would be excluded from the zone. Advice from both fishers indicate that moving the proposed lease further north would help

ameliorate the impact. As a result of this consultation with the Danish seine fishers and other organisations (specifically yachting groups) Tassal has chosen to move the location of the proposed development 400 m northwards.

4.2.4.4 Tasmanian Association of Recreational Fishing

The Board of the Tasmanian Association of Recreational Fishing has advised Tassal that they will inform members of the proposed development and provide feedback through the statutory process.

86% of respondents to the community survey indicated that they participate in recreational fishing. This indicates the materiality of the proposed development to recreational fishing stakeholders.

4.2.5 Tourism Operators

4.2.5.1 East Coast Regional Tourism Association

The East Coast Regional Tourism Association has not yet formulated an official position regarding the proposed development.

4.2.5.2 Pennicott Wilderness Journeys

Pennicott Wilderness Journeys indicated that there were no existing Hobart water-based tours in the area. Correspondence with Pennicott Wilderness Journeys and Tassal indicated that whilst this tourism operator is generally supportive of the industry as a whole, some reservations exist around the proposed development and they (as a stakeholder) would like to better understand the growth plans of the industry as well as the cumulative environmental impacts of salmon aquaculture in general. Tassal has a meeting scheduled to discuss directly with Pennicott Wilderness Journeys its growth plans and will work to ensure mutually acceptable outcomes are in place.

4.2.6 Other

Feedback received from MaST and TasPorts in relation to navigation in Storm Bay is best illustrated by the map in Figure 4.6 showing lines of navigation. The commercial shipping "safe corridor" has been marked on by Tasports and can be seen as the pink lines. MaST has conservatively mapped a minimum distance of approximately 0.25 nautical mile either side of the straight-line transit routes for vessels other than commercial shipping.

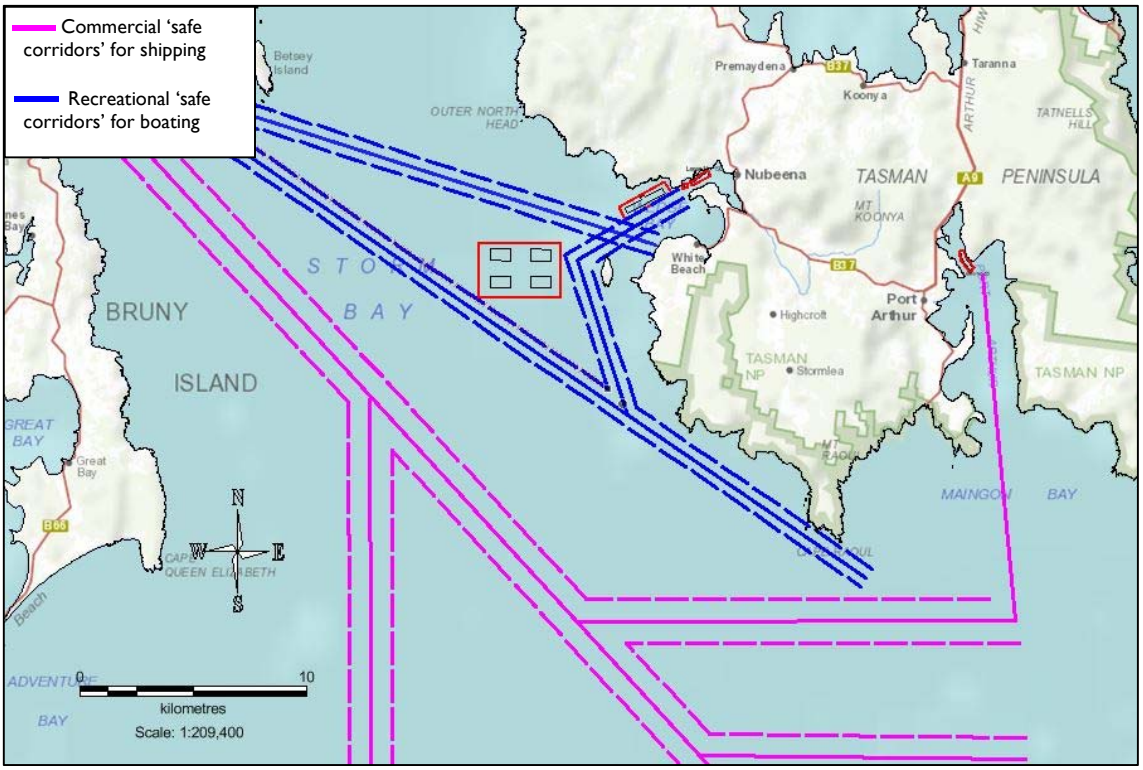


Figure 4.6 Lines of navigation for commercial shipping and other vessels in the Storm Bay area (provided by Tasports and MaST)

4.3 Further Consultation/Engagement

Tassal will continue to consult and engage with all stakeholders.

A commitment has been made to stakeholders that Tassal will notify them on progress of the EIS, and opportunities to participate in the statutory process as soon as these timelines are known.

The following organisations will be contacted directly and notified when the proposed development is open for public representation:

- Environment Tasmania
- Tasman Council
- Tasmanian Association of Recreational Fishing
- Tasmanian Seafood Industry Council
- Royal Yacht Club of Tasmania & associated yacht clubs
- Individual stakeholders as requested

5 Existing Environment

5.1 Environmental Conditions

Storm Bay is approximately 500 km^2 in area, of which about 95% ranges in depth from 30 to 85 m. The Derwent River and indirectly, the Huon River flow into Storm Bay and at times it receives intrusions of subtropical and subantarctic water (Nyan Taw and Ritz 1979). Like most continental shelves, primary production in Storm Bay is stimulated both by nutrients supplied from oceanic sources and by nutrient regeneration on the shelf (Rochford, 1984).

The particular regional oceanographic setting in which south-east Tasmanian coastal waters lie is determined by the local wind stress and by the large-scale oceanographic circulation – both of which are driven by the large-scale ocean/atmosphere coupling in the southern hemisphere (van Loon 1972a,b; van Loon and Shea, 1988; Gordon 1988).

The waters of Storm Bay are strongly influenced by interactions between the major biological assemblages of the water column and the dynamics of the large-scale (regional) oceanography. Waters to the north and east of Storm Bay are warm, stratified, subtropical and nutrient depleted. Waters to the south and west are cool, mixed, subantarctic and rich in nutrients (Harris et al., 1987, Crawford et al. 2011).

Crawford et al. (2011) describe the pattern of water circulation in Storm Bay as predominantly marine waters flowing north into the bay on the western side. Freshwater outflow from the Derwent River and the northern end of the D'Entrecasteaux Channel flows south along the eastern side of Storm Bay and around the southern end of the Tasman Peninsula.

Physical, chemical and biological parameters have been measured in Storm Bay as part of a number of studies – most significantly through the CSIRO and IMAS, and more recently, as part of their INFORMD (Inshore Network For Observation and Management: Derwent-Huon) collaboration. The studies undertaken by Clementson et al. (1989) and Crawford et al. (2011) have provided detailed information on the variability of the hydrology and biology of Storm Bay, particularly in relation to how changing environmental conditions affect stratification of the water column, nutrient cycling, primary production and food web dynamics in the Bay.

Intrusions of subtropical or subantarctic water have been shown to dramatically alter the nutrient regime in Storm Bay. This is well demonstrated by the decline in dissolved nutrients on occasions when warm, higher salinity subtropical water masses emanating from the East Australian Current (EAC) flood the shelf regions of southern Tasmania. Nutrient-rich subantarctic waters were typically more prominent in winter when the flow was predominantly from the south-west nutrients (Harris et al. 1987, Crawford et al. 2011).

5.1.1 Bathymetry

5.1.1.1 Proposed West of Wedge development area

An environmental assessment of the proposed marine farming zone extension west of Wedge Island was conducted during August and September 2016 by Aquenal (Appendix 11). The assessment area covered 11.27 km^2 (1127 ha), with depths ranging from approximately 40 – 50 m. The seabed was gently sloping, with deepest depths measured towards the southwest and shallower depths towards the northeast section of the assessment area.

Bathymetric mapping was conducted along 50 m spaced transects using a single beam echo-sounder from a vessel mounted Garmin GPS Map 551s. DGPS positions and tidally/barometrically corrected water depths were logged every two seconds to *Seabed Mapper* run on a laptop computer. A total of 56 transects at approximately 2 km lengths were travelled at an average speed of approximately 6 knots (see Figure 4 in Appendix 11).

Bathymetric data was mapped with contour lines at intervals of 0.5 m (Figure 5.1).

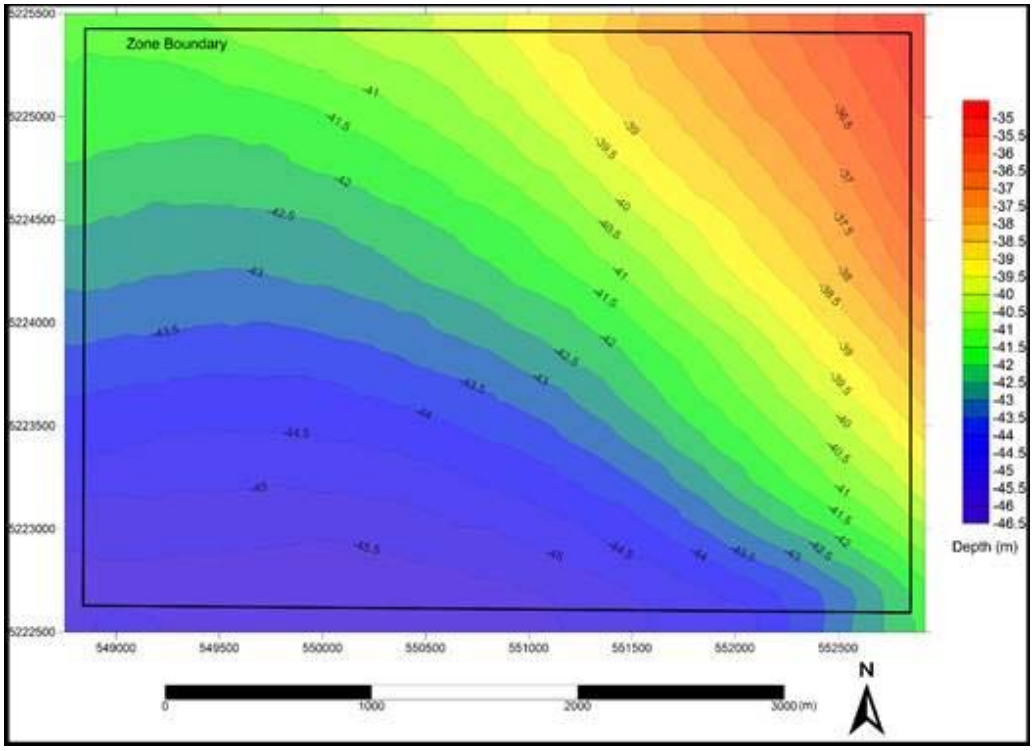


Figure 5.1 Bathymetric map of the proposed West of Wedge zone area

5.1.2 Substrates

5.1.2.1 Proposed West of Wedge development area

The substrates and benthic habitat for the proposed zone area could only be identified as one habitat category with ridged sand observed across the entire 1127 ha survey area (Figure 5.2), supporting the view that high seabed current velocities occur within the bottom waters of Storm Bay. Sediments consisted of dark orange brown sand with shell grit throughout the survey area. For full descriptions and images see Appendix 11.

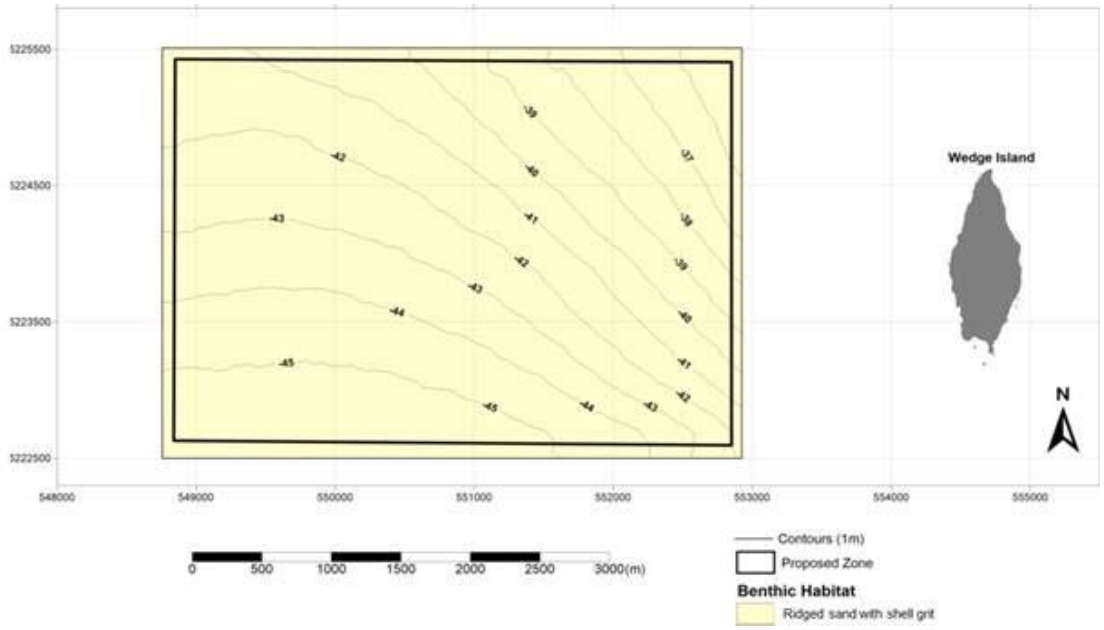


Figure 5.2 Benthic habitats within the proposed West of Wedge development assessment area

5.1.3 Hydrology

5.1.3.1 Hydrology

The proposed West of Wedge zone is located between approximately 1.8 km and 5.5 km west of Wedge Island, which is itself approximately 800 m from the closest point of the eastern shores of Storm Bay, at the southern end of the mouth of Wedge Bay (Figure 5.3). The eastern shoreline of Storm Bay is convoluted consisting of rocky headlands and intertidal zones, interspersed with sandy beaches. The bathymetry shows depth predominantly increasing with increasing distance from shore. The substrate is dominated by marine sediments apart from an area of rocky reef, which shallows around Wedge Island to the south.

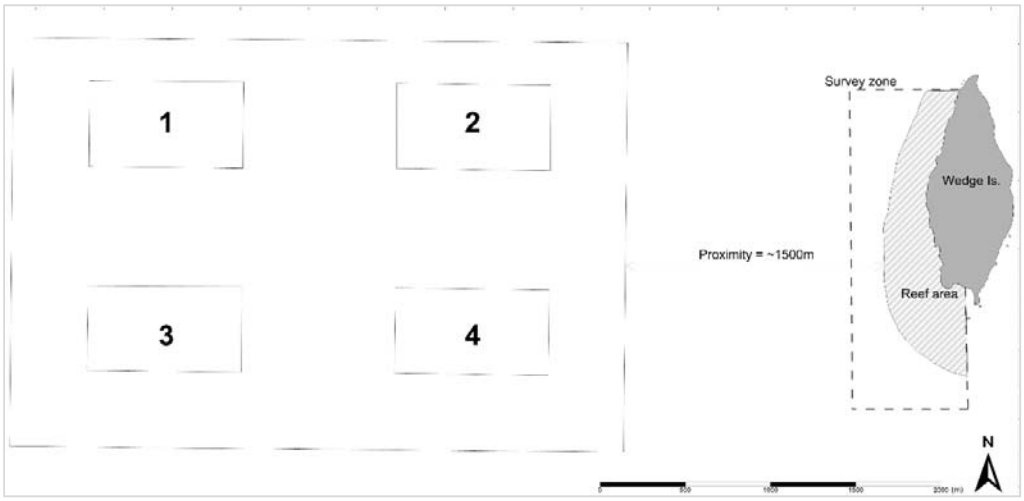


Figure 5.3 Map illustrating the proposed development with distances from Wedge Island and associated reef area

The subscriber product Tidetech (www.tidetech.org) has previously modelled tidal circulation in the lower Derwent and Storm Bay, showing a general circulation pattern of predominantly clockwise water movement.

Water movement in Storm Bay is driven by a range of influences including, but not necessarily limited to:

- wind driven surface currents
- tidal influences
- oceanic wave (swell) exposure
- barometric pressure
- current flows from the Derwent Estuary

5.1.3.1.1 *Wind*

At the mouth of Wedge Bay (43.136S 147.636E) ~2.7 km west of Wedge Island within the proposed lease, a 30 year hindcast model of wind direction and speed shows the majority of winds are from the north, through west to south west, with only a small portion of winds being from the east. This is consistent with the proposed leases being partly sheltered from easterly winds by the Tasman Peninsula (Figure 5.4).

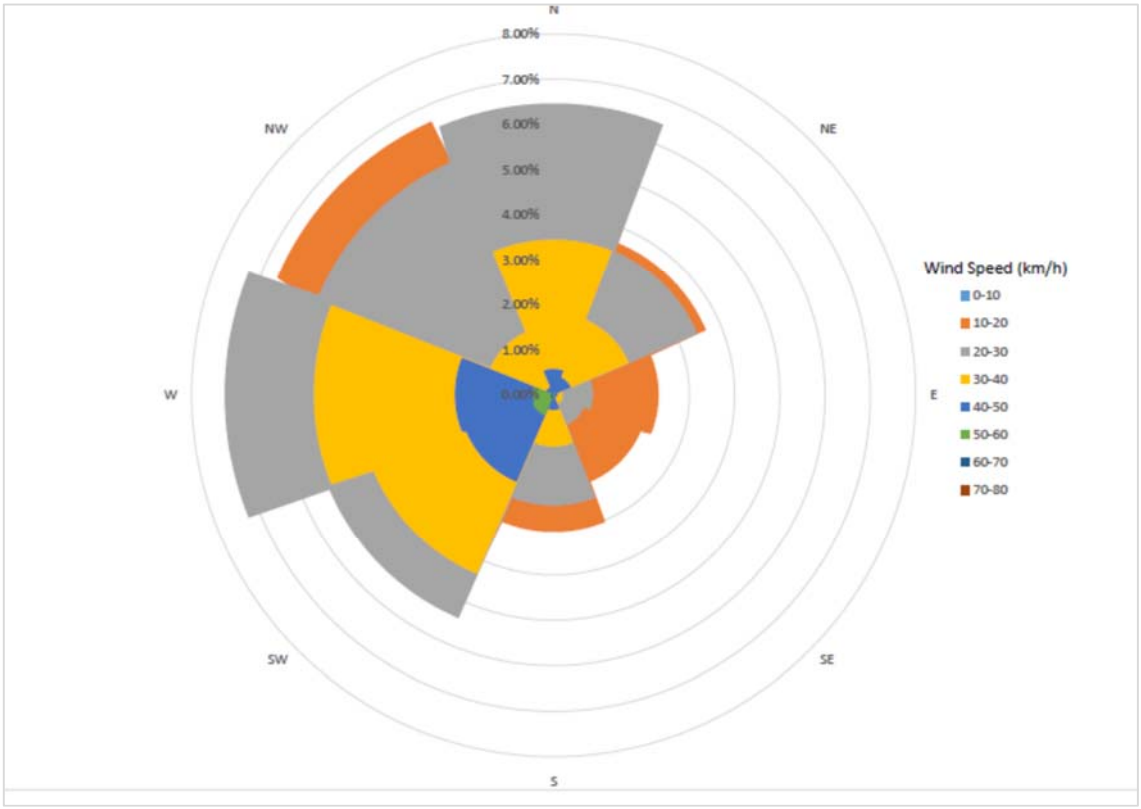


Figure 5.4 A 30 year hindcast model indicates winds within Storm Bay are predominantly from the northern and western sectors

This is also consistent with the combined 9am and 3pm wind roses for Palmers Lookout and Hobart Airport, which both show winds dominating from the westerly quadrant, and overlaid with local topographic effects (Figure 5.5 and Figure 5.6).

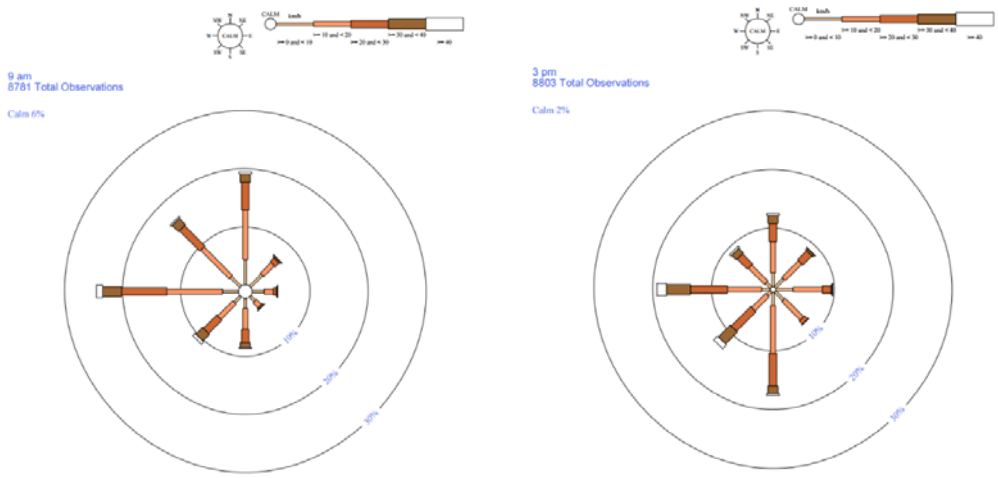


Figure 5.5 9am (left) and 3pm (right) annual wind roses for Palmers Lookout

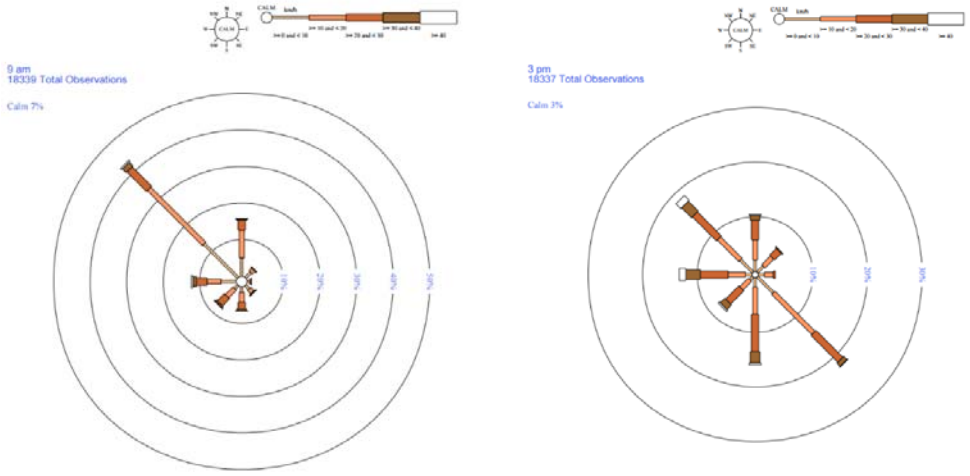


Figure 5.6 9am (left) and 3pm (right) annual wind roses for Hobart Airport

5.1.3.1.2 *Tidal Influences*

Tidal influences around Storm Bay are thought to be relatively small. The mixed semi-diurnal tide has an approximate maximum range of 1.5 m. The subscriber product Tidetech (www.tidetech.org) has previously modelled tidal circulation in the lower Derwent and Storm Bay, showing a general circulation pattern of predominantly clockwise water movement. The proposed West of Wedge development is not expected to be significantly impacted by tidal influences.

5.1.3.1.3 *Swell Influences*

Storm Bay is subject to swell from the Southern Ocean, primarily from the south. It also is subject to westerly swells which refract around the southern tip of Tasmania and enter Storm Bay.

A 30 year hindcast model centred at position 43.136S 147.636E within the proposed development (see Figure 5.7), predicting wave heights and directions every 4 hours indicated a maximum significant wave height of 6.18 m, and a maximum combined sea and swell wave height in excess of 12 m over a 30 year period.

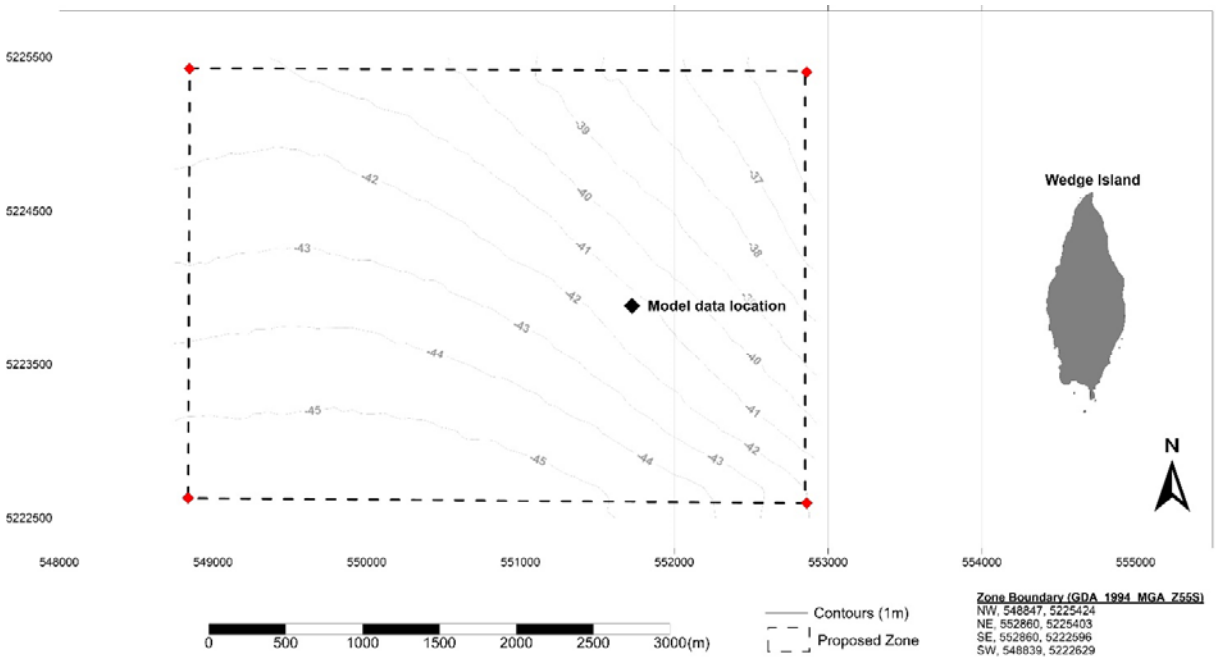


Figure 5.7 The location of the wind and wave model is located within the proposed West of Wedge development

The location for which the model was run is considered an accurate representation of swell conditions at the proposed development site.

5.1.3.1.4 *Barometric influences*

Tidal predictions in Tasmania are provided by the National Tidal Centre at Flinders University, and are based on the average barometric pressure in Tasmania being 1017 hPa. For each hPa above 1017, the tide will be 1 cm below the predicted height, while for each hPa below 1017, the tide will be 1 cm above the predicted height.

Barometric pressures between 980 hPa and 1035 hPa are not uncommon in Tasmania, therefore the tide height can be influenced by over 0.5 m due to the barometric pressure. This variation in tide height is not expected to fundamentally change the current velocities or directions for the proposed West of Wedge development.

5.1.3.1.5 *Modelled water current flows*

Water movement was modelled through the water column at the proposed development site using data from Aquadynamic Solutions (ADS). The data was averaged into 10 m deep intervals, i.e. 0-10 m, 10-20 m, 20-30 m and 30-40 m depth. The model has over 1700 points within the development area, therefore, data represents an average of these points rather than a single location.

Rose plots of velocity and direction for each depth interval (Figure 5.8) have been produced along with cumulative frequency of velocity, histograms of velocity and direction for each depth interval (Figure 5.9). A clear bi-directional flow is indicated at each depth strata from the modelled data.

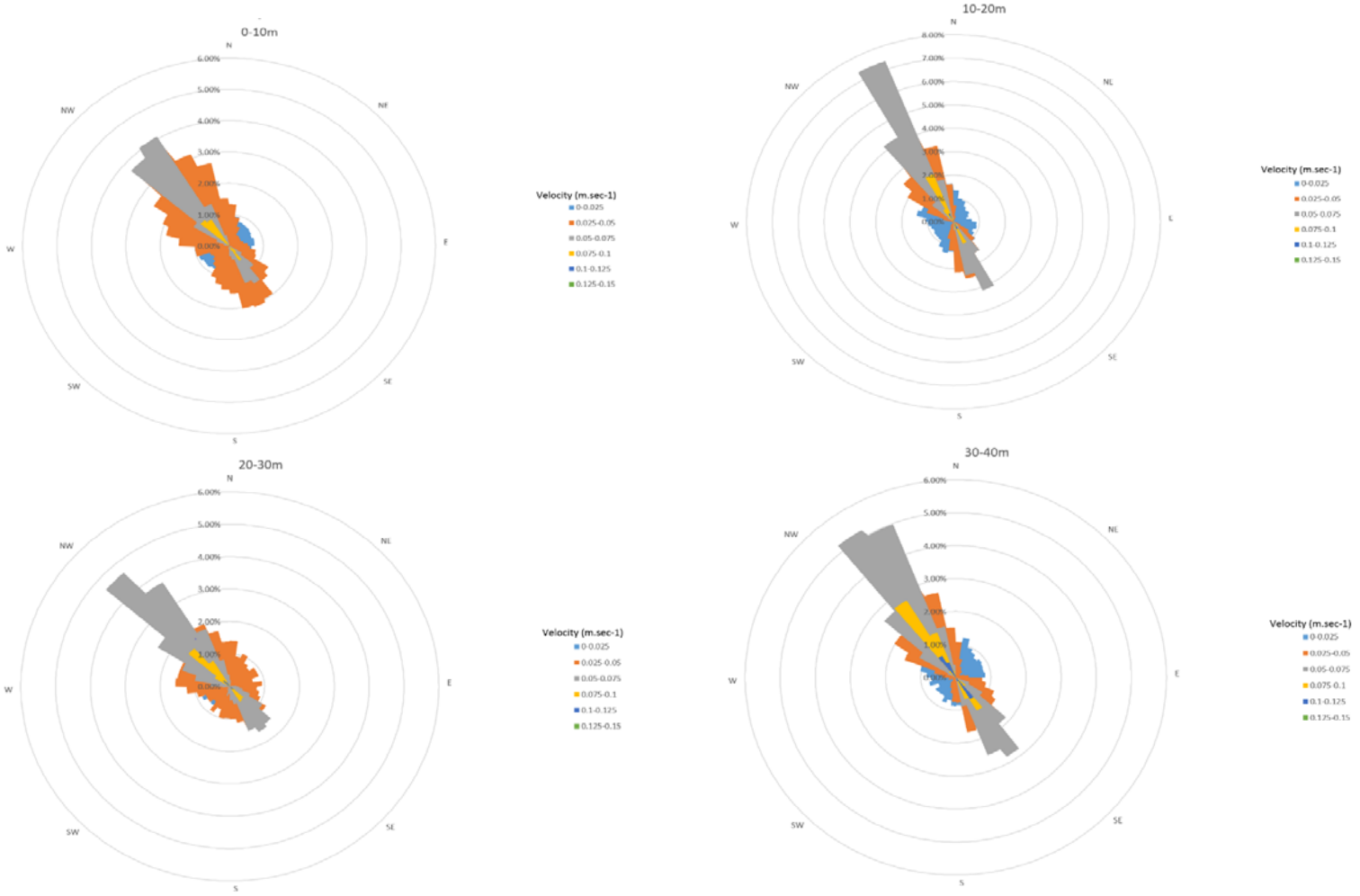


Figure 5.8 Rose plots of modelled velocity and direction for each depth interval

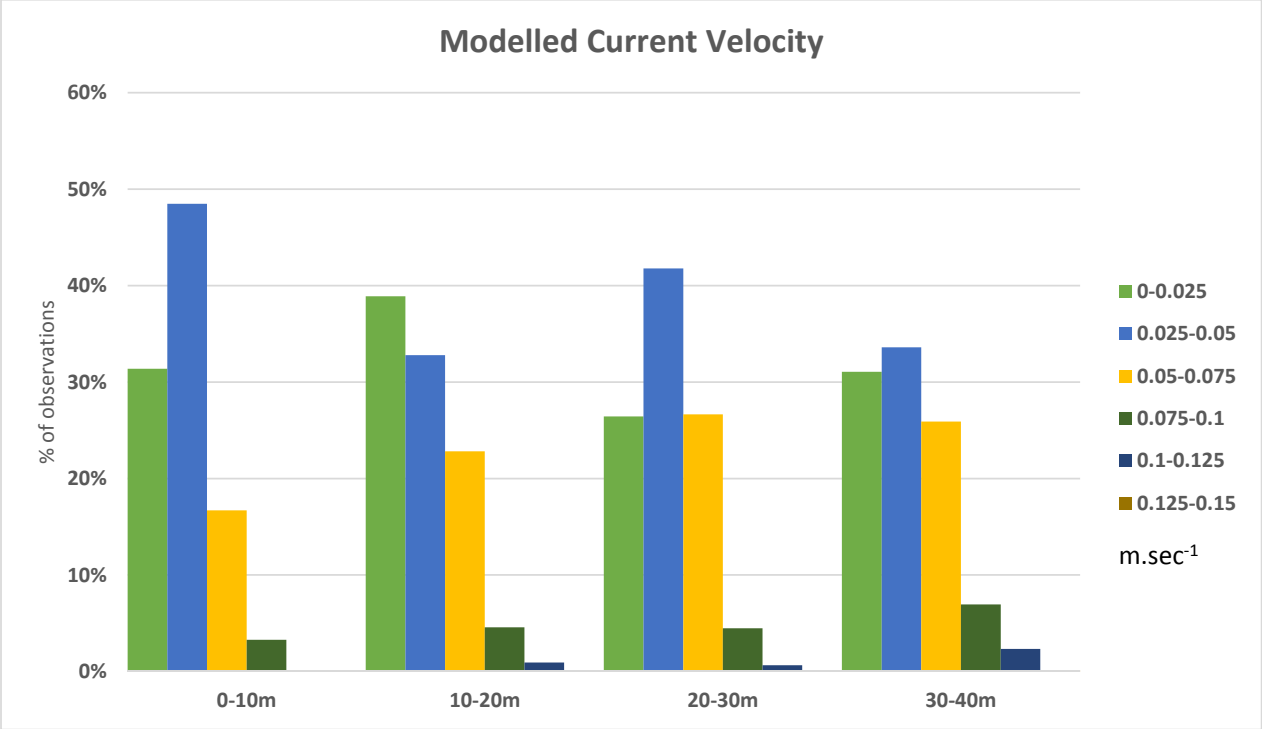


Figure 5.9 Frequency histogram of modelled current velocity through the water column

5.1.3.1.6 *Measured water current flows – ADCP data recording*

An Acoustic Doppler Current Profiler (ADCP) was deployed within the proposed West of Wedge development area from October 2016 to November 2016 (Figure 5.10). The current profiler was a Nortek AWAC 1Mhz model with a symmetrical transducer orientation.

The data collected from the ADCP provided up-to-date current velocity and direction data through the water column.

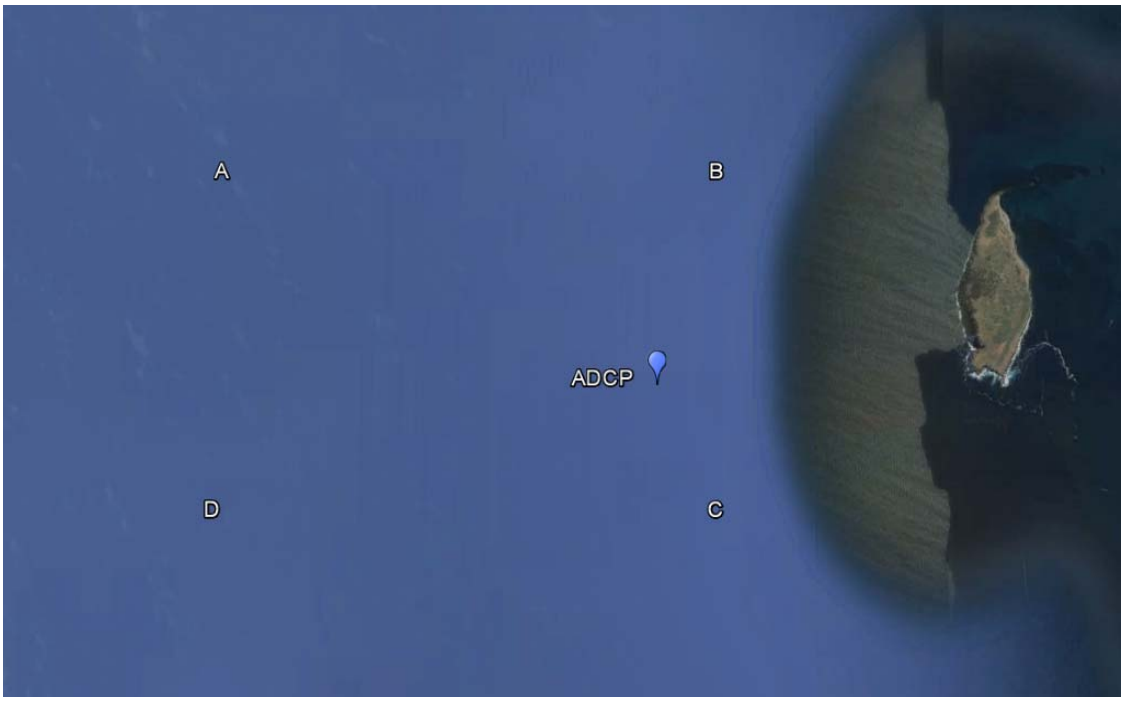


Figure 5.10 The location of the ADCP within the proposed West of Wedge development – A, B. C and D represent the zone boundaries of the proposed development

Data was composited into depth intervals and polar plots of current velocity and direction were prepared for each depth interval (Figure 5.11).

The average current velocity is faster in the middle of the water column (10-20 m and 20-30 m) than at the shallowest (surface: (0-10 m) and deepest (bottom: 30-40 m) depth intervals (Figure 5.11).

The current plots of the proposed West of Wedge development show surface and bottom water is strongly dominated by north/north-westerly flows at a speed ranging from 0-0.2 m/s. Flows in the middle of the water column are dominated by north-westerly flows at a speed of 0.1-0.3 m/s.

Current speeds were generally higher in the surface waters than at depth. Peak current speeds recorded were above 1.2 m/sec and this likely reflects a surface current in addition to wave influences in moving water over a short period of time. The modelled current speeds are lower than the measured current speeds which is likely an artefact of the model being slightly conservative for current speeds, and the way the data is derived from averaging current flow over a number of points across the proposed development zone. However, the current flows reflect the high energy environment and provide an effective means for assisting the distribution and assimilation of emissions.

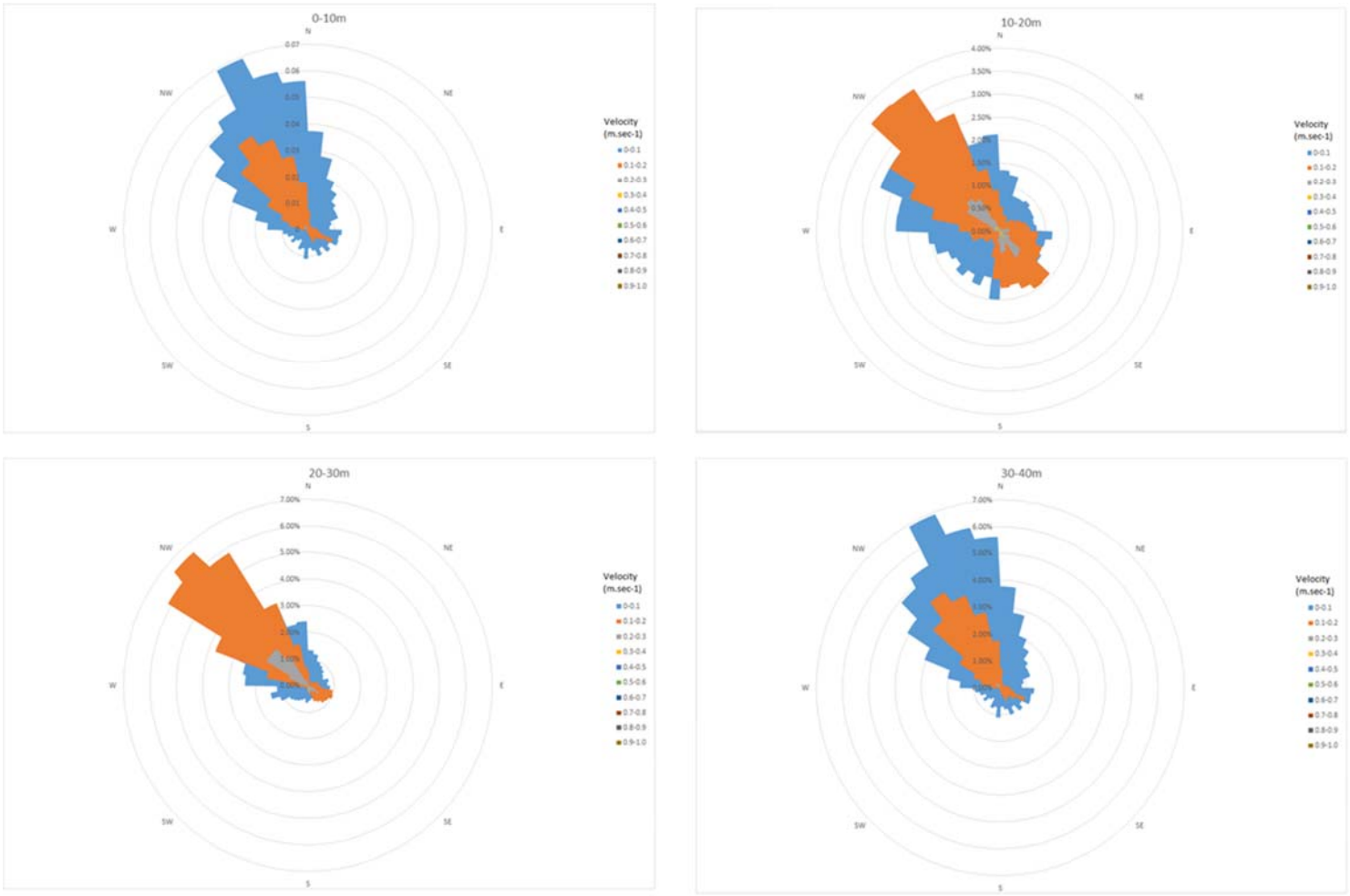


Figure 5.11 Rose plots of measured velocity and direction for each depth interval from ADCP deployment

The modelled data of current velocities is conservative compared with the real time data observed from the ADCP deployment as shown in Figure 5.12.

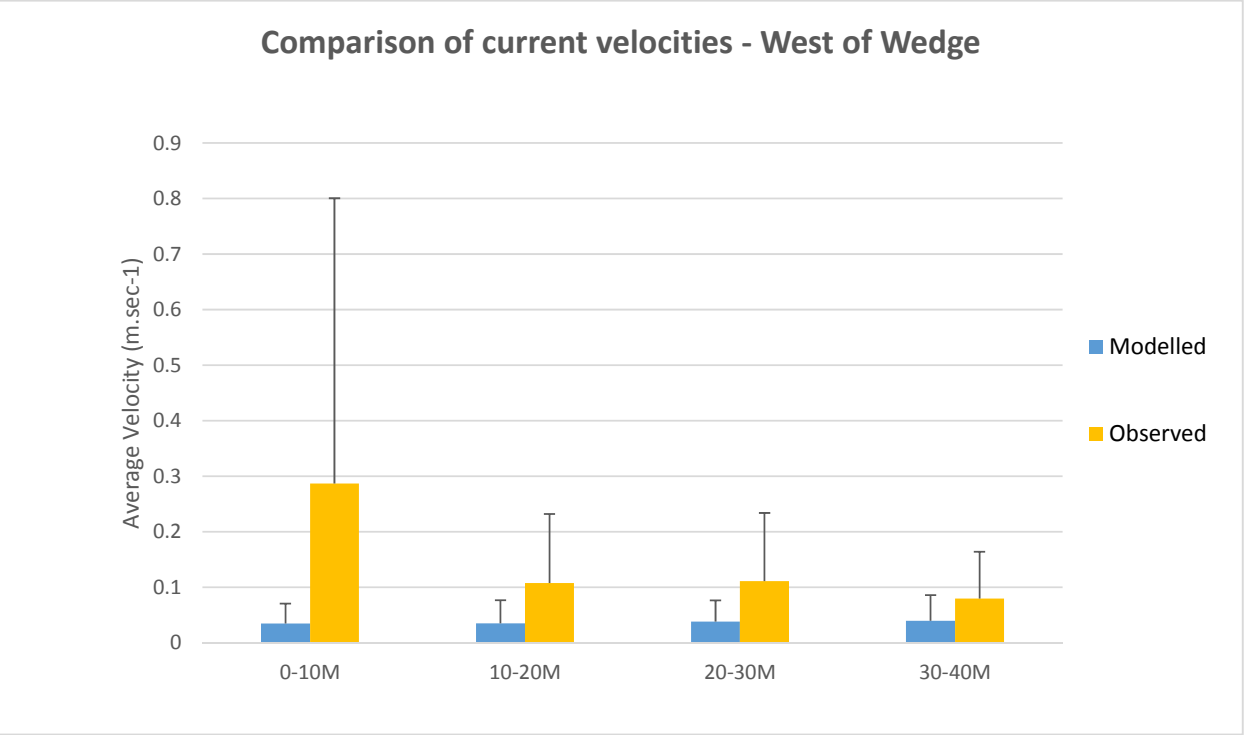


Figure 5.12 Comparison of modelled and observed data for the average velocity through the water column

Water movement at the proposed West of Wedge development has a variety of influencing factors including local and broadscale currents, wind, swell and tidal influences. Despite this complex interaction of influences the directionality of currents appears well defined. Both the modelled and measured current flows were bi-directional to a greater or lesser extent, and largely in the north-west and south-east direction.

Tassal will continue to collect velocity and current data in the area in order to gain a clearer understanding of the dynamic and exposed nature of this environment. This data will be periodically collected and updated and will feed into ongoing depositional modelling at the site. These datasets will also be supplied to marine engineers to be used in determining mooring specifications in this exposed location.

5.1.4 Water Quality

In February 2014, Tassal commissioned an independent voluntary water quality monitoring program in eastern Storm Bay, and established sampling stations in the vicinity of existing lease areas (i.e. Parsons Bay (NUB 1) and Creeses Mistake (NUB 2), along with a site located in the sheltered waters of White Beach (NUB 3), a more distant, exposed location west of Wedge Island (NUB 4) and a more recently added monitoring site (NUB 5) as shown in Figure 5.13. The latter site represents a reference location where water quality characteristics are considered to be unaffected by coastal anthropogenic activities (i.e. land based run-off, wastewater treatment facilities and aquaculture feed inputs) and is located within the proposed West of Wedge development.

Figure 5.13 Map of water quality sampling sites in the Eastern Farming Zone

The parameters studied in this monitoring program include nutrient concentration, physical water quality characteristics (i.e. temperature, salinity and dissolved oxygen) and phytoplankton community assemblages. The range of analytes measured are summarised in Table 9. These were selected on the basis that they are consistent with those measured in the Broadscale Environmental Monitoring Program (BEMP) in the D'Entrecasteaux Channel and Huon Estuary, and reflect those parameters of significant relevance to the aquaculture industry and regulatory bodies.

Table 9 Water quality parameters included in the sampling program

Component	Analyte/Parameter	Method	Samples
Physico-chemical parameters	• DO • Temperature • Salinity • pH	CTD Meter	• Surface (~0.25 m) • 5 m • Bottom (1 m above seabed)
Nutrients	• Ammonium • Nitrate • TN • Phosphate • TP • Silicate	Pole sampler/ Niskin bottle	• Surface (~0.25 m) • Bottom (1 m above seabed)
Phytoplankton	• Chlorophyll-a • Cell counts • Abundance/diversity	Integrated sampler	• Integrated sample to a depth of 12 m (one sample per site).

The results of this water quality monitoring program (covering continual monthly samples since February 2014) are shown in Figure 5.14. (For the purpose of this EIS, S1 = Nub1 (surface), B1 = Nub1 (bottom) and so on).

Figure 5.14 (A-J) describes water quality parameters as box and whisker plots for aggregated data covering the 33 sampling events. On each plot, the extent of the box represents the 20th and 80th percentiles, and the median is shown where the colour changes from blue to yellow. The mean is shown as a single red dot, and maximum and minimum values are represented as the extent of the whiskers.

Figure 5.14 (K-T) describes the same data as a time series over the sampling period. This format is useful, particularly in showing seasonal trends or where elevated "spikes" occur as a result of unusually high or low observations.

For reference, the following default trigger values have been assigned for the following water quality parameters to marine waters of south east Australia (Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000):

Ammonia (NH_4^+) – 0.015 mg/L

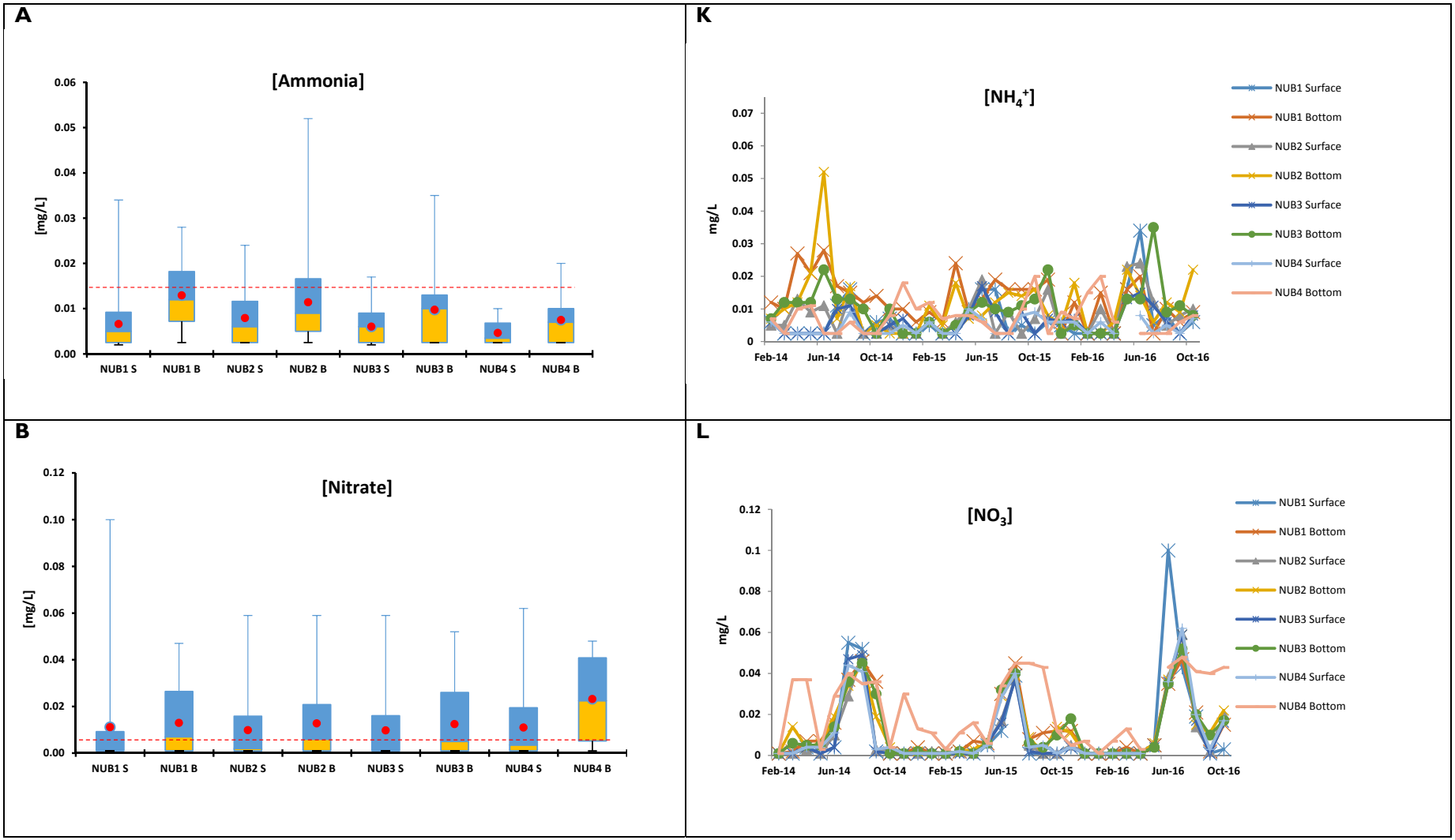
Nitrate + Nitrite (NO_x) – 0.005 mg/L

Phosphate (PO_3) – 0.01 mg/L

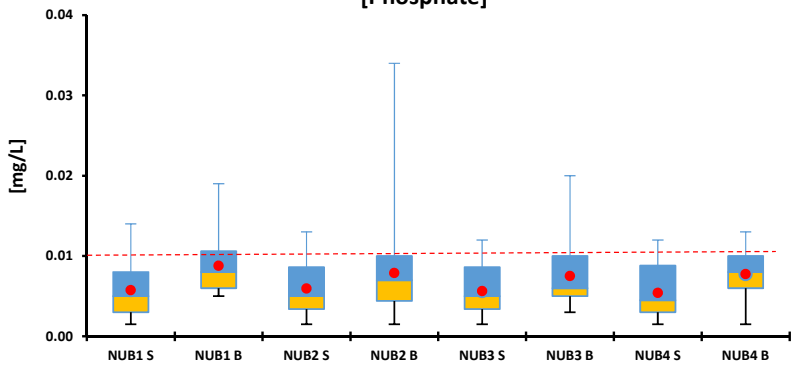
Total Nitrogen (TN) – 0.12 mg/L

Total Phosphorus (TP) – 0.025 mg/L

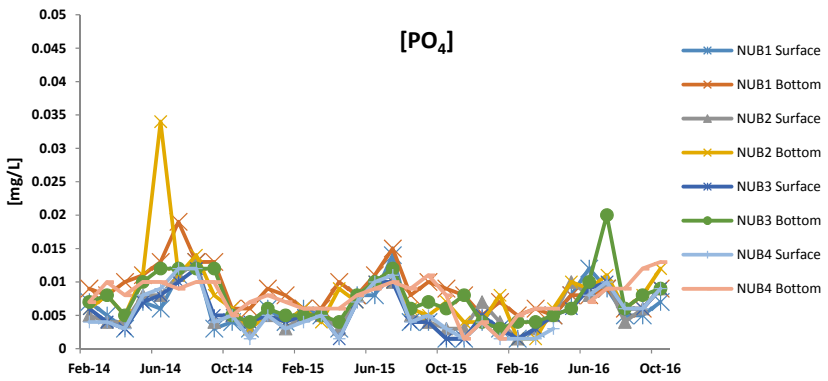
Chlorophyll a – 1.0 mg/m^3


A
[Ammonia]
[mg/L]
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NUB1 S
NUB1 B
NUB2 S
NUB2 B
NUB3 S
NUB3 B
NUB4 S
NUB4 B
K
[NH4+]
mg/L
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Feb-14
Jun-14
Oct-14
Feb-15
Jun-15
Oct-15
Feb-16
Jun-16
Oct-16
NUB1 Surface
NUB1 Bottom
NUB2 Surface
NUB2 Bottom
NUB3 Surface
NUB3 Bottom
NUB4 Surface
NUB4 Bottom
B
[Nitrate]
[mg/L]
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NUB1 S
NUB1 B
NUB2 S
NUB2 B
NUB3 S
NUB3 B
NUB4 S
NUB4 B
L
[NO3]
mg/L
0.12
0.1
0.08
0.06
0.04
0.02
0
Feb-14
Jun-14
Oct-14
Feb-15
Jun-15
Oct-15
Feb-16
Jun-16
Oct-16
NUB1 Surface
NUB1 Bottom
NUB2 Surface
NUB2 Bottom
NUB3 Surface
NUB3 Bottom
NUB4 Surface
NUB4 Bottom

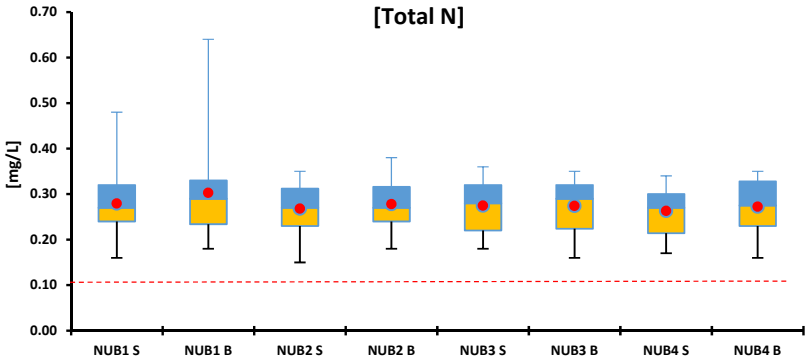
C


[Phosphate]
[mg/L]
0.04
0.03
0.02
0.01
0.00
NUB1 S
NUB1 B
NUB2 S
NUB2 B
NUB3 S
NUB3 B
NUB4 S
NUB4 B

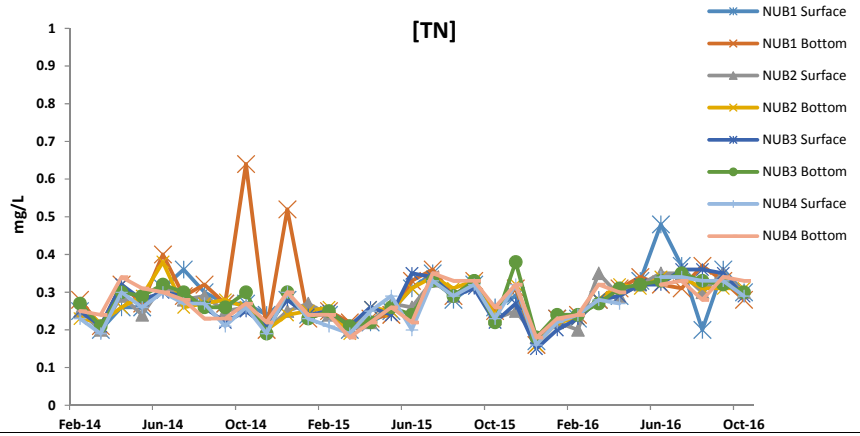
M

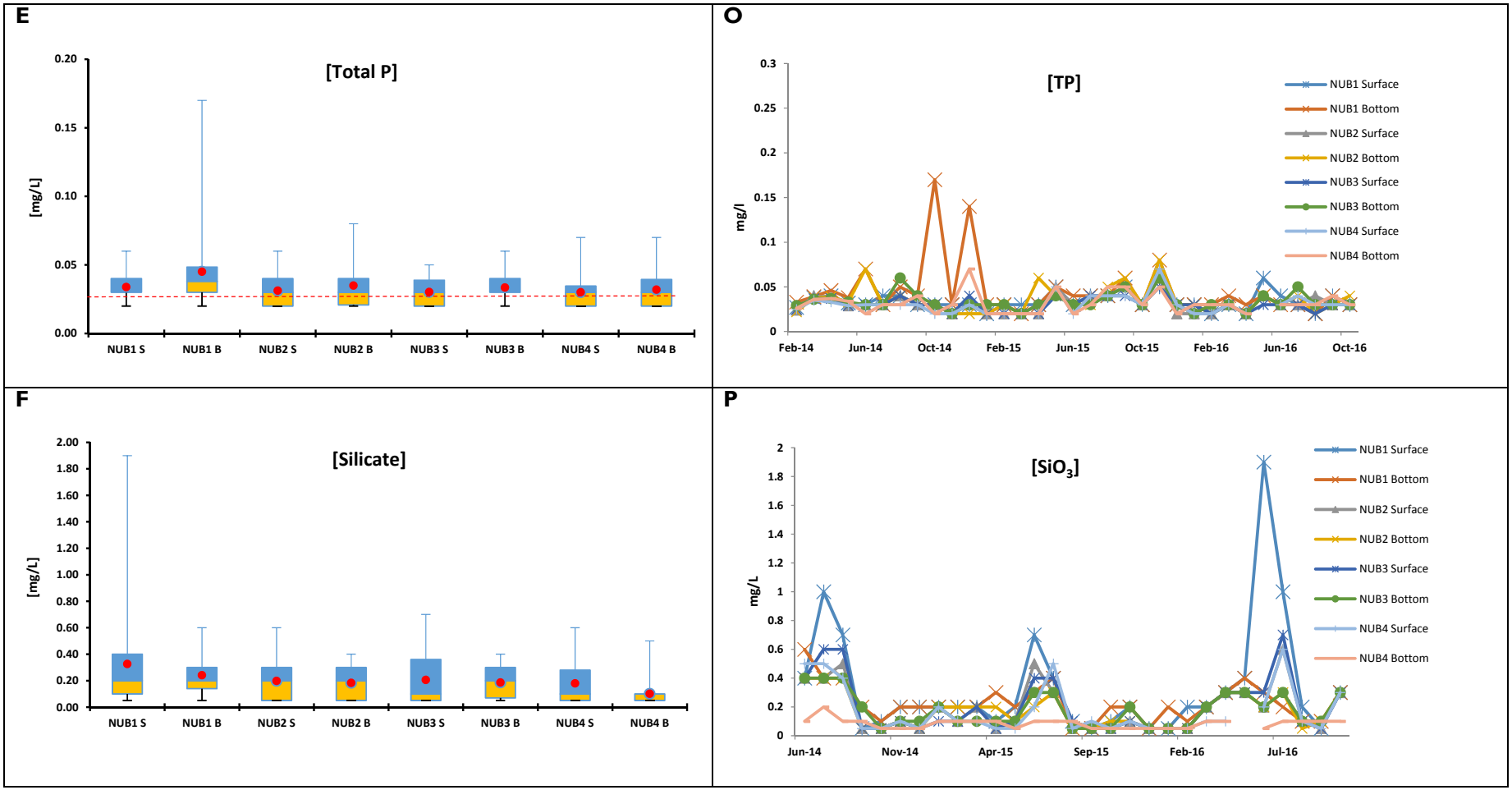

[PO4]
[mg/L]
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Feb-14
Jun-14
Oct-14
Feb-15
Jun-15
Oct-15
Feb-16
Jun-16
Oct-16
NUB1 Surface
NUB1 Bottom
NUB2 Surface
NUB2 Bottom
NUB3 Surface
NUB3 Bottom
NUB4 Surface
NUB4 Bottom

D

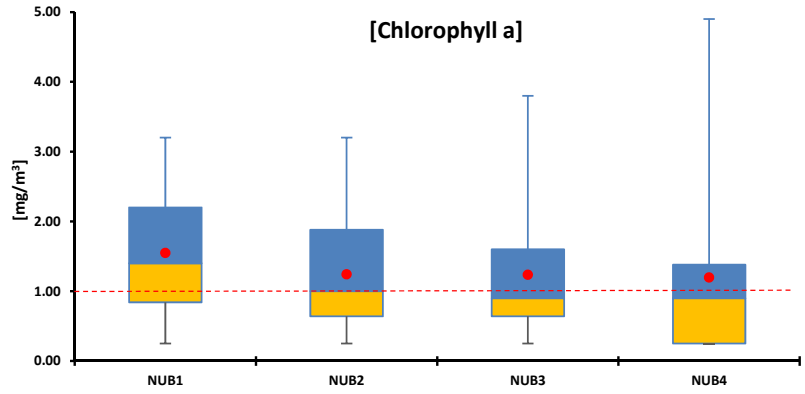

[Total N]
[mg/L]
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
NUB1 S
NUB1 B
NUB2 S
NUB2 B
NUB3 S
NUB3 B
NUB4 S
NUB4 B

N

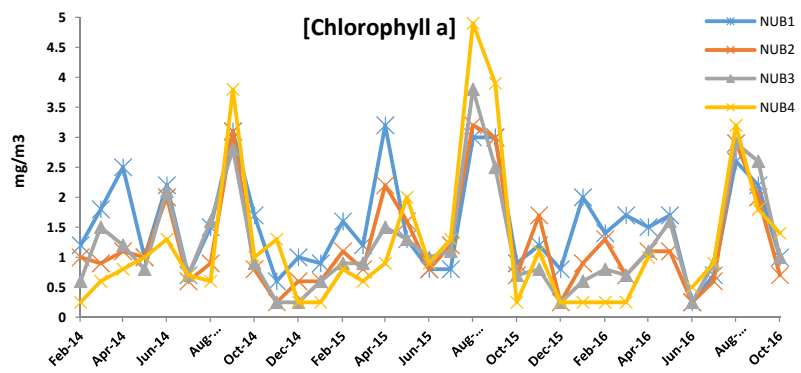

[TN]
mg/L
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Feb-14
Jun-14
Oct-14
Feb-15
Jun-15
Oct-15
Feb-16
Jun-16
Oct-16
NUB1 Surface
NUB1 Bottom
NUB2 Surface
NUB2 Bottom
NUB3 Surface
NUB3 Bottom
NUB4 Surface
NUB4 Bottom


E
[Total P]
[mg/L]
0.20
0.15
0.10
0.05
0.00
NUB1 S
NUB1 B
NUB2 S
NUB2 B
NUB3 S
NUB3 B
NUB4 S
NUB4 B
O
[TP]
mg/l
0.3
0.25
0.2
0.15
0.1
0.05
0
Feb-14
Jun-14
Oct-14
Feb-15
Jun-15
Oct-15
Feb-16
Jun-16
Oct-16
NUB1 Surface
NUB1 Bottom
NUB2 Surface
NUB2 Bottom
NUB3 Surface
NUB3 Bottom
NUB4 Surface
NUB4 Bottom
F
[Silicate]
[mg/L]
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
NUB1 S
NUB1 B
NUB2 S
NUB2 B
NUB3 S
NUB3 B
NUB4 S
NUB4 B
P
[SiO3]
mg/L
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jun-14
Nov-14
Apr-15
Sep-15
Feb-16
Jul-16
NUB1 Surface
NUB1 Bottom
NUB2 Surface
NUB2 Bottom
NUB3 Surface
NUB3 Bottom
NUB4 Surface
NUB4 Bottom

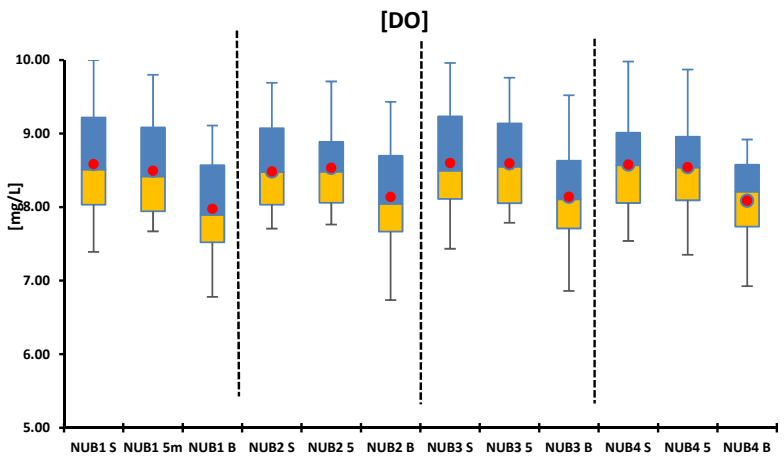
G


[Chlorophyll a]
[mg/m³]
5.00
4.00
3.00
2.00
1.00
0.00
NUB1
NUB2
NUB3
NUB4

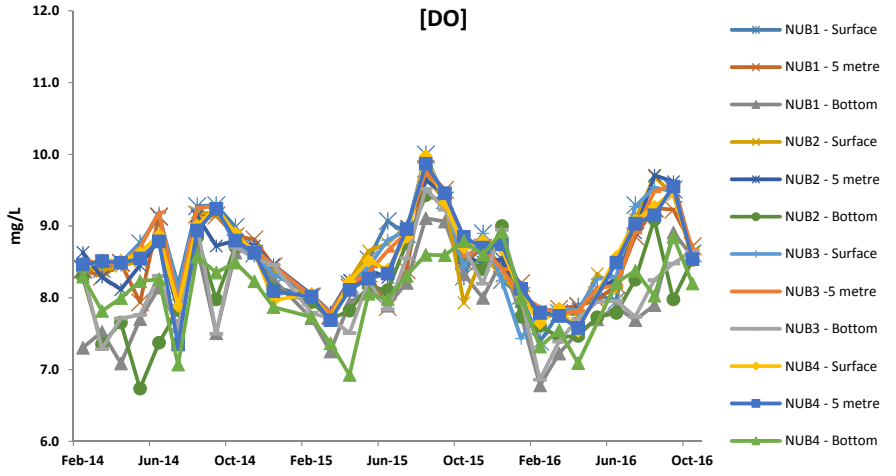
Q


[Chlorophyll a]
mg/m3
NUB1
NUB2
NUB3
NUB4
Feb-14
Apr-14
Jun-14
Aug-...
Oct-14
Dec-14
Feb-15
Apr-15
Jun-15
Aug-...
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-...
Oct-16

H


[DO]
[mg/L]
10.00
9.00
8.00
7.00
6.00
5.00
NUB1 S
NUB1 5m
NUB1 B
NUB2 S
NUB2 5
NUB2 B
NUB3 S
NUB3 5
NUB3 B
NUB4 S
NUB4 5
NUB4 B

R


[DO]
mg/L
12.0
11.0
10.0
9.0
8.0
7.0
6.0
Feb-14
Jun-14
Oct-14
Feb-15
Jun-15
Oct-15
Feb-16
Jun-16
Oct-16
NUB1 - Surface
NUB1 - 5 metre
NUB1 - Bottom
NUB2 - Surface
NUB2 - 5 metre
NUB2 - Bottom
NUB3 - Surface
NUB3 -5 metre
NUB3 - Bottom
NUB4 - Surface
NUB4 - 5 metre
NUB4 - Bottom

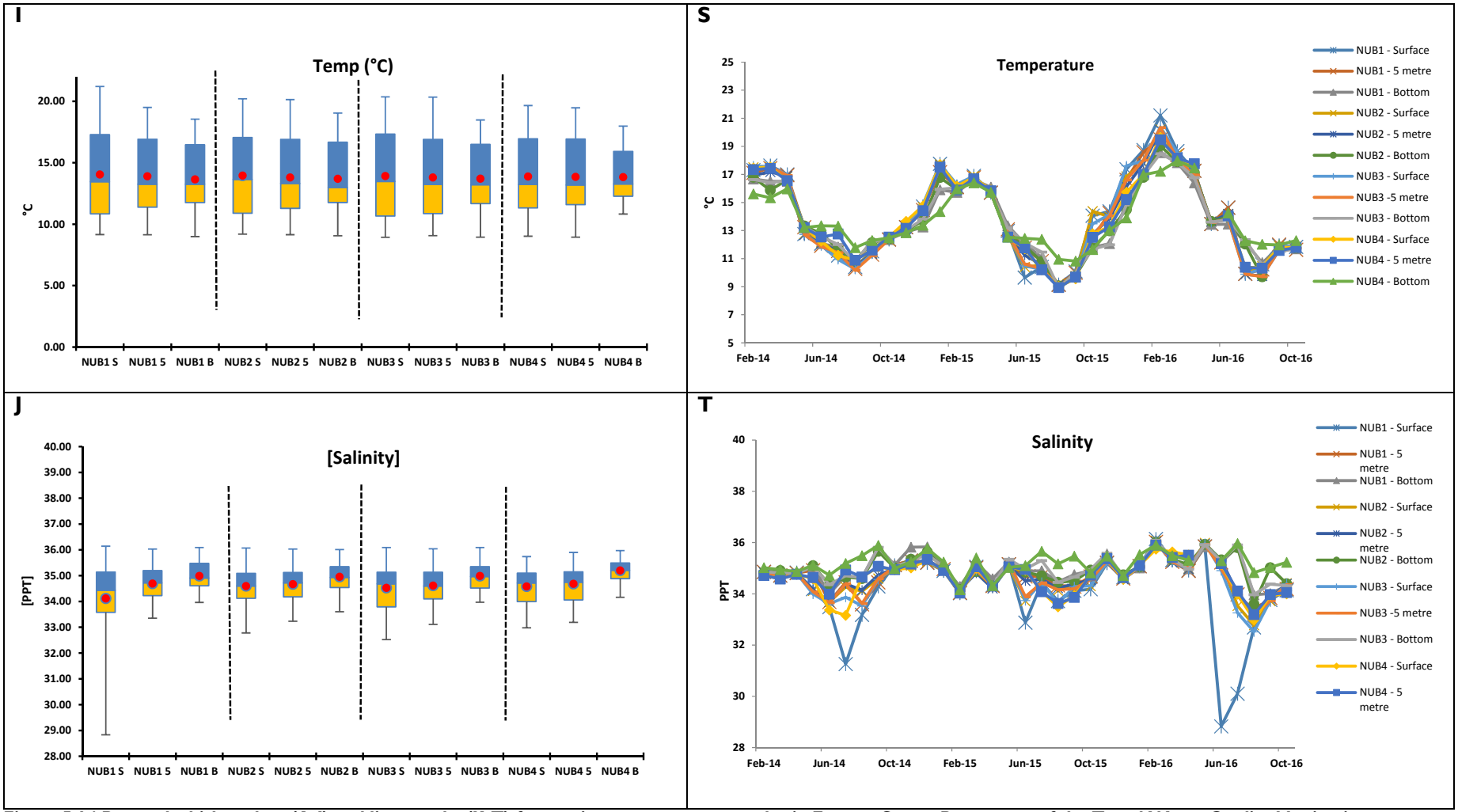


Figure 5.14 Box and whisker plots (A-J) and line graphs (K-T) for nutrient parameters samples in Eastern Storm Bay as part of the Tassal Water Quality Monitoring Program covering 26 consecutive monthly sampling events (Feb 2014-March 2016). Red dashed lines indicate ANZECC default Trigger Levels for water quality parameters in south-east Australian marine waters.

The following summary provides an explanation of the water quality sampling results for the consecutive monthly sampling taken since February 2014.

5.1.4.1 Nutrients

Ammonia: Concentrations are generally low with higher concentrations recorded for bottom samples across all sites. The maximum value obtained during the sampling period was 0.052 mg/L at the Nub2 sampling site (off Creeses Mistake) in June 2014. As shown in Figure 5.14 (K), this spike was a one-off event. Overall, ammonia concentration levels were generally stable across all sites, but were slightly higher in the more sheltered, protected bays. The range of observed values was lower at the sampling site located within the proposed West of Wedge development. Statistical values for ammonia concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 10.

Table 10 Statistical attributes for ammonia – Tasman water quality monitoring program

	Nub1 (surface)	Nub1 (bottom)	Nub2 (surface)	Nub2 (bottom)	Nub3 (surface)	Nub3 (bottom)	Nub4 (surface)	Nub4 (bottom)
median	0.0050	0.0120	0.0060	0.0090	0.0060	0.0100	0.0035	0.0070
20th	0.0025	0.0072	0.0025	0.0050	0.0025	0.0025	0.0025	0.0025
80th	0.0092	0.0182	0.0116	0.0166	0.0090	0.0130	0.0068	0.0100
min	0.0020	0.0025	0.0025	0.0025	0.0020	0.0025	0.0025	0.0025
max	0.0340	0.0280	0.0240	0.0520	0.0170	0.0350	0.0100	0.0200
mean	0.0066	0.0129	0.0079	0.0114	0.0060	0.0098	0.0046	0.0075

Nitrate: Levels were generally low, but show spiked elevations in winter months (July to Aug 2014, Jun to July 2015 and from June 2016) as shown in Figure 5.14 (L). The large variation in observations during the sampling period is shown in Figure 5.14 (B) by the mean and maximum values – the mean values across all sites are sufficiently different to the median values due to the elevated spikes observed in only 5 of the 33 monthly sampling events. This perturbation is a natural event, and represents the influx of nutrient rich Southern Ocean water that is known to occur during winter. The monitoring site west of Wedge Island (Nub4) recorded slightly higher levels of residual nitrate over an extended winter period, once again reflecting that this location is a more oceanic site than the other monitoring sites. Statistical values for nitrate concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 11.

Table 11 Statistical attributes for nitrate – Tasman water quality monitoring program

	Nub1 (surface)	Nub1 (bottom)	Nub2 (surface)	Nub2 (bottom)	Nub3 (surface)	Nub3 (bottom)	Nub4 (surface)	Nub4 (bottom)
median	0.0010	0.0070	0.0020	0.0060	0.0010	0.0050	0.0035	0.0225
20th	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0052
80th	0.0092	0.0264	0.0158	0.0208	0.0160	0.0260	0.0194	0.0408
min	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010

max	0.1000	0.0470	0.0590	0.0590	0.0590	0.0520	0.0620	0.0480
mean	0.0111	0.0129	0.0098	0.0127	0.0097	0.0124	0.0109	0.0232

Phosphate: Levels at the Nubeena sites showed slight variation across sites, with an observed "one-off" elevated reading obtained for a bottom water sample from site NUB 2 in June 2014 as shown in Figure 5.14 (M). Notwithstanding this event, average values across sampling sites showed strong consistency for both surface and bottom water phosphate concentrations. A slight decline in phosphate concentrations was observed for surface samples across all sites in spring 2014 and 2015 and is likely to be a result of nutrient uptake by seasonal phytoplankton activity. Statistical values for phosphate concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 12.

Table 12 Statistical attributes for phosphate – Tasman water quality monitoring program

	Nub1 (surface)	Nub1 (bottom)	Nub2 (surface)	Nub2 (bottom)	Nub3 (surface)	Nub3 (bottom)	Nub4 (surface)	Nub4 (bottom)
median	0.0050	0.0080	0.0050	0.0070	0.0050	0.0060	0.0045	0.0080
20th	0.0030	0.0060	0.0034	0.0044	0.0034	0.0050	0.0030	0.0060
80th	0.0080	0.0106	0.0086	0.0100	0.0086	0.0100	0.0088	0.0100
min	0.0015	0.0050	0.0015	0.0015	0.0015	0.0030	0.0015	0.0015
max	0.0140	0.0190	0.0130	0.0340	0.0120	0.0200	0.0120	0.0130
mean	0.0057	0.0088	0.0060	0.0079	0.0056	0.0075	0.0054	0.0078

Total Nitrogen: Levels were consistent across sampling sites, with strong correlation observed for minimum, average and maximum values across all sites, apart from three isolated slightly elevated observations recorded at Parsons Bay in October 2014, December 2014 and June 2016 as shown in Figure 5.14 (N). Statistical values for total nitrogen concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 13.

Table 13 Statistical attributes for total nitrogen – Tasman water quality monitoring program

	Nub1 (surface)	Nub1 (bottom)	Nub2 (surface)	Nub2 (bottom)	Nub3 (surface)	Nub3 (bottom)	Nub4 (surface)	Nub4 (bottom)
median	0.2700	0.2900	0.2700	0.2700	0.2800	0.2900	0.2700	0.2750
20th	0.2400	0.2340	0.2300	0.2400	0.2200	0.2240	0.2140	0.2300
80th	0.3200	0.3300	0.3120	0.3160	0.3200	0.3200	0.3000	0.3280
min	0.1600	0.1800	0.1500	0.1800	0.1800	0.1600	0.1700	0.1600
max	0.4800	0.6400	0.3500	0.3800	0.3600	0.3500	0.3400	0.3500
mean	0.2794	0.3030	0.2682	0.2782	0.2748	0.2742	0.2631	0.2725

Total Phosphorus: Whilst total phosphorous levels showed consistency across sites NUB 2, NUB 3 and NUB 4, Total Phosphorus concentrations at site NUB 1 showed slightly elevated levels in bottom water samples in 2014 (see Figure 5.14 (E and O)). This obvious trend is reflected in mean bottom water concentrations that are higher than those recorded at each of the other sites (see Table 14). The cause of this higher total phosphorous level remains speculative and given that the same pattern was not evident in the dissolved phosphate data recorded at the same site, then it is likely to be an organic source of phosphorous possibly relating to impacts from coastal development and run-off into Parsons Bay from Parsons Bay Creek, Stinking Creek, Badger Creek and Sucklings Creek. Statistical values for total phosphorus concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 14.

Table 14 Statistical attributes for total phosphorus – Tasman water quality monitoring program

	Nub1 (surface)	Nub1 (bottom)	Nub2 (surface)	Nub2 (bottom)	Nub3 (surface)	Nub3 (bottom)	Nub4 (surface)	Nub4 (bottom)
median	0.0300	0.0380	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300
20th	0.0300	0.0300	0.0200	0.0208	0.0200	0.0300	0.0200	0.0200
80th	0.0400	0.0484	0.0400	0.0400	0.0388	0.0400	0.0346	0.0394
min	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
max	0.0600	0.1700	0.0600	0.0800	0.0500	0.0600	0.0700	0.0700
mean	0.0338	0.0450	0.0312	0.0349	0.0302	0.0335	0.0301	0.0320

Silicate: Levels were similar across most sampling sites, with strong correlation observed for minimum, average and maximum values across all sites except site NUB 1, which showed elevated silicate concentrations compared to other sites, particularly in June 2016 (see Figure 5.14 (P)). Silicate concentrations generally peaked in late autumn-early winter each year before declining over the spring and summer months. The pattern of silicate concentration is likely to be attributable to run-off in winter (resulting in higher concentration levels in the more sheltered bays), and phytoplankton activity, particularly diatoms, which were abundant during the September sampling events. Statistical values for silicate concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 15.

Table 15 Statistical attributes for silicate – Tasman water quality monitoring program

	Nub1 (surface)	Nub1 (bottom)	Nub2 (surface)	Nub2 (bottom)	Nub3 (surface)	Nub3 (bottom)	Nub4 (surface)	Nub4 (bottom)
median	0.2000	0.2000	0.2000	0.2000	0.1000	0.2000	0.1000	0.1000
20th	0.1000	0.1400	0.0500	0.0500	0.0500	0.0700	0.0500	0.0500
80th	0.4000	0.3000	0.3000	0.3000	0.3600	0.3000	0.2800	0.1000
min	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500
max	1.9000	0.6000	0.6000	0.4000	0.7000	0.4000	0.6000	0.5000
mean	0.3258	0.2409	0.1985	0.1833	0.2061	0.1864	0.1797	0.1016

Chlorophyll-a: These concentrations are an indicator of primary production within the marine/estuarine system. Levels observed during this monitoring program showed broad consistency across sites, with concentrations increasing during late winter-early spring in both 2015 and 2016 (Figure 5.14 (Q)). The maximum value of chlorophyll-a concentration observed across the sampling period occurred in August 2015 at site NUB 4 west of Wedge Island. Although this maximum value was observed at the more remote and exposed monitoring site, there was a consistent pattern where chlorophyll-a concentrations were generally greater at the inshore monitoring sites (see Figure 5.14 (G)). Statistical values for chlorophyll-a concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 16.

Table 16 Statistical attributes for chlorophyll a – Tasman water quality monitoring program

	Nub1	Nub2	Nub3	Nub4
median	1.4000	1.0000	0.9000	0.9000
20th	0.8400	0.6400	0.6400	0.2500
80th	2.2000	1.8800	1.6000	1.3800
min	0.2500	0.2500	0.2500	0.2500
max	3.2000	3.2000	3.8000	4.9000
mean	1.5470	1.2409	1.2348	1.1969

The observed patterns of chlorophyll-a concentrations during this sampling program are consistent with recognised peaks in early spring and late autumn in many of Tasmania's coastal waterways and bays. Patterns in chlorophyll-a concentrations were also consistent with laboratory cell counts. Overall, 86 species of phytoplankton were recorded across the sampling period. Diatoms were the dominant taxonomic group recorded, with *Chaetoceros socialis* and *Skeletonema spp.* accounting for approximately 37% of cells counted.

5.1.4.2 Physico-chemical parameters

Dissolved Oxygen: Concentrations remained relatively consistent across all sites and depths with recorded observations ranging from 6.7 to 10.0 mg/L across the sampling period (see Table 17). Figure 5.14 (R) shows a seasonal pattern where dissolved oxygen levels decline gradually from September onwards through the summer months (presumed to be temperature related), and gradually increase again with the commencement of autumn. Statistical values for dissolved oxygen concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 17.

Table 17 Statistical attributes for dissolved oxygen – Tasman water quality monitoring program

	Nub1 (Surf)	Nub1 (5m)	Nub1 (Bot)	Nub2 (Surf)	Nub2 (5m)	Nub2 (Bot)	Nub3 (Surf)	Nub3 (5m)	Nub3 (Bot)	Nub4 (Surf)	Nub4 (5m)	Nub4 (Bot)
median	8.5	8.4	7.9	8.5	8.5	8.0	8.5	8.6	8.1	8.6	8.5	8.2
20th	8.0	7.9	7.5	8.0	8.1	7.7	8.1	8.1	7.7	8.1	8.1	7.7
80th	9.2	9.1	8.6	9.1	8.9	8.7	9.2	9.1	8.6	9.0	9.0	8.6
min	7.4	7.7	6.8	7.7	7.8	6.7	7.4	7.8	6.9	7.5	7.4	6.9
max	10.0	9.8	9.1	9.7	9.7	9.4	10.0	9.8	9.5	10.0	9.9	8.9

mean	8.6	8.5	8.0	8.5	8.5	8.1	8.6	8.6	8.1	8.6	8.5	8.1

Temperature: There was an obvious seasonal pattern shown with highest values recorded in summer and lowest values recorded in winter. The maximum recorded temperature over the 33 sampling events occurred in February 2016 at site NUB 1 (21.2°C) in Parsons Bay, an increase of 3.4°C from the highest recorded temperature of summer 2015 at the same site (Figure 5.14 (S)). The higher temperatures observed at all sites in summer 2016 were also observed throughout state coastal waters. At the proposed West of Wedge development site, surface water temperature increased 10.6°C between August 2015 and February 2016. Statistical values for temperature across the sampling period (Feb 2014-Oct 2016) are shown below in Table 18.

Table 18 Statistical attributes for temperature – Tasman water quality monitoring program

	Nub1 (Surf)	Nub1 (5m)	Nub1 (Bot)	Nub2 (Surf)	Nub2 (5m)	Nub2 (Bot)	Nub3 (Surf)	Nub3 (5m)	Nub3 (Bot)	Nub4 (Surf)	Nub4 (5m)	Nub4 (Bot)
median	13.5	13.3	13.3	13.6	13.3	13.0	13.5	13.2	13.2	13.2	13.2	13.3
20th	10.8	11.4	11.8	10.9	11.3	11.8	10.7	10.9	11.7	11.3	11.6	12.3
80th	17.3	16.9	16.5	17.0	16.9	16.7	17.3	16.9	16.5	17.0	16.9	15.9
min	9.2	9.1	9.0	9.2	9.1	9.1	8.9	9.1	8.9	9.0	8.9	10.8
max	21.2	19.5	18.6	20.2	20.1	19.0	20.4	20.3	18.5	19.7	19.5	18.0
mean	14.0	13.9	13.6	13.9	13.8	13.7	13.9	13.8	13.7	13.9	13.8	13.8

Salinity: Levels were broadly consistent across all sampling sites and tended to be slightly lower at site NUB 1 (Parsons Bay) than at the more exposed oceanic site NUB 4 (west of Wedge Island) (Figure 5.14 (T)). This decrease in salinity is likely to be a direct result of river in-flows (albeit minor) and this is demonstrated by the low salinity recorded in June 2016 at Parsons Bay (NUB 1), immediately after a significant rainfall event. Statistical values for salinity concentrations across the sampling period (Feb 2014-Oct 2016) are shown below in Table 19.

Table 19 Statistical attributes for salinity – Tasman water quality monitoring program

	Nub1 (Surf)	Nub1 (5m)	Nub1 (Bot)	Nub2 (Surf)	Nub2 (5m)	Nub2 (Bot)	Nub3 (Surf)	Nub3 (5m)	Nub3 (Bot)	Nub4 (Surf)	Nub4 (5m)	Nub4 (Bot)
median	34.4	34.7	34.9	34.6	34.7	34.9	34.7	34.6	35.0	34.7	34.7	35.2
20th	33.6	34.2	34.6	34.1	34.2	34.5	33.8	34.1	34.5	34.0	34.1	34.9
80th	35.1	35.2	35.5	35.1	35.1	35.3	35.1	35.1	35.3	35.1	35.2	35.5
min	28.8	33.4	34.0	32.8	33.2	33.6	32.5	33.1	34.0	33.0	33.2	34.2
max	36.1	36.0	36.1	36.1	36.0	36.0	36.1	36.0	36.1	35.7	35.9	36.0
mean	34.1	34.7	35.0	34.6	34.7	35.0	34.5	34.6	35.0	34.6	34.7	35.2

5.1.5 Geoconservation Sites

A desktop search of LISTMap was undertaken and indicates that there are two listed geoconservation sites located in the surrounding area of the proposed development (LISTMap, 2016): Wedge Island and Roaring Beach (see Figure 5.15). These sites are also recorded on the Tasmanian Natural Values Atlas with the following descriptions.

- Wedge Island is unique in its cross profile – it is wedge shaped, reflecting differential wave attack. The island is Jurassic dolerite, hence no lithological influence on its form.
- Roaring Beach is a raised, fossil cobble beach and a longitudinal dune complex.

The proposed West of Wedge development would be located approximately 1.8 km from Wedge Island and at least 5 km from Roaring Beach.

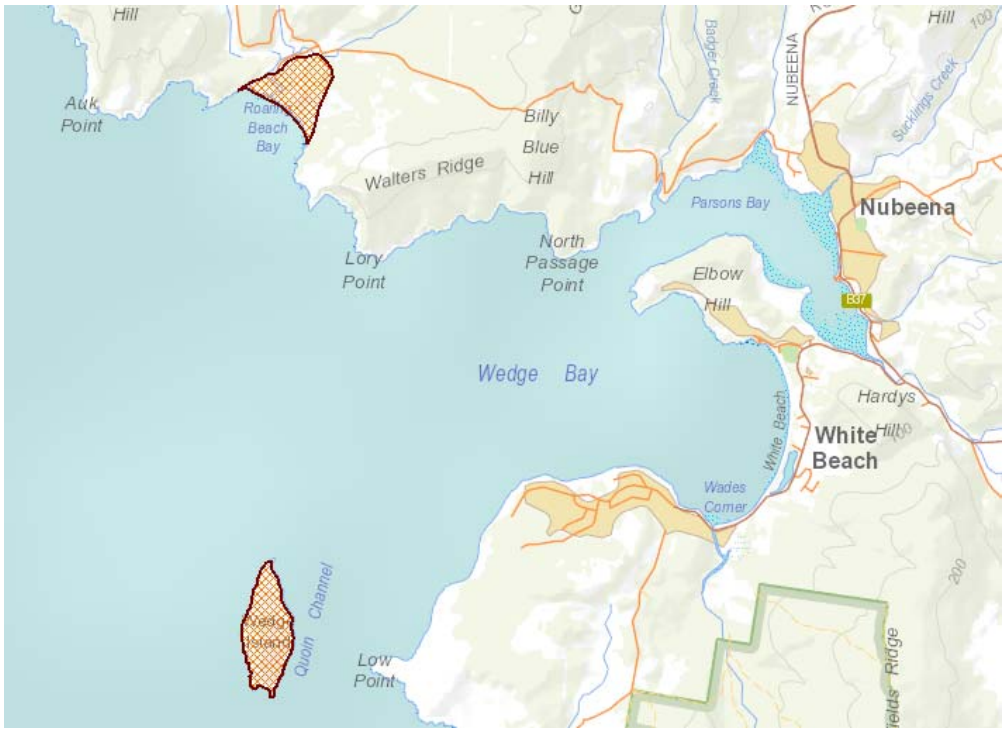


Figure 5.15 Geoconservation sites in the vicinity of the proposed West of Wedge development

5.1.6 Wind and Wave Conditions

For a detailed discussion of existing wind and wave conditions in the proposed development area refer to sections 5.1.3.1.1 through to 5.1.3.1.3.

5.2 Flora and Fauna

5.2.1 Marine Vegetation

The proposed West of Wedge development is situated in an offshore location with the eastern zone boundary approximately 1.8 km from the nearest coast (western side of Wedge Island). The zone

assessment identified only one habitat category within the assessment area, with ridged sand observed across the entire 1127 ha survey and no benthic vegetation.

The macroalgal communities present to the east of the proposed development on adjacent coastlines are strongly influenced by prevailing swell action. The generalised scheme for characterising Tasmanian macroalgal assemblages provides a useful framework for describing community structure (Figure 5.16; Edgar 1984). Reefs on maximally exposed coastline on the western side of Wedge Island would be expected to be dominated by large brown algae such as *Durvillea potatorum*, *Lessonia corrugata* and *Phyllospora comosa* in shallow water (< 10 m). In deeper water (i.e. > 10 m), *Ecklonia radiata* dominated assemblages are expected to populate these reefs. Reefs subject to less swell action (sub-maximally or moderately exposed) would be expected to be typified by 'mixed algal assemblages' and would occur on the more sheltered eastern side of Wedge Island. It should be noted that *Lessonia corrugata* tends to be the dominant brown algae in shallow water (e.g. 5-10 m) throughout eastern Storm Bay. Elsewhere in Tasmania, *Phyllospora comosa* is much more common.

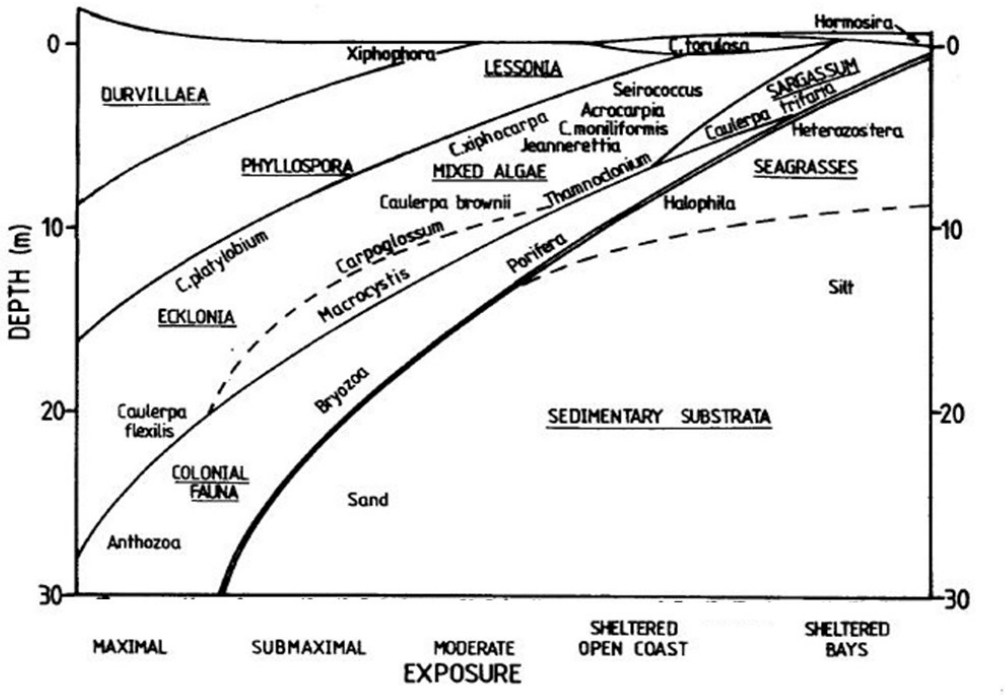


Figure 5.16 Generalised scheme detailing the distribution of benthic assemblages on Tasmanian reefs (reproduced from Edgar, 1984)

As part of the FRDC funded project '*Understanding broadscale impacts of salmonid farming on rocky reef communities*', subtidal surveys of macroalgal communities were undertaken in eastern Storm Bay during 2015 (see Appendix 6). The survey sites were slightly less exposed to swell compared with the Wedge Island area and provide a good indication of the species likely to occur along the coastline adjacent to the proposed West of Wedge development (see Table 20).

Table 20 Macroalgal taxa were recorded during subtidal surveys in eastern Storm Bay in June 2015

Macroalgal Species	
Acrocarpia paniculata	*Macrocystis pyrifera*
Asparagopsis armata	*Perithalia caudata*

Ballia callitricha	*Peyssonnelia* spp. (encrusting)
Callophyllis rangiferina	*Phacelocarpus peperocarpos*
Carpoglossum confluens	*Phyllospora comosa*
Caulerpa flexilis	*Plocamium angustum*
Caulerpa simpliciuscula	*Plocamium dilatatum*
Caulerpa trifaria	*Pollexfenia lobata*
Caulocystis cephalornithos	*Polyopes constrictus*
Chaetomorpha coliformis	*Polysiphonia spp.*
Chaetomorpha spp.	*Ptilota hannafordii*
Champia spp.	*Rhodymenia spp.*
Cystophora moniliformis	*Sargassum fallax*
Cystophora platylobium	*Sargassum lacerifolium*
Cystophora retroflexa	*Sargassum vestitum*
Dictyopteris muelleri	*Ulva* spp.
Ecklonia radiata	Unidentified algae (crustose coralline)
Gelidium spp.	Unidentified algae (encrusting brown)
Gigartina muelleriana	Unidentified algae (filamentous green)
Halopteris paniculata	Unidentified algae (foliose red)
Hemineura frondosa	Unidentified algae (turf)
Laurencia spp.	*Xiphophora gladiata*
Lenormandia marginata	*Zonaria turneriana/angustata*
Lessonia corrugata	

5.2.2 Benthic Fauna

In and around the Tasman region of Tassal's Eastern Farming Zone, diverse assemblages of invertebrates were recorded, with no strong patterns in community composition across the extent of the survey area (Aquenal, 2016). A range of faunal groups were observed in the sediment samples including anthozoans, crustaceans (e.g. amphipods, cumaceans, decapods, ostracods, tanaids), molluscs, echinoderms and polychaete worms. One of the most common taxa recorded was the bivalve *Glycymeris striatularis* which was recorded from 15 of the 40 grab samples collected. Other prominent taxa included anthozoans (Family Edwardsiidae), brittle stars (*Ophiura kinbergi*) and trumpet worms (Family Pectinariidae). For further details, refer to Appendix 11.

5.2.3 Fish

Whilst not a regulatory requirement, Tassal commissioned baited remote underwater video (BRUV) surveys to improve understanding of fish communities within the proposed zone. Surveys were conducted inside each of the four lease areas. The objective of the surveys was to document the diversity of fish species occurring within the proposed zone. The BRUV system used in the survey comprised of a stainless steel frame with a bait cylinder attached at the centre of the camera's field of view. The alignment of the frame and camera view was horizontal, providing footage of the seafloor and benthic fish communities. Video footage was recorded with a GoPro Hero4 video camera.

A total of 16 BRUV deployments were conducted, comprising four deployments within each of the proposed lease areas. At each site, video footage was recorded for at least 20 minutes from the time the video frame had settled on the seabed. Table 21 lists the fish species recorded in the surveys with southern sand flathead (*Platycephalus bassensis*) and southern school whiting (*Sillago bassensis*) the most prominent species observed. Additional species recorded included barracouta (*Thyrsites atun*), common gurnard perch (*Neosebastes scorpaenoides*) and spikey dogfish (*Squalus megalops*). For additional detail, refer to Appendix 17.

Table 21 Fish species were recorded during BRUV surveys in the proposed zone area in Aug-Sep 2015

Fish Species	
Thyrsites atun	Barracouta
Neosebastes scorpaenoides	Common Gurnard Perch
Contusus brevicaudus	Prickly Toadfish
Pseudophcis bachus	Red Cod
Aracana aurita	Shaw's Cowfish
Gymnapistes marmoratus	Soldierfish
Platycephalus bassensis	Southern Sand Flathead
Sillago bassensis	Southern School Whiting
Squalus megalops	Spikey Dogfish

5.2.4 Birds

Storm Bay provides a range of important habitat types for a variety of bird species. Due to the level of exposure to oceanic conditions and proximity to remote islands, seabirds, coastal shorebirds and scavengers (i.e. silver gulls) are the dominant species. These birds use this habitat to forage and feed, or as part of their seasonal migration route.

There is also a range of terrestrial/woodland species included on this list because they are known to occur within 10 km of the proposed West of Wedge development. It is possible that their range and/or preferred habitat could extend west of the Tasman Peninsula, across Storm Bay to other parts of Tasmania.

Breeding sites for many of the migratory seabird species known to occur in Storm Bay extend from Bass Strait islands (i.e. Albatross Island) in the north to sub-Antarctic islands in the south (i.e. Macquarie Island). The following list of species shown in Table 22 was provided by BirdLife Tasmania and represents species observed within the Storm Bay region, as well as those recorded within 10 km

from the mid-point of the proposed zone (UTM 550860 E, 5223619 N). Of Tasmania's 12 endemic bird species, nine endemic species are included in this list (indicated with an **'E'** in Table 22).

Table 22 Species of birds recorded in the Storm Bay region (Courtesy of BirdLife Tasmania)

Scientific Name	Common Name	Habit/Habitat
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Woodland/Scrub
Acanthiza ewingii (E)	Tasmanian Thornbill	Woodland/Scrub
Acanthiza pusilla	Brown Thornbill	Woodland/Scrub
Acanthorhynchus tenuirostris	Eastern Spinebill	Woodland/Scrub
Accipiter fasciatus	Brown Goshawk	Predator
Alauda arvensis	Skylark	Woodland/Scrub
Anthochaera paradoxa (E)	Yellow Wattlebird	Woodland/Scrub
Anthus novaeseelandiae	Richard's Pipit	Paddock/Open Space/Wetland
Aptenodytes patagonicus	King penguin	Migratory Seabird
Aquila audax	Wedge-tailed Eagle	Predator
Artamus cyanopterus	Dusky Woodswallow	Woodland/Scrub
Cacomantis flabelliformis	Fan-tailed Cuckoo	Woodland/Scrub
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	Woodland/Scrub
Carduelis carduelis	European Goldfinch	Woodland/Scrub
Catharacta lonnbergi	Brown Skua	Migratory Seabird
Charadrius ruficapillus	Red-capped Plover	Coastal/Open Space/Estuarine
Circus approximans	Swamp Harrier	Predator
Colluricincla harmonica	Grey Shrike-thrush	Woodland/Scrub
Coracina novaehollandiae	Black-faced Cuckoo-Shrike	Woodland/Scrub
Corvus tasmanicus	Forest Raven	Woodland/Scrub
Cracticus torquatus	Grey Butcherbird	Woodland/Scrub
Cuculus pallidus	Pallid Cuckoo	Woodland/Scrub
Dacelo novaeguineae	Laughing Kookaburra	Woodland/Scrub
Daption capense	Cape Petrel	Migratory Seabird
Diomedea epomophora	Southern Royal Albatross	Migratory Seabird
Diomedea exulans	Wandering Albatross	Migratory Seabird

Diomedea royal albatross sp.	Royal Albatross spp	Migratory Seabird
Egretta novaehollandiae	White-faced Heron	Paddock/Open Space/Wetland
Epthianura albifrons	White-fronted Chat	Coastal
Eudyptes chrysocome	Rockhopper Penguin	Migratory Seabird
Eudyptes chrysolophus	Macaroni Penguin	Migratory Seabird
Eudyptula minor	Little Penguin	Coastal
Falco berigora	Brown Falcon	Predator
Falco cenchroides	Nankeen Kestrel	Predator
Fregetta grallaria	White-bellied Storm-Petrel	Migratory Seabird
Fregetta tropica	Black-bellied Storm-Petrel	Migratory Seabird
Gallinula mortierii (E)	Tasmanian Native-hen	Paddock/Open Space/Wetland
Haematopus fuliginosus	Sooty Oystercatcher	Coastal
Haematopus longirostris	Pied Oystercatcher	Coastal
Haliaeetus leucogaster	White-bellied Sea-Eagle	Predator
Halobaena caerulea	Blue Petrel	Migratory Seabird
Hirundo neoxena	Welcome Swallow	Woodland/Scrub
Hirundo nigricans	Tree Martin	Woodland/Scrub
Larus dominicanus	Kelp Gull	Coastal Seabird
Larus novaehollandiae	Silver Gull	Coastal Seabird
Larus pacificus	Pacific Gull	Coastal Seabird
Lathamus discolor	Swift Parrot	Woodland/Scrub
Lichenostomus flavicollis (E)	Yellow-throated Honeyeater	Woodland/Scrub
Lugensa brevirostris	Kerguelen Petrel	Migratory Seabird
Macronectes giganteus	Southern Giant Petrel	Migratory Seabird
Macronectes halli	Northern Giant Petrel	Migratory Seabird
Macronectes spp	Northern/Southern Giant-Petrel	Migratory Seabird
Malurus cyaneus	Superb Fairy-wren	Woodland/Scrub
Manorina melanocephala	Noisy Miner	Woodland/Scrub
Melithreptus affinis (E)	Black-headed Honeyeater	Woodland/Scrub
Melithreptus validirostris (E)	Strong-billed Honeyeater	Woodland/Scrub

Morus serrator	Australasian Gannet	Coastal
Myiagra cyanoleuca	Satin Flycatcher	Woodland/Scrub
Ninox novaeseelandiae	Southern Boobook	Woodland/Scrub
Pachycephala pectoralis	Golden Whistler	Woodland/Scrub
Pachyptila belcheri	Slender-billed Prion	Coastal
Pachyptila desolata	Antarctic Prion	Coastal
Pachyptila turtur	Fairy Prion	Coastal
Pachyptila vittata	Broad-billed Prion	Coastal
Pardalotus punctatus	Spotted Pardalote	Woodland/Scrub
Pardalotus striatus	Striated Pardalote	Woodland/Scrub
Pelagodroma marina	White-faced Storm-Petrel	Migratory Seabird
Pelecanoides urinatrix	Common Diving-Petrel	Migratory Seabird
Petroica multicolor	Scarlet Robin	Woodland/Scrub
Petroica phoenicea	Flame Robin	Woodland/Scrub
Phalacrocorax carbo	Great Cormorant	Coastal
Phalacrocorax fuscescens	Black-faced Cormorant	Coastal
Phalacrocorax melanoleucos	Little Pied Cormorant	Coastal
Phalacrocorax sulcirostris	Little Black Cormorant	Coastal
Phaps chalcoptera	Common Bronzewing	Woodland/Scrub
Phaps elegans	Brush Bronzewing	Woodland/Scrub
Phoebetria fusca	Sooty Albatross	Migratory Seabird
Phoebetria palpebrata	Light-mantled Sooty Albatross	Migratory Seabird
Phylidonyris novaehollandiae	New Holland Honeyeater	Woodland/Scrub
Phylidonyris pyrrhoptera	Crescent Honeyeater	Woodland/Scrub
Platycercus caledonicus (E)	Green Rosella	Woodland/Scrub
Platycercus eximius	Eastern Rosella	Woodland/Scrub
Podargus strigoides	Tawny Frogmouth	Woodland/Scrub
Procellaria aequinoctialis	White-chinned Petrel	Migratory Seabird
Procellaria cinerea	Grey Petrel	Migratory Seabird
Pterodroma inexpectata	Mottled Petrel	Migratory Seabird

Pterodroma lessonii	White-headed Petrel	Migratory Seabird
Pterodroma leucoptera	Gould's Petrel	Migratory Seabird
Pterodroma macroptera	Great-winged Petrel	Migratory Seabird
Pterodroma solandri	Providence Petrel	Migratory Seabird
Puffinus assimilis	Little Shearwater	Coastal
Puffinus gavia	Fluttering Shearwater	Coastal
Puffinus griseus	Sooty Shearwater	Coastal
Puffinus tenuirostris	Short-tailed Shearwater	Coastal
Rhipidura fuliginosa	Grey Fantail	Woodland/Scrub
Sericornis frontalis	White-browed Scrubwren	Woodland/Scrub
Sericornis humilis (E)	Tasmanian Scrubwren	Woodland/Scrub
Stagonopleura bella	Beautiful Firetail	Woodland/Scrub
Stercorarius longicaudus	Long-tailed Jaeger	Migratory Seabird
Stercorarius parasiticus	Arctic Jaeger	Migratory Seabird
Stercorarius pomarinus	Pomarine Jaeger	Migratory Seabird
Stercorarius skua	Great Skua	Migratory Seabird
Sterna bergii	Crested Tern	Coastal
Sterna caspia	Caspian Tern	Coastal
Sterna striata	White-fronted Tern	Coastal
Strepera fuliginosa (E)	Black Currawong	Woodland/Scrub
Strepera versicolor	Grey Currawong	Woodland/Scrub
Sturnus vulgaris	Common Starling	Woodland/Scrub
Thalassarche bulleri	Buller's Albatross	Migratory Seabird
Thalassarche cauta	Shy Albatross	Migratory Seabird
Thalassarche chlororhynchos	Yellow-nosed Albatross	Migratory Seabird
Thalassarche chrysostoma	Grey-headed Albatross	Migratory Seabird
Thalassarche melanophrys	Black-browed Albatross	Migratory Seabird
Thalassarche steadi	White-capped Albatross	Migratory Seabird
Thinornis rubricollis	Hooded Plover	Coastal
Turdus merula	Common Blackbird	Woodland/Scrub

Vanellus miles	Masked Lapwing	Open space and grasslands
Zosterops lateralis	Silvereye	Woodland/Scrub

5.2.5 Marine Mammals

Storm Bay is known to host a range of marine mammals that reside, feed, forage and migrate within this waterway – for some species these activities occur regularly, others intermittently or even rarely. While some marine mammals (such as the Australian and Long-nosed Fur-seals) may be considered as resident species, other species (such as the Southern Right and Humpback Whales) are seasonal visitors during their annual migration, and long-range visitors (such as Killer Whales, Southern Elephant and Leopard Seals and the Australian Sea lion) occur unexpectedly on rare occasions (DPIPWE, 2015). Table 23 lists the marine mammal species known to inhabit the waters of Storm Bay from time to time.

Australian and Long-nosed Fur-seals have established haul out and breeding sites around the more remote, exposed locations along Tasmania's coast and offshore islands. There are approximately twelve known haul out sites (Australian and Long-nosed Fur-seals) between Sugarloaf Rocks (just south of Port Davey) in Tasmania's south west extending east to Hippolyte Rock off the Tasman Peninsula. Within this area, Maatsuyker, Little Witch and Walker Islands are known breeding sites for the Long-nosed Fur-seal. The closest haul out site from proposed West of Wedge development is approximately 16 km at Cape Raoul. Other haul out sites to the west (The Friars off Bruny Island) and east (Hippolyte Rock) are located approximately 50 km from where marine farming is proposed.

Southern Elephant Seals, the largest of all seals, are rare visitors to Tasmanian coastal waters – their closest breeding area is Macquarie Island. However, there have been a number of observations (as listed in the Tasmanian Natural Values Atlas) recorded along Tasmania's south coast, including the upper reaches of the D'Entrecasteaux Channel and Storm Bay.

Leopard seals breed on the Antarctic pack ice and range from the Antarctic coast to the sub-Antarctic and sub-tropical seas. An average of five Leopard seals visit the coast of Tasmania each year, but up to 18 have been sighted in a single year (1990) (DPIPWE, 2015). Similar to the Southern Elephant Seal, the Tasmanian Natural Values Atlas includes a number of Leopard Seal sightings dating back to the mid-1970s, most of which have been recorded along Tasmania's south coast, including the upper reaches of the D'Entrecasteaux Channel and Storm Bay.

The Australian Sea-Lion has a breeding range which extends from islands off Western Australia to islands east of Kangaroo Island (South Australia) and also occur in Tasmanian waters on rare occasions. Documented records of their presence in Tasmanian waters are likely to be an underestimate of actual numbers because they are morphologically similar to local seal species (DPIPWE, 2015).

Bottle-nosed Dolphins and Common Dolphins are the most frequently observed cetaceans in Tasmanian waters and are commonly seen feeding and foraging in Storm Bay. The Southern Right and Humpback Whales are migratory species that visit Tasmanian coastal waters on their way from the summer subantarctic feeding grounds. Storm Bay is likely to be an important transit point for marine mammals entering sheltered estuaries as part of their seasonal migration patterns. The Killer Whale, on the other hand, is probably the most cosmopolitan of all cetaceans and may be seen in any marine region, occurring throughout its vast oceanic range, between equatorial regions and polar pack ice zones, and has even been observed in the River Derwent in 2010 and 2015. Their abundance is usually greatest in coastal waters and cooler regions where productivity is high (Dahlheim & Heyning 1999).

Table 23 Marine mammals that may be found in the waters of Storm Bay

Scientific name	Common name
Eubalaena australis	Southern Right Whale
Megaptera novaeangliae	Humpback Whale
Orcinus orca	Killer Whale
Balaenoptera borealis	Sei Whale
Balaenoptera acutorostrata unnamed subsp.	Dwarf Minke Whale
Balaenoptera bonaerensis	Antarctic Minke Whale
Balaenoptera musculus	Blue Whale
Delphinus delphis	Common Dolphin
Tursiops truncatus	Bottlenose Dolphin
Grampus griseus	Risso's Dolphin
Lagenorhynchus obscurus	Dusky Dolphin
Arctocephalus pusillus	Australian Fur-seal
Arctocephalus forsteri	Long-nosed Fur-seal
Hydrurga leptonyx	Leopard Seal
Mirounga leonine	Southern Elephant Seal
Neophoca cinerea	Australian Sea-lion
Arctocephalus tropicalis	Sub-Antarctic Fur-Seal

5.2.6 Threatened Communities and Species

Listed threatened and migratory species under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBCA) and Tasmanian *Threatened Species Protection Act 1995* (TSPA) that have been identified within habitats surrounding the proposed West of Wedge development zone are shown in Table 24. These species have been selected on the basis of their inclusion in:

- the Australian Government's online EPBC Protected Matters Report
- the Tasmanian Government's Natural Values Atlas
- the Tasmanian Government's online list of Threatened Species

For both the EPBC Protected Matters Report and the report generated using the Tasmanian Natural Values Atlas, buffers of 5 km from the outer extent of the proposed zone were adopted to ensure adequate coverage across Storm Bay, including important habitats where listed threatened or migratory species are likely to occur, breed, or forage for food.

Table 24 Listed Threatened and Migratory species and communities under the EPBCA and TSPA within 5 km of the proposed farming zone west of Wedge Island

Threatened Ecological Communities					
Name		**EPBC Status**			**Type of Presence**
Giant Kelp Marine Forests of South East Australia		Endangered			Community likely to occur within area
Lowland Native Grasslands of Tasmania		Critically Endangered			Community likely to occur within area
Listed Threatened Species					
Birds					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Aquila audax fleayi	Wedge-tailed Eagle (Tasmanian)	Endangered	Endangered		Breeding likely to occur within area
Botaurus poiciloptilus	Australasian Bittern	Endangered	Not Listed		Species or species habitat likely to occur within area
Cataharacta skua	Great Skua	Marine	Not Listed	Protected	Coastal/oceanic seabird
Ceyx azureus diemenensis	Tasmanian Azure Kingfisher	Endangered	Endangered		Species or species habitat likely to occur within area
Diomedea exulans antipodensis	Antipodean Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans gibsoni	Gibson's Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu strict)	Southern Royal Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)	Wandering Albatross	Vulnerable	Endangered		Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora sanfordi	Northern Royal Albatross	Endangered	Endangered		Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor	Little penguin	Not Listed	Not Listed	Protected	Coastal seabird
Fregetta grallaria grallaria	White-bellied Storm-Petrel	Vulnerable	Not Listed		Species or species habitat likely to occur within area
Haliaeetus leucogater	White-bellied Sea Eagle	Not Listed	Vulnerable		
Halobaena caerulea	Blue Petrel	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Lathamus discolor	Swift Parrot	Endangered	Endangered		Breeding likely to occur within area
Limosa lapponica baueri	Bar-tailed Godwit (bauera)	Vulnerable	Not Listed		Species or species habitat likely to occur within area
Limosa lapponica menzbieri	Bar-tailed Godwit (menzbieri)	Critically Endangered	Not Listed		Species or species habitat likely to occur within area
Macronectes giganteus	Southern Giant-Petrel	Endangered	Vulnerable	Specially protected	Foraging, feeding or related behaviour likely to occur within area

Macronectes halli	Northern Giant-Petrel	Vulnerable	Rare		Species or species habitat likely to occur within area
Morus serrator	Australasian Gannet	Not Listed	Not Listed	Protected	Coastal seabird
Pachyptila turtur subantarctica	Fairy Prion (southern)	Vulnerable	Endangered	Specially protected	Species or species habitat likely to occur within area
Pardalotus quadragintus	Forty-spotted pardalote	Endangered	Endangered		Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera	Gould's Petrel	Endangered	Not Listed		Species or species habitat likely to occur within area
Pterodroma mollis	Soft-plumaged Petrel	Vulnerable	Endangered		Species or species habitat likely to occur within area
Sternula nereis nereis	Australian Fairy Tern	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Thalassarche bulleri	Buller's Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta cauta	Shy Albatross, Tasmanian Shy Albatross	Vulnerable	Vulnerable		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi	White-capped Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma	Grey-headed Albatross	Endangered	Endangered		Species or species habitat likely to occur within area
Thalassarche melanophris impavida	Campbell Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Endangered		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta salvini	Salvin's Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis	Hooded Plover	Vulnerable	Not Listed		Species or species habitat likely to occur within area
Tyto novaehollandiae castanops (Tasmanian population)	Masked Owl (Tasmanian)	Vulnerable	Endangered		Species or species habitat likely to occur within area
	Fish				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Brachionichthys hirsutus	Spotted Handfish, Spotted-hand Fish	Critically Endangered	Endangered		Species or species habitat likely to occur within area
Brachiopsilus ziebelli	Ziebell's Handfish	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Protroctes maraena	Australian Grayling	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Thymichthys politus	Red Handfish	Critically Endangered	Not Listed		Species or species habitat may occur within area
Frogs					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**

Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Mammals					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Arctocephalus pusillus	Australian Fur Seal	Not Listed	Not Listed	Protected	
Balaenoptera acutorostrata	Dwarf Minke Whale	Marine	Not Listed	Protected	
Balaenoptera bonaerensis	Antarctic Minke Whale	Marine	Not Listed	Protected	
Balaenoptera borealis	Sei Whale	Not Listed	Vulnerable	Specially Protected	
Balaenoptera musculus	Blue Whale	Endangered	Endangered		Species or species habitat may occur within area
Caperea marginata	Pygmy Right Whale	Migratory	Not Listed	Protected	
Delphinus delphis	Common Dolphin	Marine	Not Listed	Protected	
Grampus griseus	Risso's Dolphin	Marine	Not Listed	Protected	
Mirounga leonina	Southern elephant seal	Endangered	Vulnerable	Specially Protected	
Dasyurus maculatus maculatus (Tasmanian population)	Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population)	Vulnerable	Rare		Species or species habitat likely to occur within area
Eubalaena australis	Southern Right Whale	Endangered	Endangered		Species or species habitat known to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable	Vulnerable		Species or species habitat may occur within area
Perameles gunnii gunnii	Eastern Barred Bandicoot (Tasmania)	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Sarcophilus harrisii	Tasmanian Devil	Endangered	Endangered		Species or species habitat likely to occur within area
Arctocephalus forsteri	Long-nosed Fur Seal	Not Listed	Rare		Species or species habitat likely to occur within area
Arctocephalus tropicalis	Sub-Antarctic Fur Seal	Vulnerable	Endangered		
Tursiops truncatus	Bottlenose Dolphin	Marine	Not Listed	Protected	
Other					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Antipodia chaostola leucophaea	Tasmanian Chaostola Skipper, Heath-sand Skipper	Endangered	Endangered		Species or species habitat likely to occur within area

Discocharopa vigens	Charopid land snail	Critically endangered	Not Listed		Species or species habitat may occur within area
Gazameda gunnii	Gun's Screw Shell	Not Listed	Vulnerable		
Lissotes menalcas	Mount Mangana Stag Beetle	Not Listed	Vulnerable		
Parvulastra vivipara	Tasmanian Live-bearing Seastar	Vulnerable	Vulnerable		Species or species habitat may occur within area
Pseudalmenus chlorinda myrsilus	Tasmanian Hairstreak (Butterfly)	Not Listed	Rare		
Pseudemoia pagenstecheri	Tussock Skink	Not Listed	Vulnerable		
Plants					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Acacia ulcifolia	Juniper Wattle	Not Listed	Rare		
Caladenia caudata	Tailed Spider-orchid	Vulnerable	Vulnerable		Species or species habitat likely to occur within area
Juncus vaginatus	Clustered Rush	Not Listed	Rare		
Lepidium hysoppifolium	Basalt Pepper-cress	Endangered	Endangered		Species or species habitat may occur within area
Prasophyllum apoxychilum	Tapered Leek-orchid	Endangered	Endangered		Species or species habitat likely to occur within area
Pterostylis ziegeleri	Grassland Greenhood, Cape Portland Greenhood	Vulnerable	Not Listed		Species or species habitat may occur within area
Thelymitra jonesii	Sky-blue Sun-orchid	Endangered	Endangered		Species or species habitat likely to occur within area
Sharks					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Carcharodon carcharias	Great White Shark	Vulnerable	Vulnerable		Species or species habitat known to occur within area
Listed Migratory Species					
Marine Birds					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Apus pacificus	Fork-tailed Swift	Not Listed	Not Listed		Species or species habitat likely to occur within area
Diomedea exulans antipodensis	Antipodean Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora epomophora	Southern Royal Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)	Wandering Albatross	Vulnerable	Endangered		Foraging, feeding or related behaviour likely to occur within area

Diomedea exulans gibsoni	Gibson's Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora sanfordi	Northern Royal Albatross	Endangered	Endangered		Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus	Southern Giant Petrel	Endangered	Vulnerable		Foraging, feeding or related behaviour likely to occur within area
Macronectes halli	Northern Giant Petrel	Vulnerable	Rare		Species or species habitat may occur within area
Puffinus carneipes	Flesh-footed Shearwater	Not Listed	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Sterna albifrons	Little Tern	Not Listed	Not Listed		Species or species habitat may occur within area
Thalassarche bulleri	Buller's Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta cauta	Shy Albatross, Tasmanian Shy Albatross	Vulnerable	Vulnerable		Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma	Grey-headed Albatross	Endangered	Endangered		Species or species habitat may occur within area
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Endangered		Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris impavida	Campbell Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta salvini	Salvin's Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi	White-capped Albatross	Vulnerable	Not Listed		Foraging, feeding or related behaviour likely to occur within area
Listed Migratory Marine Species					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Balaenoptera musculus	Blue Whale	Endangered	Endangered		Species or species habitat may occur within area
Caperea marginata	Pygmy right whale	Not Listed	Not Listed	Protected	Species or species habitat may occur within area
Carcharodon carcharias	Great White Shark	Vulnerable	Vulnerable		Species or species habitat may occur within area
Eubalaena australis	Southern Right Whale	Endangered	Endangered		Species or species habitat known to occur within area
Lagenorhynchus obscurus	Dusky Dolphin	Not Listed	Not Listed	Protected	Species or species habitat may occur within area
Lamna naus	Porbeagle, Mackerel Shark	Not Listed	Not Listed		Species or species habitat likely to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable	Not Listed		Species or species habitat may occur within area
Orcinus orca	Killer whale, Orca	Not Listed	Not Listed		Species or species habitat may occur within area
Listed Migratory Terrestrial Species					

Species	Common Name	EPBC Status	TSPA Status	NCA Status	Type of Presence
Hirundapus caudacutus	White-throated Needletail	Not Listed	Not Listed		Species or species habitat likely to occur within area
Myiagra cyanoleuca	Satin Flycatcher	Not Listed	Not Listed		Species or species habitat known to occur within area
Listed Migratory Wetland Species					
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**NCA Status**	**Type of Presence**
Ardea alba	Great Egret, White Egret	Not Listed	Not Listed		Species or species habitat likely to occur within area
Ardea ibis	Cattle Egret	Not Listed	Not Listed		Species or species habitat likely to occur within area
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Not Listed	Not Listed		Species or species habitat may occur within area
Limosa lapponica	Bar-tailed Godwit	Not Listed	Not Listed		Species or species habitat may occur within area

See section 6.1.6.1 for a more detailed assessment of potential threats or threatening processes impacting upon listed threatened ecological communities, species or migratory species as a result of the marine farming activities proposed in this EIS.

5.3 Reservations

5.3.1 World Heritage Areas

The Tasman Peninsula accommodates the Port Arthur Historic Site and the Coal Mines Historic Site, both of which are inscribed on the UNESCO World Heritage List. Both of these sites are located in excess of 10 km from the proposed West of Wedge development.

5.3.2 Ramsar sites

There are no Ramsar sites within the proposed development or surrounding area.

5.3.3 Marine Reserves

There are no Marine Reserves within the proposed development and surrounding area.

5.3.4 National Parks

The proposed West of Wedge development lies approximately 6 km to the north-east of the Tasman National Park. This park covers over 10,800 Ha of the Tasman Peninsula, mostly comprising the southern coastal extremities of the Tasman Peninsula (see Figure 5.17).

Figure 5.17 Map highlighting the Tasman National Park area on the Tasman Peninsula (LISTMap 2016)

The Tasman National Park is one of 19 National Parks in Tasmania, and features a unique dry sclerophyll forest estate and world-class scenic walks along a landscape dominated by sea cliffs and coastal bays. The Park also contains high natural values that include the following:

- threatened and priority flora, plant communities
- threatened and priority fauna species
- natural landscapes and sites of geoconservation

5.3.5 Other Conservation Areas

Other conservation areas occurring in the area of the proposed West of Wedge development (

Figure 5.18) include:

- Wedge Island Conservation Area
- Crooked Billet Bay Conservation Area
- Roaring Beach Conservation Area
- Apex Point Conservation Area

- North Passage Point Conservation Area
- Brother and Sister Conservation Area.

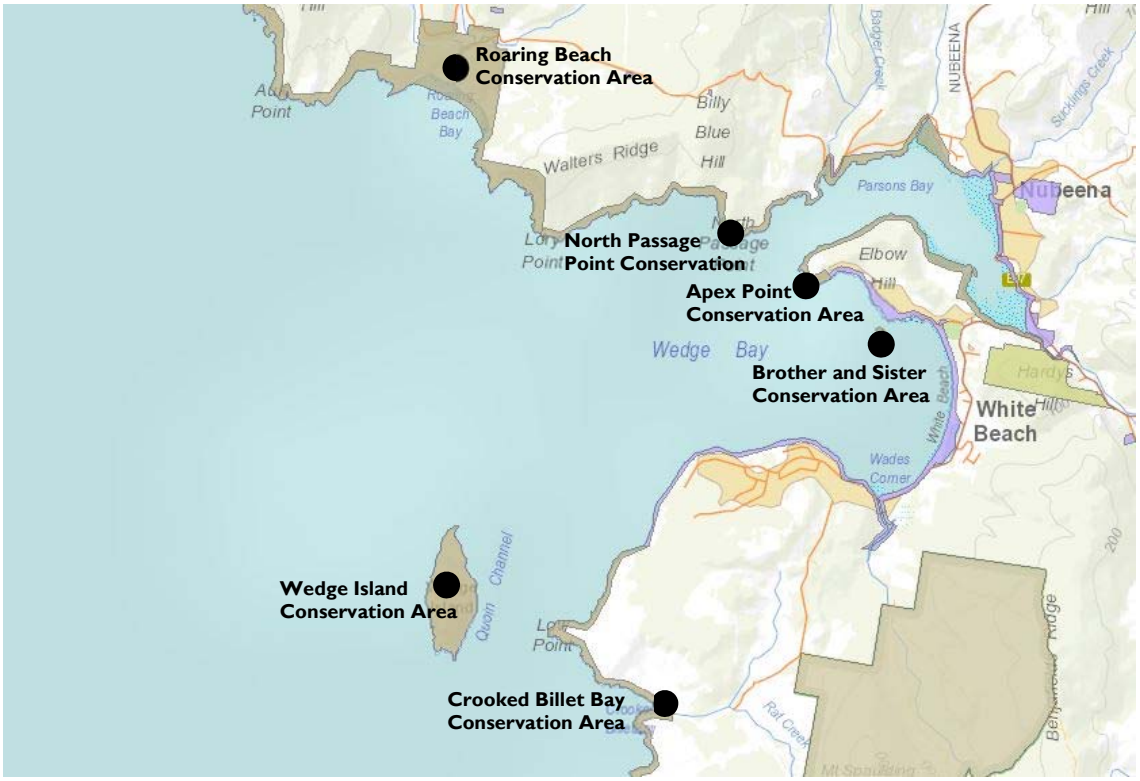


Figure 5.18 Conservation areas occurring in the area of proposed West of Wedge development (LISTMap 2016)

5.4 Land Planning Aspects

5.4.1 Land Tenure

Land tenure adjacent to the proposed West of Wedge development (to the east) includes a range of conservation areas, private freehold ownership (some containing conservation covenants), land managed under State and local government jurisdictions and public reserves (including the Tasman National Park). The coastal strip comprises the Wedge Island Conservation Area, Crooked Billet Bay Conservation Area and publicly reserved land extending north to the Apex Point Conservation Area.

Figure 5.19 shows the land tenure divisions adjacent to the proposed West of Wedge development (key – land under freehold ownership = pale yellow, land under conservation covenant = yellow, conservation area = light brown, National Park = brown, municipal open space = teal, public reserve = orange, hatched area = crown land reserved for timber production).

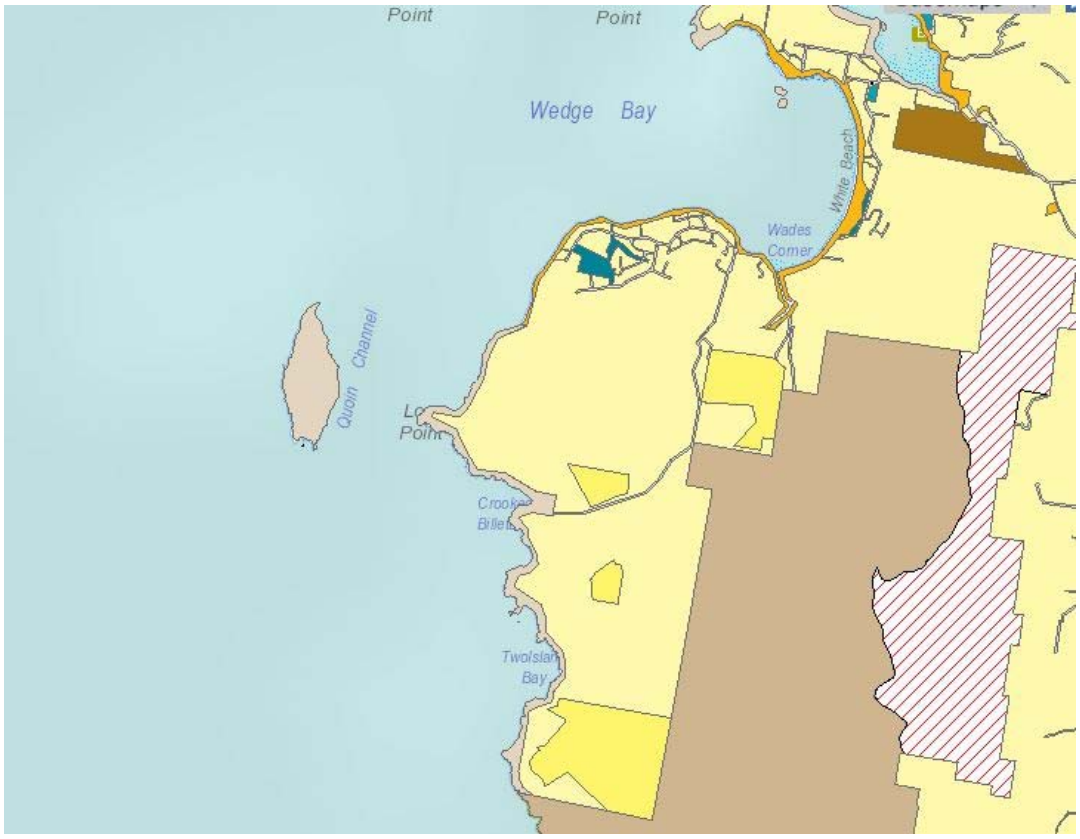


Figure 5.19 Map indicating land tenure divisions (LISTMap 2016)

5.4.2 Land Zoning

5.4.2.1 Tasman Draft Interim Planning Scheme

The Tasman Draft Interim Planning Scheme 2015 covers the plan area and adjacent land. Zonation of land adjacent to the proposed development covers a range of uses, including environmental management, rural living, rural resource, low density residential, open space and light industrial.

Figure 5.20 shows the land tenure divisions adjacent to the proposed new development West of Wedge Island (key – rural resource = pale yellow, environmental management = teal, open space = green, rural living = pale pink, low density residential = salmon pink, light industrial = hot pink).

Figure 5.20 Map indicating the land tenure divisions (LISTMap 2016)

5.4.3 Land Use

The coastal strip adjacent to the proposed development (including Wedge Island) is zoned as environmental management but is primarily allocated as conservation areas. Land zoned as rural resource and the Tasman National Park form significant areas adjacent to the coastal reserves and low density residential developments that comprise the White Beach community.

This area is popular for a range of recreational activities, providing important access routes to boating, swimming and fishing in and around Wedge Bay.

5.5 Maritime Aspects

There is a range of existing uses of the marine environment within the Eastern Farming Zone. These include commercial boating, fishing, recreational activities and tourism uses.

5.5.1 Commercial Shipping and Other Vessels

Presently, Storm Bay is used for commercial shipping activities as an access point to the port of Hobart and Derwent estuary. Hobart port supports a range of primary and general commercial shipping activities. Primary uses include support of cruise ships and Antarctic resupply vessels. General uses include commercial shipping vessels involved with fuel import/export, general cargo import/export and the export of forestry materials. Between 1999-2000 to 2013-14, between 244 and 347 commercial vessels visited the port of Hobart each year. Most of these vessels utilise commercial shipping lanes (identified by TasPorts during consultation period) (seen in pink in Figure 4.6) when transiting the Storm Bay area. As illustrated (in Figure 4.6) the proposed West of Wedge development is located a significant distance from these lanes.

5.5.2 Recreational Boating

Recreational vessels utilising the area in and around the proposed West of Wedge development range from small run-abouts to sailing vessels, and occasionally luxury yachts.

Organised boating events that occur in the area, or attract vessels to transit through the area, include:

- Sydney to Hobart Yacht Race
- Melbourne to Hobart Yacht Race (east and west coast)
- Launceston to Hobart Yacht Race
- Maria Island Yacht Race

Each of these events run annually and, except the Maria Island yacht race, operate during the Christmas/New Year period.

The Sydney to Hobart Yacht Race is the most prominent yacht racing event occurring within the Storm Bay area. The race route follows the east coast of New South Wales, Victoria and Tasmania before rounding the Tasmanian Peninsula into Storm Bay, finishing in the waters of the Derwent River.

Figure 5.21 shows the tracker paths of the competing yachts for the 2016 race and the approximate location of the proposed West of Wedge development (black rectangle). As illustrated, the paths of the yachts do not cross the proposed development. However, Tassal is aware that this snapshot only illustrates one year and understands that the routes are subject to change depending on weather and other variables in a particular year. Consultation with key yachting stakeholders was conducted around this in conjunction with other concerns. For more information around this consultation refer to sections 4.2.1 and 4.2.3.1.

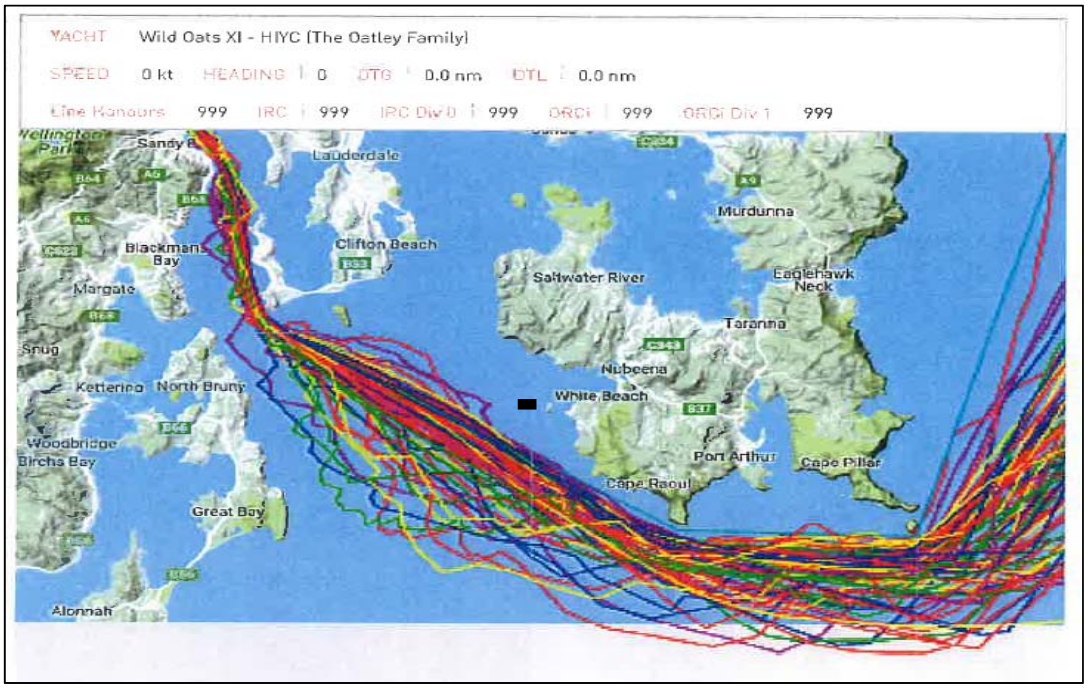


Figure 5.21 Snapshot of the 2016 Sydney to Hobart yacht race illustrating the tracker paths of the competing yachts (coloured lines). The location of the proposed West of Wedge development has been overlayed (shown as black rectangle). NOTE: Image is indicative of zone placement

5.5.3 Commercial Fishing

The proposed West of Wedge development is located within the fishing block 36/7G2 (DPIPWE, 2016). There are a range of commercial fisheries undertaken in this development area including abalone, rock lobster and scalefish. Target species include:

- abalone - blacklip
- rock lobster
- garfish
- Australian salmon
- squid
- banded morwong
- southern calamari
- wrasse
- flounder
- flathead

The following sections on the abalone, rock lobster and scalefish fisheries include catch data from DPIPWE for the period January 2006 to August 2015. These data show fishing trends for a variety of commercial species within the specified fishing blocks in these waters.

5.5.3.1 Abalone Fishery

The abalone fishery in Storm Bay comprises fishing blocks 17-21. The proposed West of Wedge development is located within block 20 (see Figure 5.22).

The only species of abalone commercially harvested from the development area is blacklip abalone, *Haliotis rubra*.

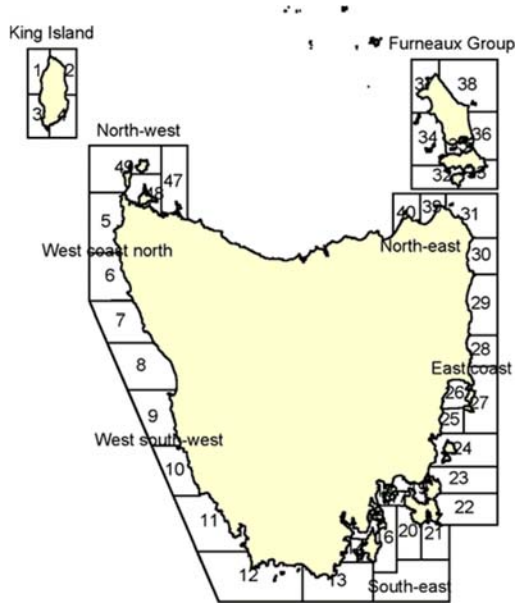


Figure 5.22 Abalone fishing blocks around Tasmania (sourced from DPIPWE[2])

Abalone catch data from fishing block 20 between January 2006 and August 2015 is shown in Figure 5.23.

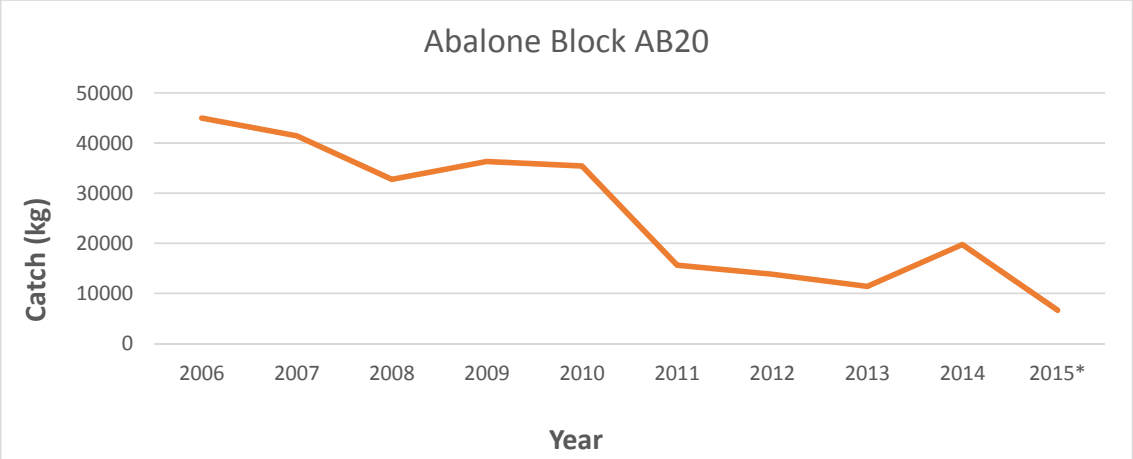


Figure 5.23 Abalone catch rate from 2006 to 2015 (*January-August 2015) in Storm Bay; fishing block AB20 (DPIPWE[1])

5.5.3.2 Rock Lobster Fishery

The proposed West of Wedge development falls within Area 1 of the commercial rock lobster fishing zone (see Figure 5.24).

Commercial catch, pot lifts, catch per unit effort (CPUE) and stock abundance (legal size) are shown in Figure 5.24. The numbers at the top of each figure give the 2012 value for catch, pot lifts, CPUE and legal size stock abundance, as well as the % change from the previous year. The dotted lines on the

[2] DPIPWE (2016). Commercial Fisheries Database. http://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/scalefish-fishery/commercial-scalefish

CPUE and stock abundance graphs are the area reference points. The lower red dotted line is the limit reference point and is the lowest year between 1998/99 – 2011/12. The upper dotted blue line is the target reference point and is the most recent peak period of the fishery, for most areas this occurred around 2005/6 (Hartmann et al 2013).

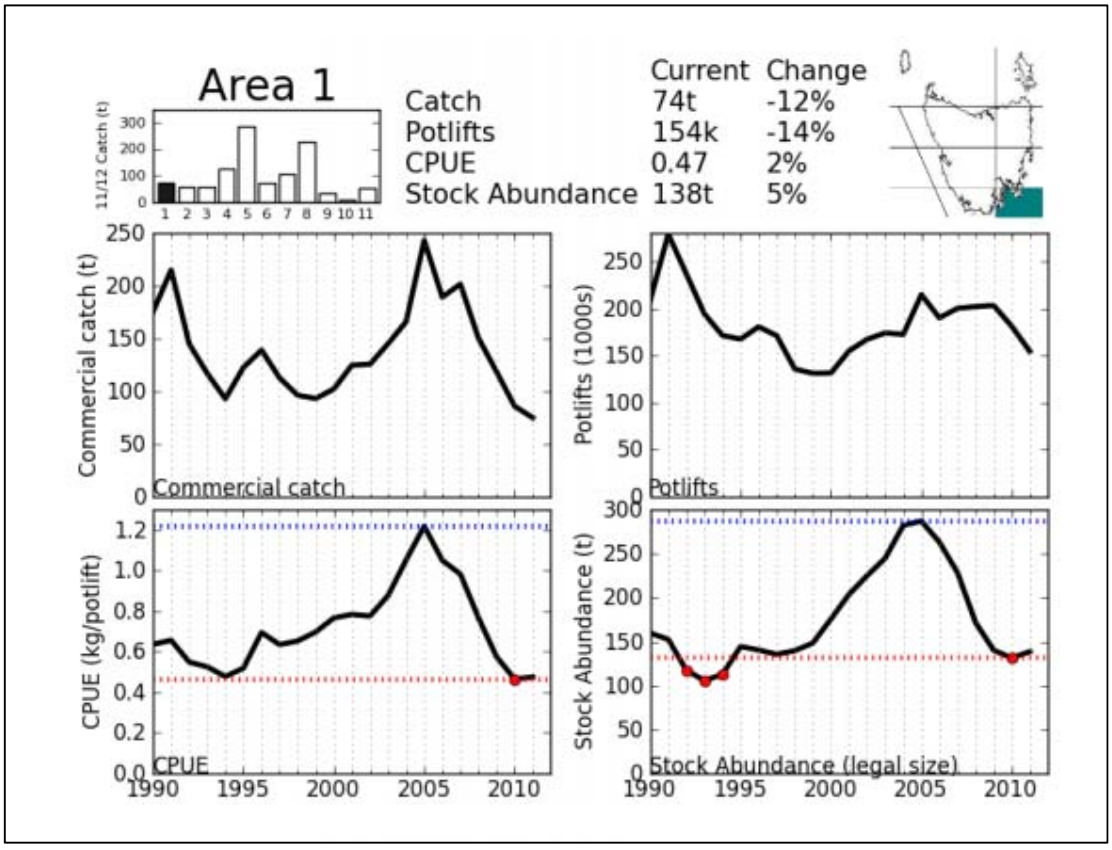


Figure 5.24 Characteristics of commercial rock lobster fishery between 1990 and 2012 (DPIPWE[3])

Catch data for rock lobster between 2007 and 2015 for the blocks specified in Figure 5.26 show that the number of rock lobster caught was highest in block 7G2G (see Figure 5.25). Data is not available where there are less than 5 boats fishing within that fishing block, and is therefore not presented in the graph. 7G2F is the block in the immediate vicinity of Wedge Island.

[3] DPIPWE (2014). Rock Lobster Stock Assessment.
http://dpipwe.tas.gov.au/Documents/2013_Rock_Lobster_stock_assessment_update.pdf

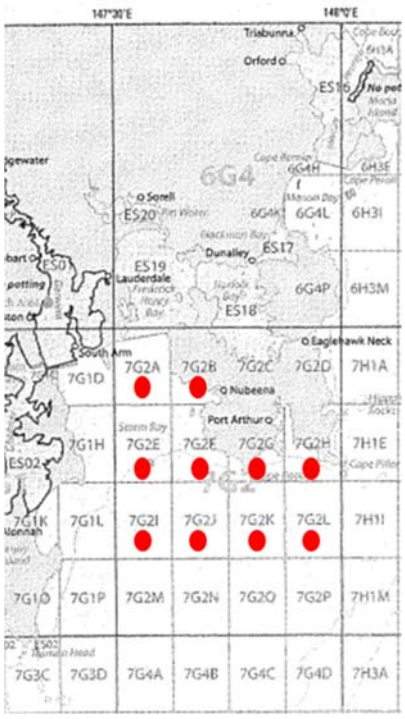


Figure 5.25 Rock lobster fishing blocks in the Storm Bay region. Red spots indicate blocks where data has been extracted in this section (DPIPWE[1])

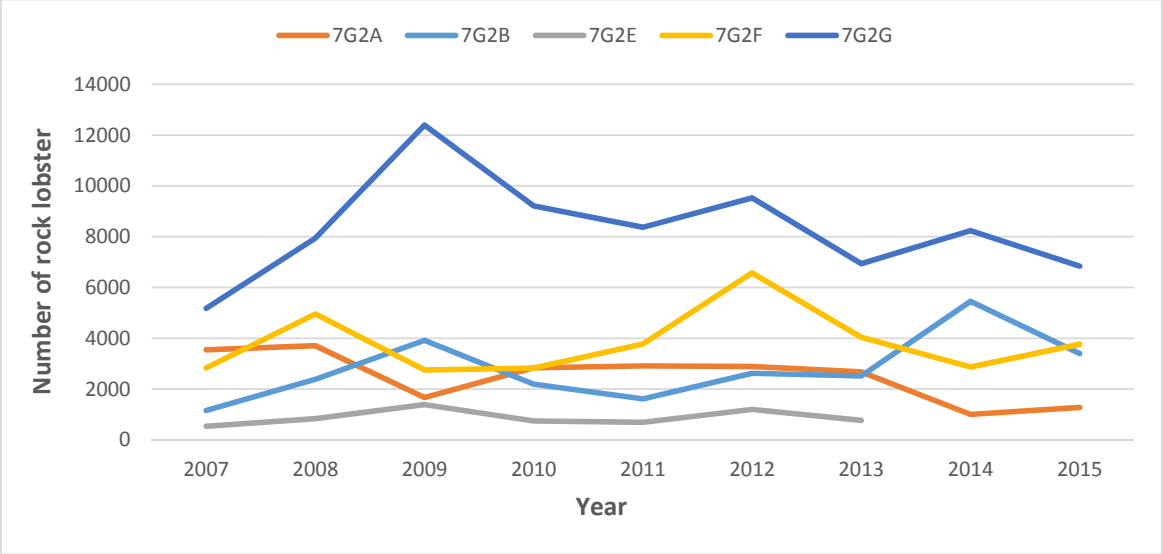


Figure 5.26 Number of rock lobster caught in each fishing block (where data available) from 2007 to August 2015

5.5.3.3 Scalefish Fishery

The Tasmanian Scalefish fishery is managed under the provisions of the Living Marine Resources Management Act 1995. This multi-species fishery encompasses a range of scalefish, shark and cephalopod species, and utilises a variety of fishing methods (Hartmann and Lyle 2011). Catch and effort of the fishery is controlled through input controls such as capped licence numbers, closed seasons, and gear restrictions.

The species that are targeted by commercial fishers in the Southern and Eastern Scalefish and Shark Fishery are:

- Blue grenadier (*Macruronus novaezelandiae*)
- Tiger flathead (*Neoplatycephalus richardsoni*)
- Silver warehou (*Seriolella punctata*)
- Gummy shark (*Mustelus antarcticus*)
- Pink ling (*Genypterus blacodes*)

For 2015, the recorded commercial scalefish catch for the west of Wedge Island area (fishing blocks 7G21 and 7G22: see Figure 5.27 and Figure 5.28) was approximately 170 t (fishing blocks combined).

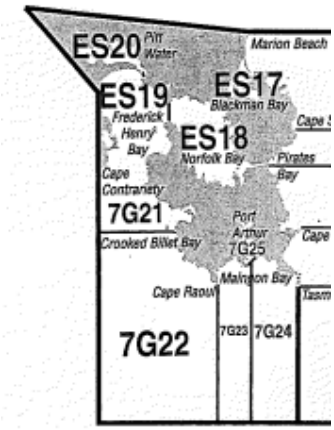


Figure 5.27 Scalefish fishery blocks for Wedge Island include block 7G21 and 7G22

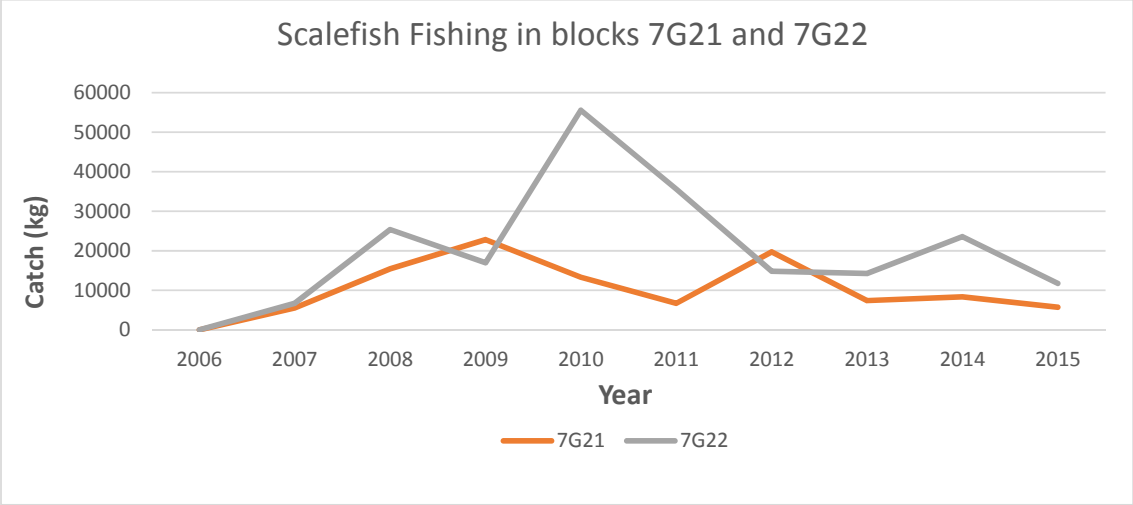


Figure 5.28 Scalefish fishery catch data from blocks 7G21 and 7G22 from 2006 to 2015 (DPIPWE[1]). Data not available in 2006 as blocks were not broken down to sub-block level in 2006

5.5.3.4 Danish Seine Fishery

Danish seine vessels in Tasmania typically operate close to shore (although outside of the one nautical mile limit) on flat sandy bottom, with low impact on benthic habitats (DPIPWE, 2014). Water depths fished are approximately between 10 to 90 metres.

Trawling was prohibited in Tasmanian coastal waters in 2001 and at the time holders of a Tasmanian fishing licence - general trawl and limited trawl - were only permitted to use Danish seine nets, which is still the case today. In Tasmania, the fishery consists of eight licences, two limited trawl and six general trawl.

Danish seine operations mainly occur in Tasmania's south east waters with tiger flathead and southern school whiting being the major target species.

The Tasmanian Danish seine fishery map for the south east is illustrated in Figure 5.29. The area highlighted in blue is where a whiting codend is permitted to be used. The green area is where an operator that has an endorsement to use a whiting codend in part of the Derwent and Frederick Henry Bay. The area in Storm Bay, shaded in purple, is the only area a limited trawl licence is permitted to operate. The area shaded in red is the one nautical mile limit (and includes the D'Entrecasteaux Channel) and Danish seine fishing gear cannot be used in these areas.

Refer to section 4.2.4.3.1 for information around stakeholder engagement with Danish Seine fishermen in the Storm Bay area.

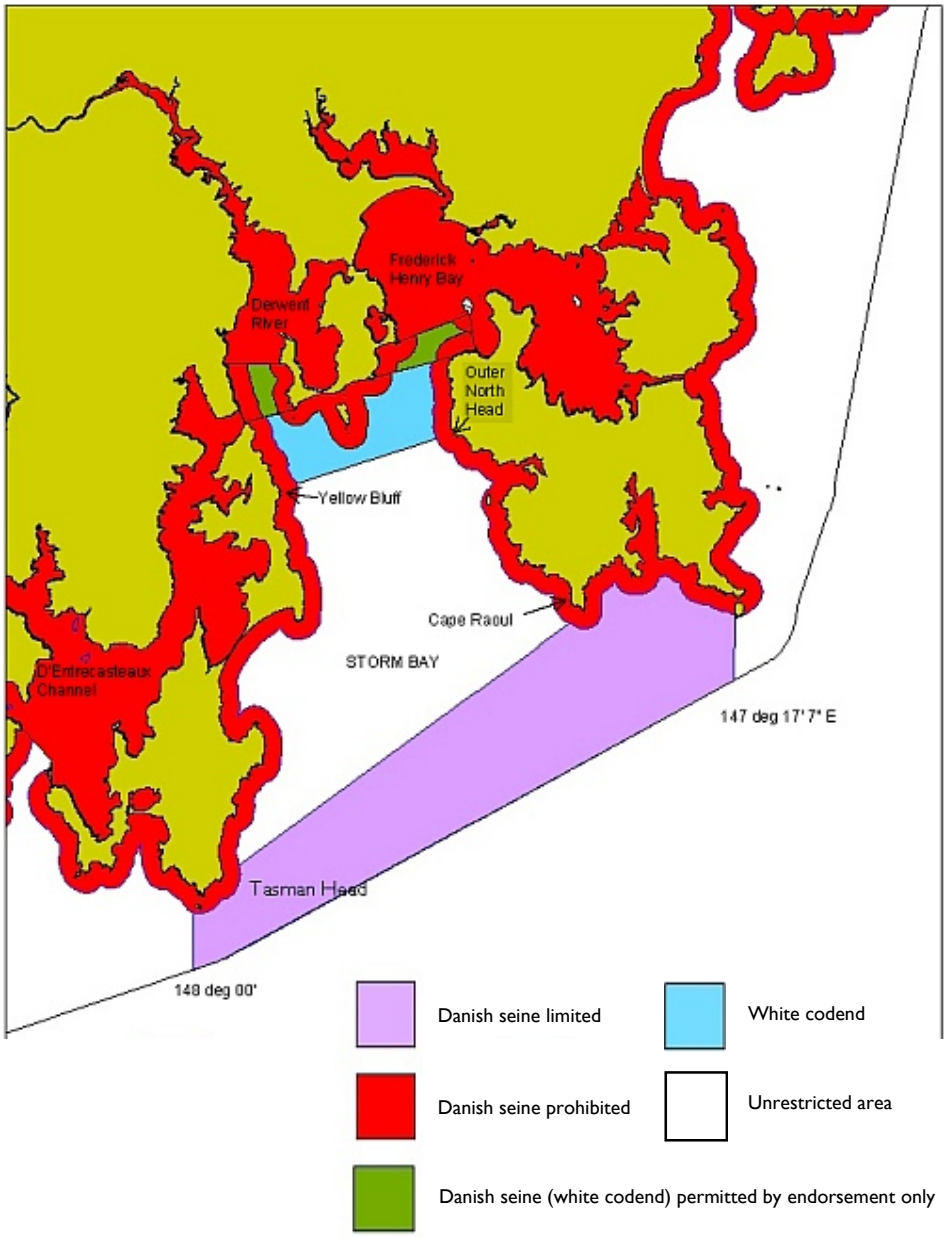


Figure 5.29 Danish Seine netting areas in Storm Bay

5.5.4 Recreational Fishing

Recreational fishing provides social and economic benefit to communities throughout south east Tasmania (DPIPWE 2010). Given the proximity to shore, recreational fishing in the Wedge Island area is predominantly by boat. Boat-based recreational fishing effort is particularly important being nearly 5 times higher than shore-based activity. Popular fishing methods include line fishing, potting, dive harvesting and gill-netting (DPIPWE 2010; Lyle et al 2009). There are currently no restrictions on fishing in the area of the proposed West of Wedge development.

The waters of south-eastern Tasmania represent a particularly significant area for recreational catches of Flathead, Australian Salmon, Flounder, Black Bream, Tuna, Gould's Squid, Southern Calamari, Rock Lobster and Abalone.

The southern sand flathead (*Platycephalus bassensis*) is the dominant species of flathead caught in Tasmanian waters, accounting for an estimated 95% of the total Tasmanian catch for the 2007/08 fishing season (Lyle *et al* 2009), with over 85% of the catch coming from the central-east and south-east coasts. The predominant method for recreational flathead fishers is baited line fishing.

Over half of Tasmania's total recreational rock lobster (*Jasus edwardsii*) catch is from the south-east (Lyle *et al* 2009). A high proportion (around half) of those caught are released. The majority of recreationally caught rock lobster in Tasmania are caught by potting, with diver collection also popular (Lyle and Tracey 2010).

Over 50% of the total Tasmanian recreational catch of Gould's squid (known as arrow squid; *Nototodarus gouldi*) is from the south-east region. Similarly, the south-east of Tasmania is popular for southern calamari fishing, but the spread of catch is more even across the state than for Gould's squid (Lyle *et al* 2009). The predominant catch method is line fishing using lures/jigs.

Several species of tuna are targeted by recreational fishers, including skipjack tuna (*Katsuwonus pelamis*), albacore (*Thunnus alalunga*), bluefin tuna (*Thunnus maccoyii*) and yellowfin tuna (*Thunnus albacores*). Skipjack tuna and albacore account for the majority of tuna caught in Tasmania (51% and 46% of total catch respectively) (Lyle *et al* 2009). A high proportion of recreationally caught tuna are released (Lyle *et al* 2009).

5.5.5 Recreational Activities

Recreational activities that are known to take place in the proposed West of Wedge development area can be broadly divided into three main categories:

- On-water activities
    - Boating/sailing
    - Kayaking
    - Fishing

- In-water activities
    - Diving
    - Snorkelling
    - Surfing

- On-land activities
    - Fishing
    - Camping
    - Walking
    - Wildlife watching
    - General sight-seeing

Roaring Beach to the north of Wedge Island is a popular surfing spot, and is the only surfing beach on the western side of Tasman Peninsula. The 900 m long southwest-facing beach is located on the more exposed western coast, 5 km west of Nubeena.

5.6 Heritage

5.6.1 Aboriginal Heritage

All Aboriginal heritages are protected under the *Aboriginal Relics Act 1975*, which states that if at any time during works, suspected Aboriginal heritage is uncovered, works must be ceased and Aboriginal Heritage Tasmania is to be contacted.

Aboriginal Heritage Tasmania conducted a desktop study of the Tasmanian Aboriginal Site Index (TASI) regarding the proposed West of Wedge development and has advised that there are no Aboriginal heritage sites recorded within the proposed development area. Accordingly there is no requirement for an Aboriginal heritage investigation and AHT has advised they have no objections to the project proceeding.

5.6.2 European and Other Heritage

5.6.2.1 Places listed on the Tasmanian Heritage Register (maintained by the Tasmanian Heritage Council), including consideration of cultural landscapes

Tassal has conducted a search of the Tasmanian Heritage Register (Heritage Tasmania 2016). The Tasmanian Heritage Register is a register of places that are recognised as being of historic cultural heritage significance to the whole of Tasmania. These places are important to Tasmania and Tasmanians because of their contribution to the State's culture and society. The Register is maintained by the Heritage Council under the *Historical Cultural Heritage Act 1995*.

There are 41 registered places under the Tasman Council municipality, however none of these are located within the proposed West of Wedge development or surrounding area.

It is noted that there are registered places several kilometres away from the proposed development. The main places include the *Cascade Probation Station* at Koonya, the *Coal Mines Historic Site* at Saltwater River and, the *Port Arthur Penal Settlement* at Port Arthur.

5.6.2.2 Places on the Tasmanian Historic Places Inventory (maintained by the Tasmanian Heritage Office)

Tassal has conducted a search of the Tasmanian Heritage Places Inventory, under the Australian Heritage Places Inventory. The inventory lists 25 historic places within the Tasman Local Government Area, with the most notable places being the Port Arthur Historic Site and the Coal Mines Historic Site, both of which are inscribed on the UNESCO World Heritage List. These important sites are located on the eastern side of the Tasman Peninsula, approximately 10 km from the proposed West of Wedge development.

5.6.2.3 Local government planning scheme heritage schedules

Tassal has conducted a search of the local government planning scheme heritage schedules. There are no scheduled historic places within or in close proximity to the proposed West of Wedge development.

5.6.2.4 Other places of heritage significance

There are no other places of heritage significance within the proposed West of Wedge development area or surrounds.

5.7 Social and Economic Description

5.7.1 Population

The closest populated areas to the proposed West of Wedge development are the small gazetted localities of Nubeena, White Beach and Highcroft.

Population data from the Australian Bureau of Statistics (ABS) has been accessed to describe the population of these localities and the Tasman region (see Table 25). The Tasman Statistical Local Area (SLA) also includes the towns of Port Arthur, Eaglehawk Neck and Murdunna (http://www.abs.gov.au/websitedbs/censushome.nsf/home/map accessed 20-May-2016).

The ABS does not release data for gazetted localities; however population data for the ABS has been accessed to describe the State Suburb (SSC).

Table 25 Population age data for Nubeena, White Beach and the Tasman Statistical Local Area (SLA)

Age (years):	Nubeena (State Suburb)			White Beach (State Suburb)			Highcroft (State Suburb)			Tasman (LGA)		
	Males	*Females*	*Persons*	*Males*	*Females*	*Persons*	*Males*	*Females*	*Persons*	*Males*	*Females*	*Persons*
0-4 years	17	17	31	6	6	12	4	0	4	53	46	99
5-9 years	18	16	34	4	7	11	5	3	8	73	74	147
10-14 years	19	19	38	9	9	18	5	4	9	74	68	142
15-19 years	8	9	17	6	6	12	0	3	3	37	35	72
20-24 years	9	9	18	0	6	6	0	3	3	21	22	43
25-29 years	9	12	21	6	8	14	2	3	5	45	37	82
30-34 years	7	5	12	4	9	13	2	3	5	38	63	101
35-39 years	13	17	30	6	10	16	6	2	8	59	48	107
40-44 years	13	19	32	9	12	21	5	3	8	66	72	138
45-49 years	24	8	32	13	9	22	3	6	9	79	78	157
50-54 years	13	24	37	7	9	16	4	6	10	117	104	221
55-59 years	26	25	51	9	12	21	4	3	7	127	97	224
60-64 years	13	12	25	25	17	42	5	2	7	133	100	233
65-69 years	18	14	32	17	12	29	0	0	0	106	107	213
70-74 years	15	15	30	13	0	13	0	0	0	100	66	166
75-79 years	6	13	19	0	6	6	0	0	0	51	50	101
80-84 years	10	8	18	5	3	8	0	0	0	39	39	78
85 years and over	0	8	8	3	3	6	0	0	0	19	20	39
TOTAL	**238**	**247**	**485**	**142**	**144**	**286**	**45**	**41**	**86**	**1237**	**1126**	**2363**

The populations of Nubeena, White Beach and Highcroft are the most likely to be effected by the proposed West of Wedge development. Figure 5.30, Figure 5.31 and Figure 5.32 describe the population data for these suburbs.

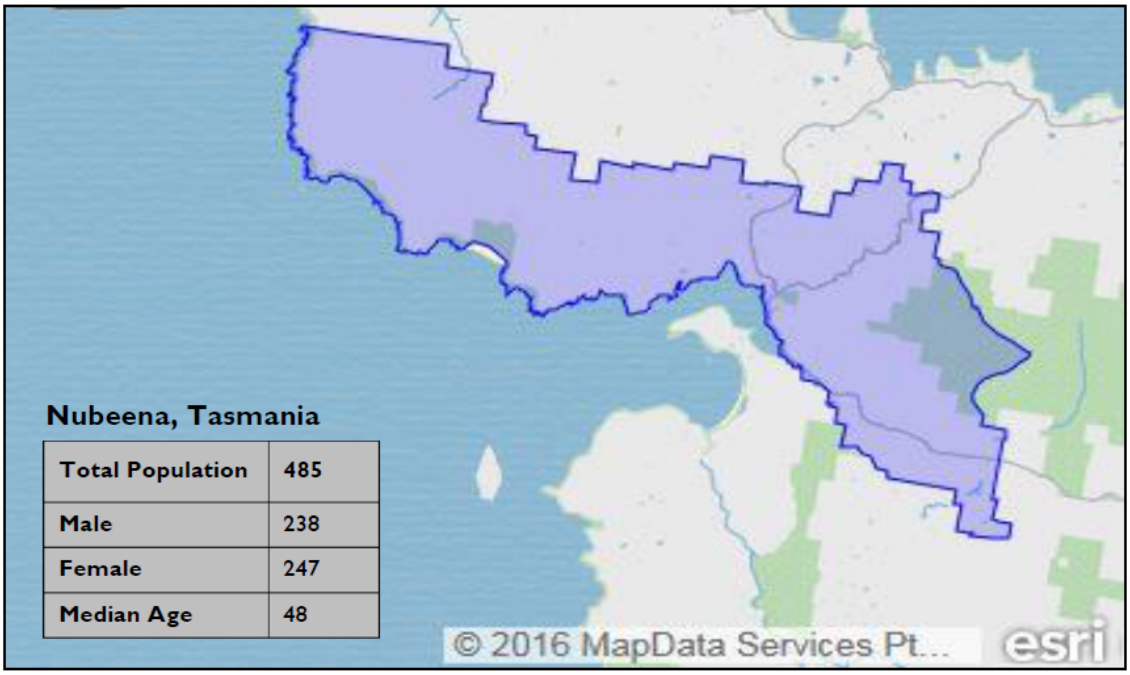


Figure 5.30 State Suburb (SSC) of Nubeena

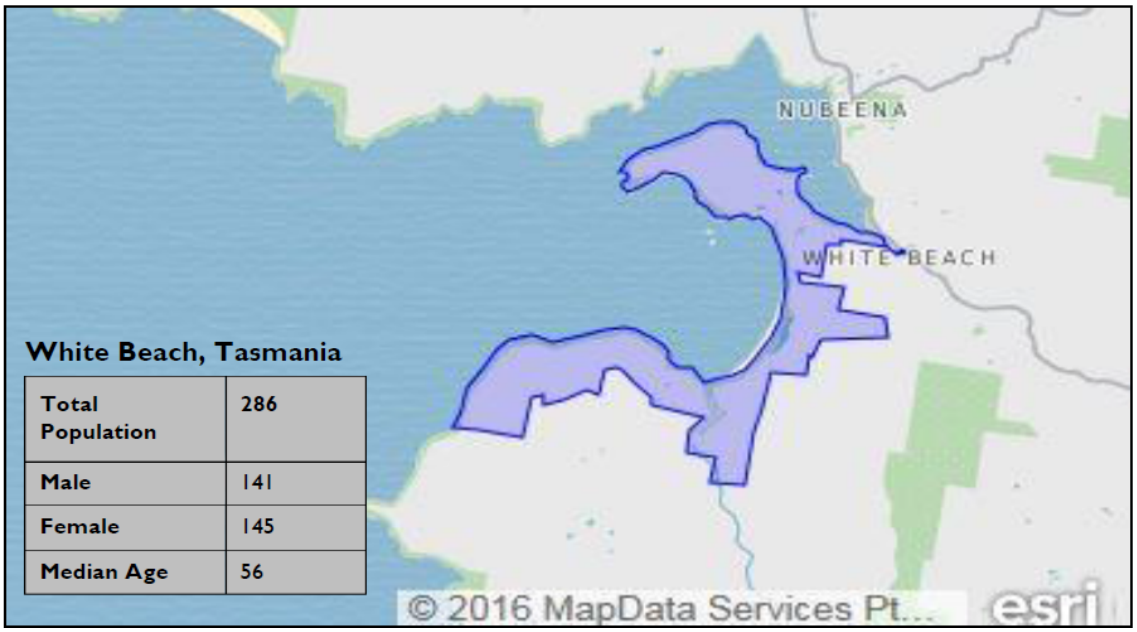


Figure 5.31 State Suburb (SSC) of White Beach

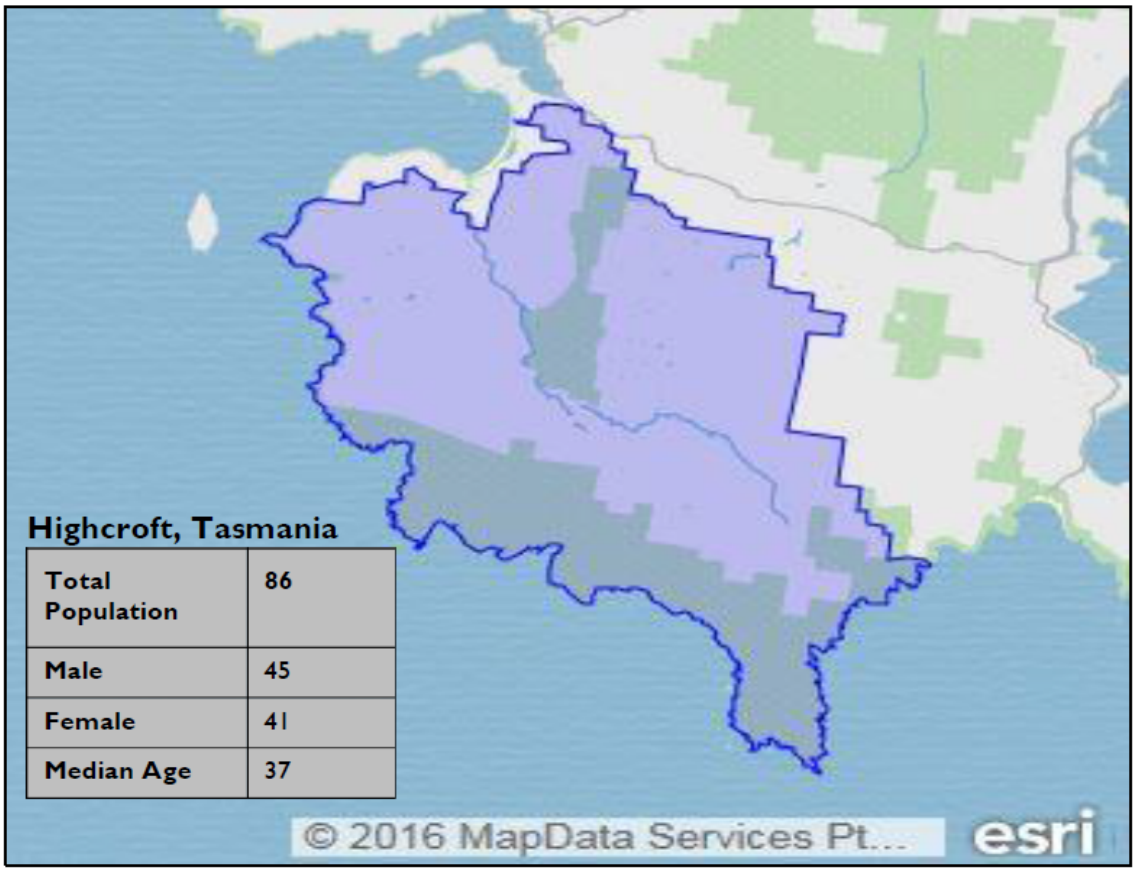


Figure 5.32 State Suburb (SSC) of Highcroft

Aboriginal and Torres Strait Islander people make up 7.2% of the population in Nubeena, 3.2% of the population in White Beach and 5.1% of the population in Highcroft.

Of the employed people aged 15 years and over, 6.6% of the population in Nubeena and 5.7% of the population in White Beach work in the Aquaculture Industry.

The Tasman LGA has been significantly affected by downturns and closures in the forestry industry (Commonwealth of Australia, 2015) with unemployment in the Tasman LGA higher than Tasmania as a whole (see Figure 5.33). The most recent figures show the unemployment rate in the Tasman LGA at 7.2% compared to 6.7% for Tasmania as a whole, but over the last five years, the gap has generally been wider (Department of Employment 2016a & b).

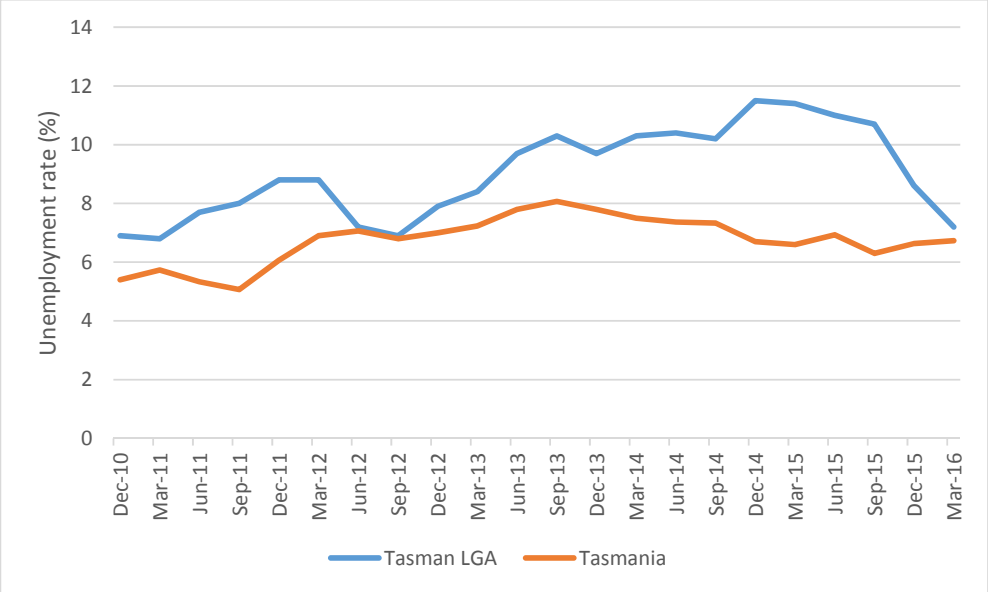


Figure 5.33 Unemployment rate: Tasman LGA and Tasmania

The finfish aquaculture sector provides the majority of employment within the Tasmanian aquaculture industry. The average weekly wage for salmonid industry employees is also almost double the Tasmanian average, which is particularly significant given the largely rural and regional nature of the industry and this also makes development in this industry a benefit to those unemployed (Commonwealth of Australia, 2015).

5.7.2 Economic Description

5.7.2.1 Tourism

The proposed West of Wedge development falls within the vicinity of the Tasman Peninsula Tourism Region. The region includes more than 60 attractions and activities including the Port Arthur and Coal Mines Historic Sites as well as the Tasman National Park. The region also incorporates the 'Peninsula Convict Trail' touring route which extends from Eaglehawk Neck to Koonya and Premaydena then further on to Nubeena and White Beach, before heading to Port Arthur (Port Arthur and Tasman Tourism Association 2016[4]).

The number of tourists visiting the Tasman Peninsula region has increased in the past five years with latest numbers recording a 2.3% increase between 2014 and 2015. It was also noted that visitors are also choosing to spend more time in the area, with an increase in overnight stays (Tourism Tasmania, 2015[5]).

[4] Port Arthur and Tasman Tourism Association (2016) Tasman Region http://www.tasmanregion.com.au/ date accessed 10-Jun-2016

[5] Tourism Tasmania (2015). Tasmanian Visitor Survey data. Tourism Tasmania. Available via the Web Reporter website at: http://www.tvsanalyser.com.au/

5.7.2.2 Land Based

Accommodation

There are numerous accommodation options throughout the Tasman Peninsula region. An extensive desktop search using several mainstream websites (www.google.com.au, www.stayz.com.au, and www.tasmanregion.com.au) identified 15 accommodation options in the Nubeena/White Beach/Port Arthur regions. There is no accommodation on Wedge Island nor along the coastline between east of Wedge Island and Cape Raoul. Note that the accommodation identified may not be exhaustive for the region.

Restaurants, cafes, bars and other food outlets

There are numerous restaurants, cafes, bars and food outlets in the Tasman Peninsula region. Three main eateries were identified in the Nubeena/White Beach area, and four eateries in the Port Arthur area. Note that the restaurants, cafes, bars and other food outlets identified may not be exhaustive for the region.

Cultural heritage

Cultural heritage is a major contributor to tourism on the Tasman Peninsula based around the two World Heritage listed Australian Convict Sites, the Port Arthur Historic Site and the Coal Mines Historic Site. These sites operate on a daily basis throughout the year.

Both sites are located several kilometres from the proposed West of Wedge development and will not be affected by the proposed development.

Lookouts

No renowned lookouts have aspects that will be affected by the proposed West of Wedge development. The nearest well-known lookout is at Cape Raoul, from which the proposed West of Wedge development is not visible.

Walks and treks

There are multiple walks and treks located within the Tasman Peninsula area. National Parks and Wildlife list five short walking tracks of 5 hours or less: Waterfall Bay walk, Bivouac Bay walk, Cape Hauy walk, Cape Raoul walk and the Coal Mine Historic Site walk. Multi-day walks include the Tasman Coastal Trail and the Three Capes Track.

The Three Capes Track commences 2 km inland in the vicinity of White Beach, immediately inside the National Park boundary on Noyes Road. The track continues south of Mt Spaulding through to the scarp overlooking Tunnel Bay, which is the first point with coastal views. Due to the track being inland and not elevated until Tunnel Bay the proposed West of Wedge development is not visible to walkers.

National Parks and Wildlife and Port Arthur and Tasman Tourism Association does not list any walking tracks within the Nubeena or coastal White Beach area, however these areas do allow for activities such as walking and bike riding.

5.7.2.3 Marine-based

There are many marine-based commercial tourism operations on the Tasman Peninsula, the majority of which operate from Port Arthur and Eaglehawk Neck. Some marine-based tourism operators utilise the area in the vicinity of the proposed West of Wedge development intermittently. More generally,

the Storm Bay area surrounding Wedge Island is popular for boating, fishing and yachting as well as diving and kayaking.

Pennicott Wilderness Journeys operates their 'Tasman Island Cruise' daily, departing from Port Arthur, with a second tour operating between the months of December to April. The tour route follows the coastline past Cape Pillar, around Tasman Island, up to Eaglehawk Neck, returning to conclude at Port Arthur. Pennicott Wilderness Journeys also operates regular privately chartered tours in the Storm Bay area, around Wedge Island and Cape Raoul (Pennicott Wilderness Journeys, pers. comm.).

Par-Avion airlines operate scenic plane and helicopter tours around Tasmania including flights around the Tasman Peninsula. Currently no tours incorporate landing at any area on the Tasman Peninsula.

Roaring 40°S Kayaking operates guided kayaking tours in southern Tasmania. They do run tours at Fortescue Bay on the eastern side of the Tasman Peninsula but do not operate any tours in the vicinity of the proposed West of Wedge development (Roaring 40°S Kayaking, pers. comm.).

5.7.2.4 Industry

In addition to aquaculture (finfish farming), the Nubeena area and larger Tasman Peninsula area supports a number of industries including agriculture, commercial fishing, retail/hospitality and tourism, providing valuable employment for the region.

6 Potential Effects and their Management

6.1 Impacts on the Natural Environment

6.1.1 Water Quality

6.1.1.1 Recognised effects of farming emissions on water quality

A key component of marine finfish aquaculture, both in terms of fish performance and developing an ecologically responsible industry, involves understanding the environmental effects of farming on water quality. The magnitude and spatial extent of these impacts on marine systems relate mainly to both the prevailing environmental conditions and the physical attributes of the farming operation itself (Stenton-Dozey 2013).

Aspects of the physical environment that are most likely to influence water quality characteristics in marine systems include temperature, depth and current speed. However, hydrodynamic processes are clear determinants of the magnitude and spatial scale to which water quality impacts from finfish farming are dispersed within the water column – at both near and far-field scales (Buschmann et al. 2007).

The operational and physical configuration of finfish farming activities can also affect the nature of emissions entering the receiving environment. The actual size of the farm, stocking density, feed composition, the ability of cultured species to translate feed inputs into growth and the configuration/design of marine cages all play a role in the nature and extent of emissions into the water column (Stenton-Dozey 2013).

Aquaculture has the potential to impact negatively on water quality, the severity of which depends on the type and intensity of the farming activity and the capacity of the receiving environment to assimilate any impact (Black 2001).

The primary potential impacts to water quality from marine finfish aquaculture include dissolved nutrients (dissolved nitrogen and phosphorus), turbidity, dissolved organic carbon and depletion of dissolved oxygen (Price and Morris 2013).

Dissolved inorganic nutrient emissions are released into the receiving environment either directly as soluble excretions from finfish (predominantly ammonia) or indirectly as remineralised compounds from particulate organic waste. Increased emissions of dissolved nutrients from finfish aquaculture have the potential to promote eutrophication or nutrient enrichment within marine ecosystems. Symptoms of eutrophication are generally observed as changes to the abundance or composition of phytoplankton communities (such as algal blooms), reduced water clarity and/or by the depletion of oxygen within the water column as algal blooms enter the decay phase (Navarro et al. 2008, Stenton-Dozey 2013).

Approximately 5% of the total feed input from salmon farming is released into the receiving environment as a form of nitrogen (Wild-Allen 2005), of which 85% is released as dissolved nitrogen (predominantly ammonium) and 15% in particulate form. The phosphorus component released into the environment is considered to be divided between particulate labile detritus (at a fixed Redfield ratio of 16N:1P) and dissolved inorganic phosphorus. However, because nitrogen is the limiting nutrient in marine systems, the environmental impacts of salmon farming in the Channel and Huon MFDP areas (in south east Tasmania) are regulated through a total permissible dissolved nitrogen output (TPDNO).

One of the environmental concerns relating to fish farming in Tasmania is the potential for aquaculture to increase the likelihood of eutrophication of marine ecosystems, since the combination of stocking densities and feed inputs could lead to imbalanced levels of nitrogen and phosphorous in receiving waters relative to ambient conditions.

The potential for adverse environmental impacts associated with excess water column nutrients from finfish aquaculture was the focus of a major research initiative undertaken in south east Tasmania through the Sustainable Aquaculture of Finfish CRC. This multidisciplinary study commenced in 2001 and involved a whole of ecosystem assessment of environmental issues associated with the Tasmanian salmonid industry. These studies are described in Volkman et al. (2009).

The Volkman et al. (2009) study included wide-ranging investigations into the biological and physical processes affecting the environmental conditions of the D'Entrecasteaux Channel and Huon Estuary. These investigations addressed nutrient cycling, an assessment of anthropogenic nutrient inputs from fish farms, wastewater treatment plants, run-off of land-based sediments, and the development of a complex biogeochemical model to assist in future management and monitoring strategies for these waterways.

Thompson et al. (2008) developed a monitoring program based on the results of the Volkman (2009) to enable potential broadscale ecological and water quality impacts to be detected at the wider ecosystem level. This program is acknowledged widely as world's best practice – few countries have a comparable program, and the monitoring design has been adopted as a regulatory compliance requirement within an adaptive management framework (Macleod et al. 2015). Ross and Macleod (2013) suggested that the dataset from this monitoring program provides a reliable body of information upon which to assess the ecological condition of the D'Entrecasteaux Channel and Huon Estuary.

Studies undertaken in Scotland have also found that at most farm sites, enrichment levels are low and that primary production attributable to fish farm nutrients is small relative to that generated by other marine and terrestrial nutrient inputs. In addition, research targeting microalgal responses to nutrient inputs has also failed to conclusively establish a link between perceived increases in Harmful Algal Blooms (HABs) and expansion of the fish farming industry (The Scottish Association for Marine Science and Napier University 2002).

Further, results from finfish environmental monitoring studies undertaken in New Zealand suggest that dissolved nutrient emissions have not led to significant enrichment or detrimental impacts to water quality (Forrest et al. 2007).

Whilst the recognised effects of impacts from finfish farming emissions on water quality have been widely studied since the mid 1990's, Price and Morris (2013) note the significant improvements in management of marine finfish aquaculture over the last 20 years in operations, resulting in reduced emissions and improved water quality outcomes. This has mainly been observed through improvements in feeding practices, feed formulation, understanding fish behaviour and a better understanding of the site characteristics where the environmental effects of finfish farming can be assimilated in a more sustainable way.

6.1.1.2 Expected levels of farming emissions

6.1.1.2.1 *Proposed Production Strategy*

The production strategy at the proposed West of Wedge development would involve alternating year classes within the zone area. As stated in section 3.4.1, the mooring arrangement would have capacity to accommodate 16 pen bays per lease within each of the

four leases. Smolt will be introduced at approximately 140 g average weight and grown out to harvest over a 19 month period.

Figure 6.1 shows the sequence of smolt introduction, splitting of stock and harvesting at the proposed West of Wedge development for two successive year classes, commencing with the first introduction of smolt to the zone in winter.

Smolt would be introduced to Lease Area 1 in the month of July and placed directly into 16 double stocked cages (6.1A).

After a period of 6 months, these fish would be divided (split) into their final grow out cages, which will result in an additional 16 stocked cages to be moved to Lease Area 2 (6.1B). This biomass splitting will occur during January (i.e. 6 months after introduction to the lease). In effect, after splitting, there will be 16 x 168 single stocked cages in both Lease Areas 1 and 2 (i.e. 32 stocked cages in total). Fish will be harvested in December (6.1D) (i.e. some 18 months after being placed into Lease Area 1).

Similar to above, the same pattern will be adopted for Lease Areas 3 and 4 for the following year class. This means smolt will be introduced into Lease Area 3 in July (6.1C) and there will one split (i.e. 16 into 32) after 6 months prior to the final grow out phase (6.1E). Once again, harvesting will be carried out in December, 18 months after the smolt were first introduced into the zone.

The staggering of stock input across leases will provide for adequate periods of fallowing and benthic remediation - at full production, lease areas will be vacant for between 6-12 months as restocking of lease areas alternates between year classes.

Figure 6.1 Stocking management of year classes for the proposed West of Wedge development

6.1.1.2.2 *Soluble nutrient emissions from stock/feed/faeces*

Initial Staged Approach

Under a conservatively set proposed staged approach (i.e. industry-wide cap on production set at 30,000 tonnes per year) Tassal proposes to introduce smolt according to the schedule over the first three years of production within Storm Bay shown in Table 26.

Table 26 Smolt input schedule for first three years of production within Storm Bay

Year	Feed input (t)	West of Wedge Soluble nitrogen emissions (t)
1	3530	150
2	7051	300
3	9409	400

The initial proposed staged production at the proposed West of Wedge development will require a feed input ranging from 3530 t in the first year to 9409 t in the third year. These amounts are consistent with initial conservative approach to production management within Storm Bay.

Figure 6.2 shows the soluble emissions for each of the first three years' staged entry. These emissions range from 150 t to 400 t per year across three successive year classes.

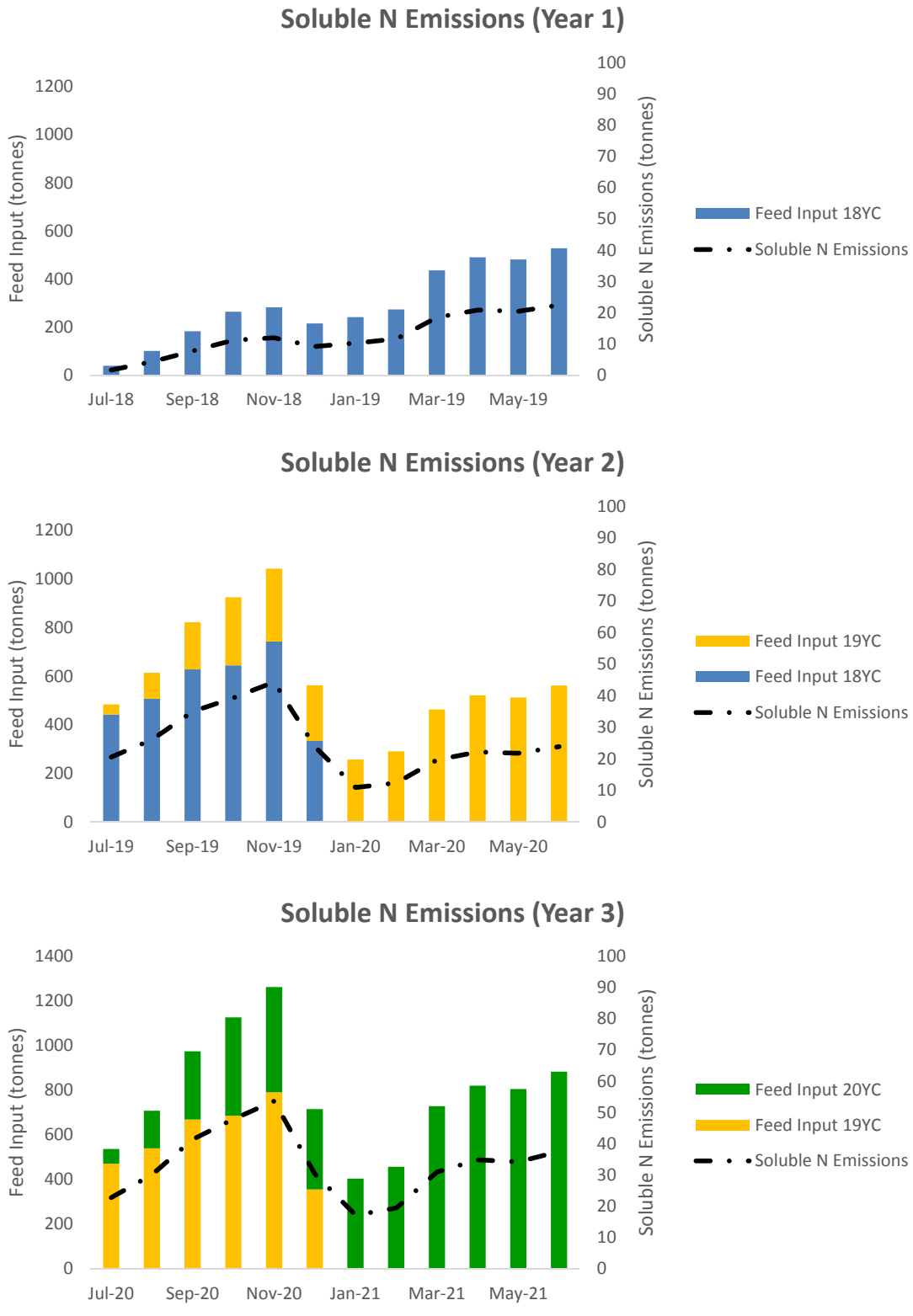


Figure 6.2 Soluble nitrogen emissions for first three years of staged production

Proposed maximum production

For the purpose of this EIS, Tassal considers that the proposed West of Wedge development could potentially stock 1.8 million fish per year. However, this level of input would only eventuate with regulatory approval following an assessment of Tassal's initial staged entry development approach. Any increase from the initial proposed industry-wide cap in production (i.e. 30,000 t/yr) would need to be supported by the results of the environmental monitoring program and biogeochemical modelling studies.

For example, the feed input to the proposed West of Wedge development at maximum capacity of 1.8 million smolt per year, is expected to be 11,700 t/yr. This represents 585 t of nitrogen emissions released into the receiving environment annually, of which 497.2 t is released annually as soluble nitrogen emissions, predominantly as ammonium excreted by farmed fish.

Annual soluble emissions have been calculated to include the overlap of production cycles when two separate year classes are simultaneously stocked within the zone. Figure 6.3 shows the monthly feed input (columns) where the two colours (blue and gold) represent the amount of feed provided to each of the separate year classes. The total monthly soluble nitrogen emissions are shown by the black continuous line.

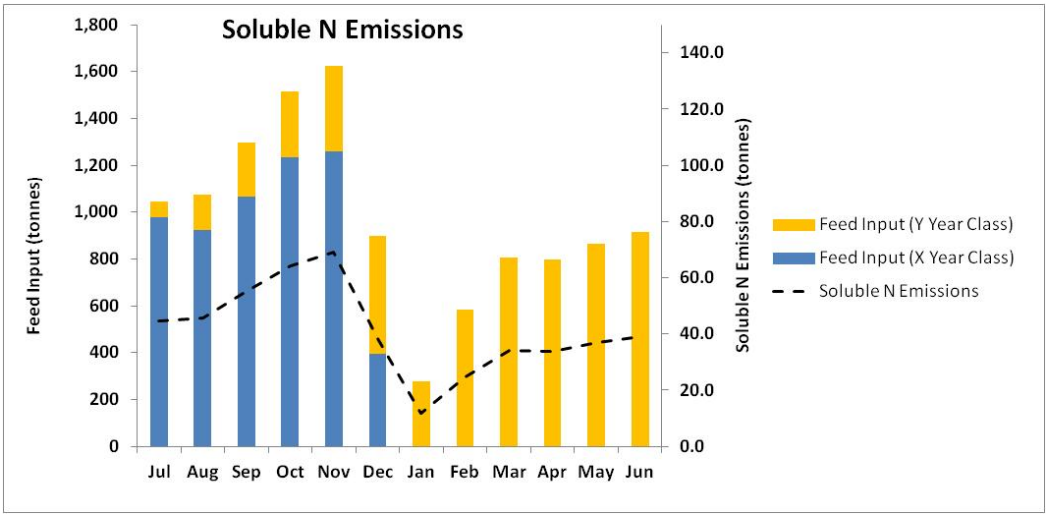


Figure 6.3 Monthly feed inputs for separate year classes at the proposed West of Wedge development

6.1.1.2.3 *Soluble effluent stream from in-situ net cleaning*

The deployment of stocked cages at the proposed West of Wedge development would require in-situ cleaning. Current projections regarding net cleaning suggest that each of the 64 cages housed within the proposed zone would require in-situ net cleaning approximately 10 times per year.

This means that the expected soluble fraction (i.e. <100 µm) from net cleaning activities at the proposed West of Wedge development would be approximately 8.6 t/yr (1.3 t/yr N). These calculations are based on the maximum weight of material removed during net cleaning activities for net cleaning effluent in the Eastern Farming Zone as determined by CFOC (2012).

Based on biomass splits that occur as previously described, the four proposed leases will not be fully stocked at 64 cages all year round. Figure 6.3 illustrates a worst case scenario, and the actual volume is likely to be considerably less with high frequency/low volume net cleaning

regimes. In addition, the use of K-grid net technology consists of a net material with a surface that is less attractive to biofouling organisms than other net types (such as monofilament nets).

6.1.1.3 Evaluation of potential effects

6.1.1.3.1 *Overview of hydrodynamic models*

Hydrodynamic models are used to describe the motion of water in a range of coastal environments. Modelled outputs can include such features as a time history of current velocity, temperature, depth as well as the ability to predict the fate of release particles from a particular source.

Ecological assemblages in the marine environment respond and behave differently when environmental conditions change. The application of a hydrodynamic model in this EIS is intended to describe the potential fate of nutrient emissions from marine farming activities, particularly the scale and extent of emissions and the likelihood of potential interactions with ecological communities (such as rocky reef communities) based on the magnitude and spatial extent of released particles.

The development of an effective management regime to support this proposal is underpinned by modelling a range of scenarios to assist the decision-making processes of industry, planning and regulatory authorities (i.e. DPIPWE and EPA) throughout and beyond this EIS. It is important to note the underlying assumptions and limitations of hydrodynamic models, and that their use alone should not be considered as a panacea, but rather one element of a range of adaptive management tools to develop a more intimate understanding of how natural systems respond to the impacts from finfish farming under this proposal.

The modelled outputs described below include assumptions for a range of parameters (i.e dispersal period, particle decay rate, seasonal influence, etc) that have been determined based on best current knowledge.

Nevertheless, previous ecological and hydrological studies undertaken in Storm Bay by the CSIRO and IMAS (Clementson et al. 1989, Harris et al. 1991 and Crawford et al. 2011) have provided a sound platform of local knowledge and understanding of coastal processes. This offers a high degree of confidence that forecasted modelled outputs will assist in management decision-making and the development of an appropriate environmental monitoring program.

6.1.1.3.2 *Nutrient dispersion modelling for proposed marine finfish farming zones in Storm Bay*

To assist in understanding the potential ecological impacts associated with the proposed West of Wedge development (as well as the cumulative impacts from other proposed marine farming zones in Storm Bay), DPIPWE commissioned IMAS to process a range of modelled simulations (using CONNIE3 – a hydrodynamic model developed by the CSIRO) to describe the patterns of dispersion of farm derived dissolved nutrients. These outputs describe Tassal's proposal specific emissions, and provide useful insight into the consideration of potential ecological effects from the proposed feed inputs.

The objective of these modelled simulations is to inform the development of an appropriate environmental monitoring program based on the net pattern of dispersion resulting from the combined farm derived emissions for each company proposing to undertake finfish farming in Storm Bay.

CONNIE3 possesses the capacity to examine and describe the connectivity associated with marine environments using an existing hydrodynamic model, and in this instance, modelled outputs were generated to determine the fate and dispersion pattern of known nutrient loads added to the Storm Bay system.

The use of CONNIE3 is restricted to outputs covering the time period between June 2014 and October 2016, therefore modelled outputs reflect predicted nutrient loads and their dispersion over four discrete seasonal runs within this period.

For the purpose of this EIS, Figures 6.3-6.5 are presented as annual results – the average of each of the four seasonal outputs were generated through CONNIE3. Each of the seasonal outputs describe the temporal variability related to seasonal variations in the hydrodynamics of Storm Bay, as well as temporal differences in feed inputs during production cycles.

The modelled outputs represent dispersion patterns for dissolved nitrogen emissions based on a maximum 40,000 tonne production of farmed salmon in Storm Bay proposed by DPIPWE (industry combined total inclusive of existing farming operations in Storm Bay). An initial conservative industry-wide cap on production of 30,000 t/yr has been proposed by the regulatory authority until such time that additional environmental monitoring and modelling studies confirm that finfish farming in Storm Bay at that level is sustainable and can potentially support a higher level of production. Total Permissible Dissolved Nitrogen Outputs (TPDNOs) will be set by the EPA for each company's current and/or proposed operations.

6.1.1.3.3 *Proposal Specific*

Tassal's apportionment of the Total Permissible Dissolved Nitrogen Output (TPDNO) within Storm Bay represents 30% of the total TPDNO set by DPIPWE for all companies undertaking/proposing salmonid finfish farming within this region.

Approximately 85% of nitrogen emissions entering the marine environment from salmonid farming operations are excreted by fish as soluble nitrogen in the form of ammonium – a preferred source of nutrients by microalgae and other marine plant life (Volkman et al. 2009).

The effects of an increase in soluble nitrogen emissions (497.2 t/yr) would lead to changes in dissolved nitrogen concentrations in the receiving environment. Possible impacts could manifest in increased primary production, but only within a localised area due to the highly dispersive (diluting) nature of the Storm Bay system. The environmental effects of marine finfish aquaculture on water quality and primary production are well described in Stenton-Dozey (2013), Price et al. (2013) and Price at al. (2015).

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 Storm Bay. This proposition is supported by Crawford et al (2011) who suggested that waters off Nubeena are more heavily influenced by freshwater from the Derwent River outflow and showed an unusual pattern of temperature and salinity stratification compared to the more marine dominated waters off the eastern side of Bruny Island.

Proposal specific pattern of dispersion of emissions

Modelled simulations describing the dispersion of farm derived dissolved nutrients from Tassal's proposed West of Wedge development support the view that the receiving environment within Storm Bay is highly dispersive (diluting) with nutrient concentrations being rapidly reduced to <1.0% of the total output within a localised area (i.e. in close proximity to the lease areas).

Figure 6.4 shows the modelled data as contour plots over the 0-15 m and 15-28 m depth ranges, with contour levels representing the average percentage of the total farm inputs between each level. This output represents an average of the four seasonal modelled outputs for each depth range to present an annual result.

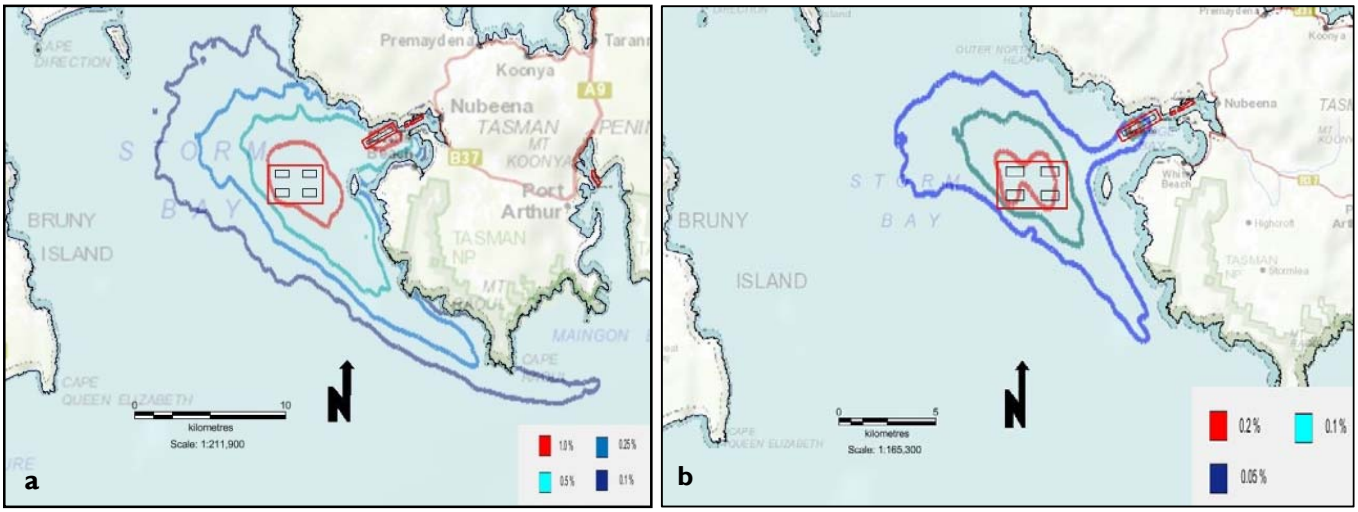


Figure 6.4 Model representation of the annual dispersion of dissolved nitrogen released from the proposed Tassal Pty Ltd farms in Storm Bay integrated over the 0-15m depth range (a) and 15-28m depth range (b). Results are shown as the proportion of the total dissolved nitrogen released (with contours shown for (a) 0.1%, 0.25%, 0.5% and 1.0% and (b) 0.05%, 0.1% and 0.2%)).

In this instance, the contour levels are provided for 0.05%, 0.1%, 0.2%, 0.25%, 0.5% and 1.0% - the proportions of total dissolved nitrogen released from the farm and show that most (99%) of the soluble emissions from feed inputs are restricted to the area enclosed by the red contour lines. These plots describe the dispersion of farm-derived nutrients without any background loading, and provide an indication of added emissions to the system in terms of scale and geographic distribution.

This pattern of dispersion is consistent with previous studies that investigated water movement within the Storm Bay region (Crawford et al. 2011), with nutrient emissions from Tassal's proposed West of Wedge development generally being restricted within the mid to south-east sectors of Storm Bay and an overall flow effect in a south easterly direction along and down the eastern side of the Tasman Peninsula.

Modelled simulations describing the dispersion of farm derived dissolved emissions over the 15-28 m depth range show a reduced dispersion footprint compared to the 0-15 m depth range (Figure 6.4), suggesting that most of the dissolved nitrogen is dispersed through current flows in the surface waters. This is supported by results from previous Tassal ADCP current meter deployments near the proposed zone that showed lower current flows at depth, hence reduced dilution would be expected in these bottom waters.

Proposal specific – ammonia dispersions relative to background levels

Simulations of farm derived dissolved nutrients and their pattern of dispersion were also modelled against background nutrient levels based on data from previous research and monitoring undertaken in Storm Bay. These studies provide sufficient environmental baseline information from which to derive site-specific risk levels based on the ANZECC (2000) Guidelines for Fresh and Marine Water Quality. Data collected over 24 monthly sampling events are regarded as sufficient to indicate ecosystem variability and can be used to derive water quality trigger values (ANZECC 2000).

Water quality data obtained from industry specific, IMAS and DPIPWE monitoring programs in Storm Bay were used to describe the water quality attributes for nutrients concentrations (ammonia) in terms of the 50th, 80th and 95th percentiles.

These percentiles (derived from real data) represent normal background conditions (50th percentile), low risk conditions (i.e. < 80th percentile), conditions where there would be an increased likelihood of ecological risk above this level (i.e. >80th percentile), and levels that represent a greater likelihood of adverse ecological interactions (i.e. >95th percentile).

Table 27 shows the derived background (50th percentile), low risk (80th percentile) and higher risk (95th percentile) for ammonium concentrations obtained from previous Storm Bay monitoring studies undertaken by IMAS.

Table 27 The 50th (median), 80th and 95th percentile values for ammonium (mg N m^{-3}) in surface (1-10 m) and at depth (varied depending on site; typically >=50m) based on results of water sampling conducted as part of previous sampling in Storm Bay. In all cases nitrogen concentrations represent the average of several sample sites taken across Storm Bay. Data was provided by DPIPWE.

	July			October			January			April			Annual		
	50th	80th	95th	50th	80th	95th	50th	80th	95th	50th	80th	95th	50th	80th	95th
Ammonium															
Surface	6.8	9.2*	20.1*	6.3	13.8*	25.1+	6.9	10.4	28.2+	7.2	10	16.2+	6.0	9.7	16.3
Depth	6.3	9.2*	20.1*	10.5	13.8*	25.1+	13.6	23.7	28.2+	9.8	14.9	16.2+	8.9	16.1	28.0

Where insufficient numbers of background samples exist to establish percentile values consistent with ANZECC the following values have been used:

***Annual values for the full column**

+ Seasonal values for the full water column

Ammonium is an important water quality parameter that is frequently used (in combination with other physical or chemical parameters) to measure the environmental condition of aquatic systems. Elevated levels of this nutrient can potentially result in an adverse biological response, or impact upon marine ecosystems.

Figure 6.5 shows the modelled dispersion of dissolved nitrogen (ammonium) emissions from Tassal's proposed farming leases (in combination with background ammonium levels) over the 0-15m and 15-28m depth ranges.

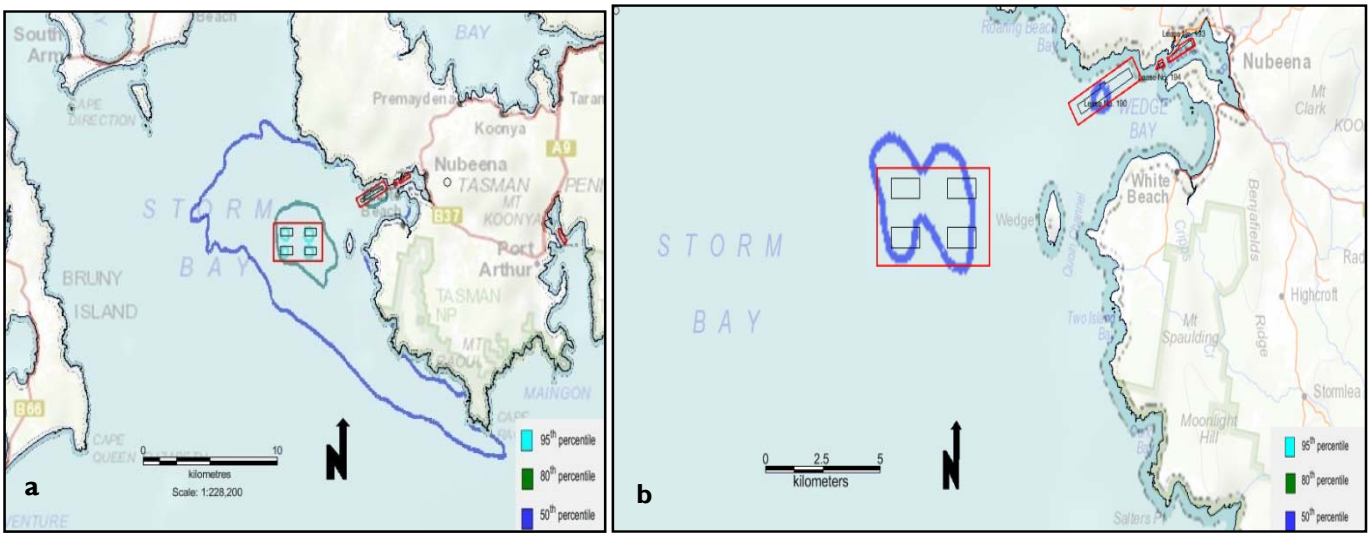


Figure 6.5 Model representation of the annual dispersion of dissolved nitrogen (ammonium) released from the proposed Tassal Pty Ltd farms in Storm Bay integrated over the 0-15m depth range (a) and 15-28m depth range (b). The concentrations shown include a measure of background (median) ammonium concentrations based on data (average) from Crawford et al. (pers comm). The contours show the 95th, 80th and 50th percentiles.

This output represents an average of the four seasonal modelled outputs for each depth range to present an annual result. The contours show the 95th (light blue), 80th (green) and 50th (dark blue) percentiles of ammonium concentrations.

Under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000), three ecosystem conditions are recognised:

1. High conservation/ecological value systems
2. Slightly to moderately disturbed systems, and
3. Highly disturbed systems.

The ecosystem condition of Storm Bay is considered to be representative of a slightly to moderately disturbed system, or 'condition 2 ecosystem'.

In terms of ecological risk, or the likelihood of adverse environmental impacts from the proposed West of Wedge development, the percentiles shown as contour lines represent the transition between environmental risk levels. For each level of risk (95th percentile, 80th percentile and 50th percentile), the areas between contour lines can be categorised as:

<50th percentile – below this contour line indicates the median or background levels (i.e. the expected levels prior to the inclusion of modelled feed inputs).

<80th percentile – below this contour line represents waters where ecologically or biologically meaningful changes would not be expected to occur (i.e. acceptable level of change below this value) following the inclusion of modelled feed inputs. The ANZECC (2000) Guidelines suggest the use of 80th percentiles (for stressors such as ammonia) as 'low-risk' trigger levels.

>95th percentile – the point at which a greater likelihood of ecological interactions would be expected to occur.

Therefore, the area enclosed by the green contour line (80th percentile) represents an area where there is a greater likelihood that environmental effects from finfish farming may be

observed with the addition of the proposed feed inputs. The area contained between the 50th percentile contour (dark blue) and the 80th percentile contour (green) represents lower-risk levels for water quality impacts, where nitrogen loads might be expected to exceed background levels, but where there is a low risk that adverse biological impacts would be observed. The waters below the 50th percentile contour represent those waters where there is least likely to be any observed environmental effect from the proposed level of farming, and would be comparable to current background ammonium concentrations in Storm Bay.

Although the receiving environment is located within a highly dispersive system, modelled dispersion of dissolved nitrogen (ammonium) emissions suggest that low risk trigger levels would be exceeded within and around the proposed zone, with elevated ammonium concentrations extending up to approximately 1.5 km from the zone boundary. This predicted footprint shows seasonal variability and can be seen to extend towards the rocky shores of Wedge Island (see Appendix 19), therefore any proposed monitoring would include sampling stations within this predicted intermediate area of impact.

Higher risk levels (i.e. >95th percentile) of ammonium emissions are mainly restricted to within the lease areas but extending into the proposed zone. The modelling also shows that the potential for adverse interactions is markedly reduced in the bottom waters, with a much smaller footprint than surface waters. The modelling suggests that the low risk trigger levels would not be exceeded within the bottom water layer.

The proposed development is situated above sandy substrates in a well-mixed area of Storm Bay, where depth is approximately 40 m, and is approximately 1.8 km from the nearest rocky coast (Wedge Island). The immediate environment surrounding the proposed zone does not represent an area where the impacts from elevated dissolved nitrogen emissions on water quality are considered to have a significant or adverse impact on ecosystem structure and function within this area. This is supported by monthly monitoring data collected adjacent to an existing marine farm at Creeses Mistake, Nubeena, where no adverse environmental or biological impacts from dissolved nitrogen emissions have been observed within and around the vicinity of the farm over time.

6.1.1.3.4 *Holistic/combined proponent basis*

Modelled simulations describing the combined dispersions of farm derived dissolved nutrients for proposed industry-wide marine farming developments in Storm Bay also suggest that the receiving environment is highly dispersive, and that the known pattern of dispersion (i.e. greater dispersion within surface waters) also applies. In addition, the modelled outputs describe the connectivity and interaction of dissolved nitrogen emissions from three distinct proposed marine farming zones within Storm Bay (off Trumpeter Bay, northern Storm Bay and west of Wedge Island).

Similar to Section 6.1.3.3, modelled outputs are shown as a proportion of the total nitrogen (ammonium) released from the proposed developments in Storm Bay. Three contour lines are shown to describe the 95th, 80th, and 50th percentiles derived from previous monitoring data, and indicate the expected transition points between recognised risk levels (i.e. 50th percentile=existing background levels, 80th percentile=low-risk trigger level and 95th percentile=higher risk level).

Figure 6.6 shows the annual pattern of dispersion of farm released ammonium emissions in combination with background levels of ammonium. This method of representing modelled data provides context for particular areas or regions that may be more likely to experience the effects or adverse impacts of emissions, and where more targeted monitoring activities should be located in order to better define the magnitude and scale of potential impacts.

Similar to the modelled scenarios for emissions from Tassal's proposed West of Wedge development, the majority of dissolved nitrogen emissions for the proposed three marine farm developments in Storm Bay remain localised around each of the proposed lease areas, however the combined dispersion of dissolved nutrients at low concentrations covers a more extensive area of Storm Bay. The cumulative effect of feed inputs, particularly for surface waters, shows that current background conditions for ammonium concentrations would be exceeded (i.e. >50th percentile) around the Storm Bay area, suggesting that combined emissions (albeit at low concentrations) would extend north and south into Storm Bay. This effect is markedly reduced for bottom waters.

An interesting feature of the modelled outputs includes the level of interaction/connectivity between the proposed developments located in northern Storm Bay (Petuna) and west of Wedge Island (Tassal). Targeted monitoring will be required to better understand the potential cumulative environmental impacts that may occur as a result of these interactions.

Dissolved nitrogen emissions from the proposed development off Trumpeter Bay on the eastern side of Bruny Island appear unlikely to interact with emissions from either Tassal's or Petuna's proposed developments, however, there is merit in targeting the waters to the north-east of the Trumpeter Bay development in any monitoring study to verify the extent of impacts based on the known patterns of water circulation within Storm Bay.

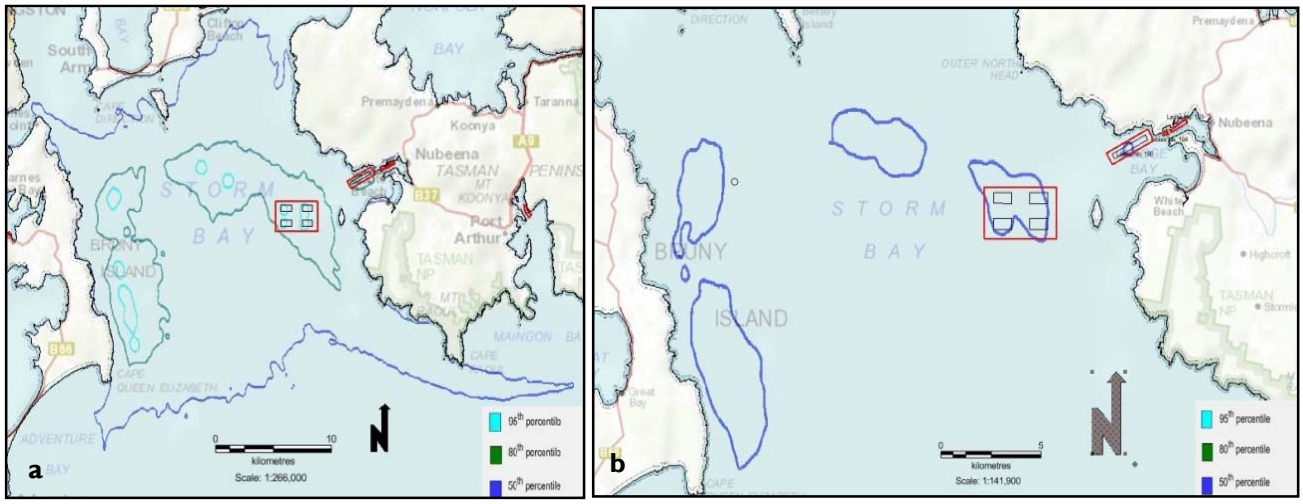


Figure 6.6 Model representation of the dispersion of dissolved nitrogen (ammonium) released from the three (3) proposed finfish developments in Storm Bay integrated over the 0-15m depth range (a) and 15-28m depth range (b). The concentrations shown include a measure of background (median) ammonium concentrations based on data (average) from Crawford (pers comm). The contours show the 95th, 80th and 50th percentiles.

The modelled outputs describing the cumulative impacts from the combined dissolved nitrogen emissions for three marine farming developments in Storm Bay show a more expansive area of potential impacts than would otherwise be the case for a single development (i.e. such as Tassal's proposed West of Wedge development).

These modelled outputs show that dissolved nitrogen emissions released from the proposed developments, particularly surface waters, extend significantly within the Bay, with higher risk trigger levels (i.e. waters enclosed by 80th percentile (green) contour) restricted to mainly offshore oceanic waters around the vicinity of the proposed developments. As with other modelled outputs, dissolved nitrogen emissions in the bottom water layer consist of a markedly reduced footprint compared to the surface water layer.

The offshore waters where nutrient emissions are expected to exceed the 80th percentile (i.e. low risk trigger level) may result in increased levels of primary production or algal blooms consistent with the findings of other studies (Stenton-Dozey 2013). A targeted near and far-field water quality monitoring program would quantify changes in nutrient concentration or microalgal community composition relative to the known baseline conditions in Storm Bay.

The proposed Storm Bay developments are located in exposed waters and it is unlikely that the environmental effects from dissolved emissions would impact upon reef communities or sensitive habitats within Storm Bay. Results from other studies undertaken in south east Tasmania and overseas (Table 28) suggest that the detectible ecological effects of elevated nutrients from soluble emissions can occur for distances of up to 500 m from an emission source. Such effects could be adequately quantified in Storm Bay with targeted environmental monitoring.

The range and complexity of possible responses to nutrient loading are extremely difficult to predict and measure, particularly at the broadscale level. A broadscale monitoring program (including sampling of pelagic, sediment and macroalgal communities) will be developed (based on the modelled outputs and particular areas of interest) to monitor the extent and scale of impacts across a range of potential impact zones (i.e. near-field and far-field).

Overall, with the implementation of an appropriate monitoring and management framework to mitigate against the known potential environmental effects of finfish aquaculture, it is considered that the proposed development would not result in any significant environmental impacts to the waters of Storm Bay within the immediate vicinity of Tassal's proposed zone and surrounding waters.

Table 28 Pelagic and broadscale effects of soluble emissions from marine cage aquaculture

Author	Title	Farmed species	Region	Measured Effect	Environmental Effect
Valentine et al. 2015	Understanding broad scale impacts of salmonid farming on rocky reef communities.	Atlantic salmon (*Salmo salar*)	South east Tasmania	Subtidal reef communities	Analysis of data from Maria Is, Tinderbox and Ninepin Pt MPA monitoring sites (1992-2015) showed no consistent pattern of broad scale change in macroalgal community structure over time. This study agreed with Crawford (2006) which found no consistent evidence of changes in macroalgal assemblages attributable to salmon farms.
Macleod et al. 2016	Clarifying the relationship between salmon farm nutrient loads and changes in microalgal community structure/distribution.	Atlantic salmon (*Salmo salar*)	South east Tasmania (D'Entrecasteaux Channel)	An assessment of increased nutrient loads on subtidal reef communities	This study found that abiotic drivers and environmental conditions may be key determinant to understanding ecosystem structure and function of microalgal assemblages in reef systems. The study also found little evidence of nutrient enrichment effects of the study reefs.
Crawford et al. 2011	Development of broad scale environmental monitoring and baseline surveys in relation to sustainable salmon aquaculture in the D'Entrecasteaux Channel region.	Atlantic salmon (*Salmo salar*)	South east Tasmania (D'Entrecasteaux Channel)	Intertidal algae	Results from intertidal communities (in particular the dominant species *Ulva* and *Hormosira*) showed natural variation and no clear trends in abundance with distance from salmon farms.
Dalsgaard and Krause-Jensen 2006	Monitoring nutrient release from fish farms with macroalgal and phytoplankton bioassays.	Sea bream (*Sparus aurata*) and Sea bass (*Dicentrarchus labrax*)	Mediterranean Sea (Greece, Cyprus, Italy and Spain)	Macroalgal and phytoplankton bioassay analysis	This study showed that fish farms clearly stimulated the pelagic primary production of the receiving environment. The effects of nutrient emissions release was observed up to a distance of about 150 m downstream in the dominant current direction.
Oh 2009	Macroalgal assemblages as indicators of the broad-scale impacts of fish farms on temperate reef habitats.	Atlantic salmon (*Salmo salar*)	South east Tasmania (D'Entrecasteaux Channel and Port Esperance)	Subtidal macroalgae	This study suggested that fish farms were associated with increased cover of opportunistic algae within 100-400 m of the farms.
Sanderson et al. 2008	Distribution of nutrients for seaweed cultivation around salmon cages at farm sites in north–west Scotland.	Atlantic salmon (*Salmo salar*)	Badcall, north-west Scotland	Ammonium concentration	Salmon farm derived enhancements of 1 µM were detected at distances >200 m.
Volkmann et al. 2009	Numerical Hydrodynamic Modelling of the D'Entrecasteaux. Channel and Huon Estuary.	Atlantic salmon (*Salmo salar*)	D'Entrecasteaux Channel and Huon Estuary	Nutrient concentrations modelled using particle traces.	The particle trace modelling showed that it is possible for a plume having concentration of 10% (i.e. 10:1dilution) of the source concentration to exist up to 500 m from the net cage on occasion.

6.1.1.4 Mitigation measures

6.1.1.4.1 *Monitoring and management response*

Tassal's current environmental monitoring program involves investigations into water quality and rocky reef systems at fine and broadscale spatial levels in the Eastern Farming Zone.

Since July 2013, Tassal has undertaken a range of ecological surveys at established monitoring sites to investigate potential impacts on biological assemblages from fish farming activities. These surveys include:

- subtidal surveys for EPBC listed species (i.e. Giant Kelp and handfish) (2013 and 2015)
- intertidal surveys of rocky shores (2013)
- understanding broadscale impacts of salmonid farming on rocky reef communities (2015)
- monthly water quality monitoring program (February 2014-ongoing)

In February 2014, Tassal commenced a monthly water quality monitoring program for the Tasman Farming Region to better understand the farming environment and to meet the requirements of the ASC certification standards. Four monitoring sites were established within the Eastern Farming Zone, including a sampling location within the proposed West of Wedge development area. To date 33 consecutive monthly sampling events have been completed, and an ideal environmental baseline established for water quality parameters at the proposed West of Wedge development. Additional monitoring studies will be developed to enable Tassal to validate the scale and extent of impacts described in the IMAS Modelling Study. These monitoring activities will also need to take account of the cumulative impacts and interactions associated with other marine farming activities in Storm Bay.

Coupled with the water quality monitoring programs are the additional biological studies aimed at understanding the potential effects of finfish farming on reef communities, particularly macroalgal assemblages. These studies also provide important baseline information which can be used to determine potential broadscale impacts on rocky reef communities from finfish farming activities in the Tasman Farming Region, including an assessment of impacts at varying feed input levels. FRDC Project 2014-042 entitled '*Understanding broadscale impacts of salmonid farming on rocky reef communities*' has already established, and completed in-situ ecological surveys along 26 fixed transect positions within the Eastern Farming Zone.

In 2015, IMAS embarked on a 3-year FRDC funded project (FRDC Project 2015-024) entitled "*Managing ecosystem interactions across differing environments: building flexibility and risk assurance into environmental management strategies"* to assist Tasmania's salmon industry determine the effectiveness of local scale monitoring activities, particularly in relation to sediment health, and address concerns relating to potential adverse environmental effects at the broadscale level, such as reef communities. Once completed, this project will assist in developing contemporary advice for managing the environmental impacts of more remote, exposed farming locations.

In addition to the FRDC projects described above, specific Giant Kelp surveys undertaken in 2013 (winter), 2015 (summer), and 2016 (winter) will be continued in 2017 (summer) to assess the relative health of Giant Kelp stands and associated biological assemblages at each of the survey locations.

In understanding the potential ecological impacts from combined emissions, the modelled outputs provided by IMAS allow both the proponents of the three proposed marine farming zones and/or the

EPA to develop risk-based management strategies for ongoing environmental assessments that may include:

- Development of a mandatory broadscale environmental management program for Storm Bay (including validation of the CSIRO/IMAS modelled outputs) – see Appendix 20
- Implementation of an adaptive management plan and annual impact assessment report
- Development of a predictive biogeochemical model (using the real monitoring data) to support ongoing management
- Development of an Area Management Agreement following ASC (Aquaculture Stewardship Council) Standards criteria

6.1.1.4.2 *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 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 has been developed by the EPA 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. More detail is included in Appendix 20.

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 Tasman Peninsula and Norfolk Bay 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.

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.

6.1.1.4.3 *Regulatory Controls*

Management Controls contained within the Tasman Peninsula and Norfolk Bay MFDP area include requirements for monitoring and reporting of environmental aspects. Management Controls include:

- **Management Control 3.1.1** There must be no significant visual, physio-chemical or biological impacts at or extending 35 metres from the boundary of the lease area, as specified in the relevant marine farming licence.

- **Management Control 3.1.2** Environmental parameters must be monitored in the lease area, 35 metres outside the boundary of the marine farming lease area and at any control site(s) in accordance with the requirements specified in the relevant marine farming licence.

- **Management Control 3.2.1** The Director, Environmental Protection Authority, may, from time to time, determine the total permissible dissolved nitrogen output (TPDNO), within specified periods, attributable to licensed finfish marine farming operations (ie; carried out under a licence issued under Part 4 of the *Living Marine Resources Management Act 1995*), for a specified area.

- **Management Control 3.2.2** A specified area may constitute:
    - An area or multiple areas covered by this plan, or
    - All the area covered by this plan

- **Management Control 3.2.3** For the purpose of assessing quantities of dissolved nitrogen output attributable to licensed finfish marine farming operations, the Director may use any method that the Director is satisfied delivers a proper measure of total dissolved nitrogen output from finfish marine farming operations.

- **Management Control 3.2.4** On making a determination under 3.2.1, the Director is to apportion the TPDNO, or a portion of the TPDNO, between the leaseholders licensed for finfish marine farming operations within that specified area or if a lease is sub-leased, any sub-lease holders within the specified area.

- **Management Control 3.2.5** An individual apportionment made under 3.2.4 may be nil.

- **Management Control 3.2.6** An individual apportionment made under 3.2.4 may be made in respect of two or more leaseholders, as if they were a single leaseholder.

- **Management Control 3.2.7** On the making of an apportionment under 3.2.4, the Director is to notify each of the relevant leaseholders or if a lease is sub-leased, any sub-lease holders, in writing of the individual apportionment made in respect of that leaseholder or sub-lease holder.

- **Management Control 3.2.8** A leaseholder or if a lease is sub-leased, any sub-lease holder notified in accordance with 3.2.7 must comply with that notice.

- **Management Control 3.3.1** The maximum permissible stocking density of salmonid fish is 15 kg/m3 of caged volume unless otherwise specified in the marine farming licence.

- **Management Control 3.3.2** Maximum permissible stocking densities for other finfish species may be specified in licence conditions.

- **Management Control 3.3.3** Lessees must ensure that farmed areas are fallowed as soon as practicable if bubbles of hydrogen sulphide and/or methane gasses form in the sediment and rise to the surface without physical disturbance of the seabed.

- **Management Control 3.3.4** Stocked finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.

- **Management Control 3.4.2** Lessees must keep the following records for each lease area held by the lessee and retain these records for a period of 5 years;

    - **Management Control 3.4.2.1** Stock biomass within the lease area on a monthly basis.

    - **Management Control 3.4.2.2** The type, origin and dry weight of food placed into the lease area on a monthly basis.

    - **Management Control 3.4.2.3** The names and quantities and date of use, of all chemicals which have been used on the lease area. This must include, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

    - **Management Control 3.4.2.4** Location (to a degree of precision to the satisfaction of the Secretary), size and stocking rates of all cages.

    - **Management Control 3.4.2.5** The duration that individual cages are held in a particular location.

- **Management Control 3.4.5** Environmental data is to be collected at each finfish lease area and analysed to specific standards and in accordance with the requirements for collection, reporting and analysis as specified in the relevant marine farming licence.

  Note: The Secretary will use the information from the environmental monitoring surveys when determining marine farming licence conditions.

- **Management Control 3.4.7** Lessees must comply with the environmental monitoring requirements for collection, analysis and reporting as specified in the relevant marine farming licence.

Note: The Secretary will use the information from the environmental monitoring surveys when determining marine farming licence conditions.

- **Management Control 3.13.8** Lessees must comply with all lawful written requirements of the Secretary.

6.1.1.4.4 *In-situ net cleaning protocols*

Measures are in place to mitigate the amount of soluble net wash released into the water column from net cleaning activities; these measures are included in the *'Environmental Best Management Practice for in-situ Net Cleaning'* (see Appendix 5). The most effective means for managing and minimising the effects of net wash effluent is through good house-keeping, where nets are cleaned more frequently to prevent the accumulation of excessive biofouling on nets (i.e. high frequency cleaning/low volume emissions).

The installation of K-grid nets at the proposed West of Wedge development is also expected to result in greater efficiencies to in-situ net cleaning than previously observed with historically used net types, purely because the surface of K-grid nets offers reduced opportunities for fouling organisms and propagules to attach. In addition, the waters of Storm Bay are subject to significantly more exposed conditions than experienced at other marine farming leases in Tassal's current farming regions (as observed through current flow measurements collected on-site), hence it is expected that soluble/suspended emissions from in-situ net cleaning activities will be dispersed more effectively than would be the case in less exposed waterways.

6.1.1.5 Overall effect following implementation of mitigation measures

Tassal's commitment to comply with the proposed initial staged entry approach to stocking the proposed West of Wedge development ensures that the environmental integrity of surrounding ecosystems can be monitored and maintained as the effects of finfish farming within these exposed waters can be better understood. If, following an evaluation of the monitoring and modelling studies during the initial stages of production support increased stocking levels, Tassal will work with the regulatory authority to maintain sustainable stocking levels within its allocated TPDNO cap.

The proposed Storm Bay developments are located in exposed waters and it is unlikely that the environmental effects from dissolved emissions would impact upon reef communities or sensitive habitats within Storm Bay. Modelled simulations describing the combined dispersions of farm derived soluble emissions for the proposed developments also suggest that the receiving environment is highly dispersive and although soluble emissions are shown to be wide-spread they are in low concentrations. The studies listed in Table 28 describe the extent of environmental impacts anticipated from soluble emissions. While these impacts are shown to be restricted to a scale of hundreds of metres, they are not anticipated to result in significant or broadscale effects to the water quality characteristics or ecosystem structure and function within Storm Bay or nearby reef communities.

The modelled simulations of cumulative feed inputs will be complemented by near-field and broadscale environmental monitoring of pelagic, benthic and reef communities to validate the expected ecological response and changes in nutrient concentrations over and above current background levels.

The high energy environment in Storm Bay (current flows and wind), combined with a naturally high dissolved oxygen (DO) concentration of the marine waters means that the environmental risks associated with the proposed West of Wedge development are considerably reduced compared to

other farming areas where the natural environmental conditions are known to take longer to assimilate emissions (i.e. Macquarie Harbour). Nevertheless, Tassal will take a cautious approach to production within Storm Bay to enable an assessment of how the environment responds to the impacts of fish farming at a more conservative level of farming.

With the implementation of an appropriate monitoring and management framework to mitigate against the known potential environmental effects of finfish aquaculture, it is considered that the proposed development would not result in any significant environmental impacts to the waters of Storm Bay within the immediate vicinity of Tassal's proposed zone and surrounding waters. A more complete description of environmental monitoring requirements is included in Appendix 20.

6.1.2 Substrates and Fauna

6.1.2.1 Recognised effects of farming emissions on substrates and benthic fauna

Finfish farms are invariably located over soft unvegetated sediments, hence the environmental effects to the seabed are generally observed as physico-chemical or ecological changes from feed and faecal deposition. There is a recognised gradient of impact on the seabed that decreases with increasing distance from farm locations (Forrest et al. 2007, Keeley 2013).

Many studies have been conducted on the impact of marine farming to the benthic environment around fish farms with known effects reasonably well established and understood (Black et al. 1997, Hargrave et al. 1997, Crawford et al. 2002, Macleod et al. 2002, Kalantzi and Karakassis 2006, Forrest et al. 2007). The degree of impact to sediments at a particular site is influenced largely by the rate of water exchange, water depth, sediment characteristics, feed management systems, the physical characteristics of feed (e.g. settlement rate), pen size and pen separation distance (Holmer 1991, Price and Morris 2013).

Recent assessments associated with the potential impacts of marine aquaculture have also identified benthic organic enrichment and sediment chemistry change as the primary environmental impacts of marine aquaculture around the world (Price and Morris, 2013). This aligns with previous literature and assessments conducted over several decades in this field.

Modern aquaculture facilities and best practice principles recognise the importance of locating marine farms in areas where there is sufficient water depth and current flow. These key factors are widely recognised as instrumental in the minimisation of waste accumulation. Although the environmental effects are most evident directly beneath the cages, the magnitude and spatial extent of these effects are highly site specific with high current flow, deep sites producing a larger but more diffuse zone of effect (Forrest 2007, Keeley 2013). Without adequate flushing and water movement at a site, wastes can accumulate at rates beyond the assimilative capacity of the sediments in and around a marine farming operation (Price and Morris, 2013).

Visible impacts of solid waste deposition tend to be confined to directly under stocked pens, evident as distinct "footprint" zones (Crawford et al. 2001). Benthic monitoring and research conducted at various sites throughout Tasmania have shown that physico-chemical and biological impacts extend beyond this footprint zone, but are generally not discernible more than 35 m from the edge of the pen (Woodward et al. 1992, Macleod et al. 2002). Physical disturbances of substrates from mooring systems also occur within farm lease and zone areas however, these impacts are localised and restricted to sediments directly beneath fixed mooring positions.

Impacts from solid waste follow the patterns of impact described for other organic pollutant sources (Pearson and Rosenberg 1978), but on a reduced spatial scale. Recorded effects include marked changes in benthic faunal and meiofaunal assemblages in terms of species number, diversity, abundance and biomass, hypoxia in the water overlying the sediment, increased sulphate reduction and the build-up and release of methane and hydrogen sulphide gas (Duplisea and Hargrave 1996, Crawford et al. 2002, Macleod et al. 2002).

Fish farms release particulate organic matter from two main sources, uneaten feed and faecal material. Salmon farming is known to cause localised benthic impacts. Faecal matter is the largest contributor of solid waste (15% dry matter basis) (Buschmann et al. 2007). While the majority of feed input used to culture marine finfish species is ingested and metabolised, a small percentage of this feed is uneaten and is deposited in particulate form on sediments under stocked pens (NPI 2001). Effects on the substrate and benthic community assemblages have been well studied and the results confirm the successional community patterns associated with organic enrichment gradients (Black et al. 2008).

From a Tasmanian context, impacts from organic enrichment of sediments manifest in a variety of forms (biological and chemical), and the level of impact can be categorised using a range of assessment techniques, including:

- key faunal indicators (species, abundance and biodiversity)
- visual assessment using underwater video
- sediment chemistry – determinations of sulphide concentration and redox potential

The methods for determining the level of impact in Tasmanian conditions are comprehensively described in Macleod and Forbes (2004) and are widely used both by industry and regulatory authorities to manage impacts from salmon farming and to assess sediment recovery characteristics for individual lease areas in Tasmania.

Studies by Edgar et al. (2009) described effects of salmonid aquaculture in Tasmanian waters on benthic infaunal communities and sediment properties near actively farmed leases. The study utilised two forms of sediment monitoring data collected by the Tasmanian salmonid industry, namely physico-chemical and benthic infauna between 1997 and 2003. Effects detected by the study on sediments near farm leases included a decline in redox potential of sediments, an increased faunal dominance pattern and an increased proportional abundance of capitellid worms, indicative of organic enrichment within sediments. Benthic impacts are reversible and an impacted site can recover to background conditions. However, the time taken for this recovery is dependent on a range of factors including previous stocking practices, husbandry techniques and environmental conditions in the region (Black 2001, Gowen and Rosenthal 1993, Wu 1995, British Columbia Environmental Assessment Office 1997, Black 2001, Forrest 2007, Keeley 2013), and abiotic and biotic factors (Lumb 1989, Chang and Thonney 1992, Lam et al. 1994). It is widely accepted that the variation in observed benthic recovery is dependent on the physical, chemical and biological characteristics of the system together with the duration and intensity of past production at a site and the level of impact at the time that site is fallowed (Gowen and Rosenthal 1993, Wu 1995, British Columbia Environmental Assessment Office 1997, Black 2001).

6.1.2.2 Expected levels of farming emissions

6.1.2.2.1 *Fish faeces and feed*

Initial Staged Approach

Under Tassal's conservative staged entry approach and proposed industry-wide cap on production set at 30,000 tonnes per year in Storm Bay, Table 29 represents the levels of feed input and solid nitrogen emissions that would apply in the first three years.

Table 29 Feed input and solid nitrogen emission (t) levels applicable for the first three years of production in Storm Bay.

Year	Feed input (t)	Solid nitrogen emissions (t)
1	3530	26
2	7051	53
3	9409	71

The initial staged production at the proposed West of Wedge development and associated feed input represents a conservative approach to production management within Storm Bay. Figure 6.7 shows the solid nitrogen emissions for each of the first three years of staged entry. These emissions range from 26 t/yr to 71 t/yr and similarly represent an adaptive management approach as the environmental effects from finfish farming are better understood from environmental monitoring (water quality, sediments and reef communities) at the fine, intermediate and broadscale levels within Storm Bay.

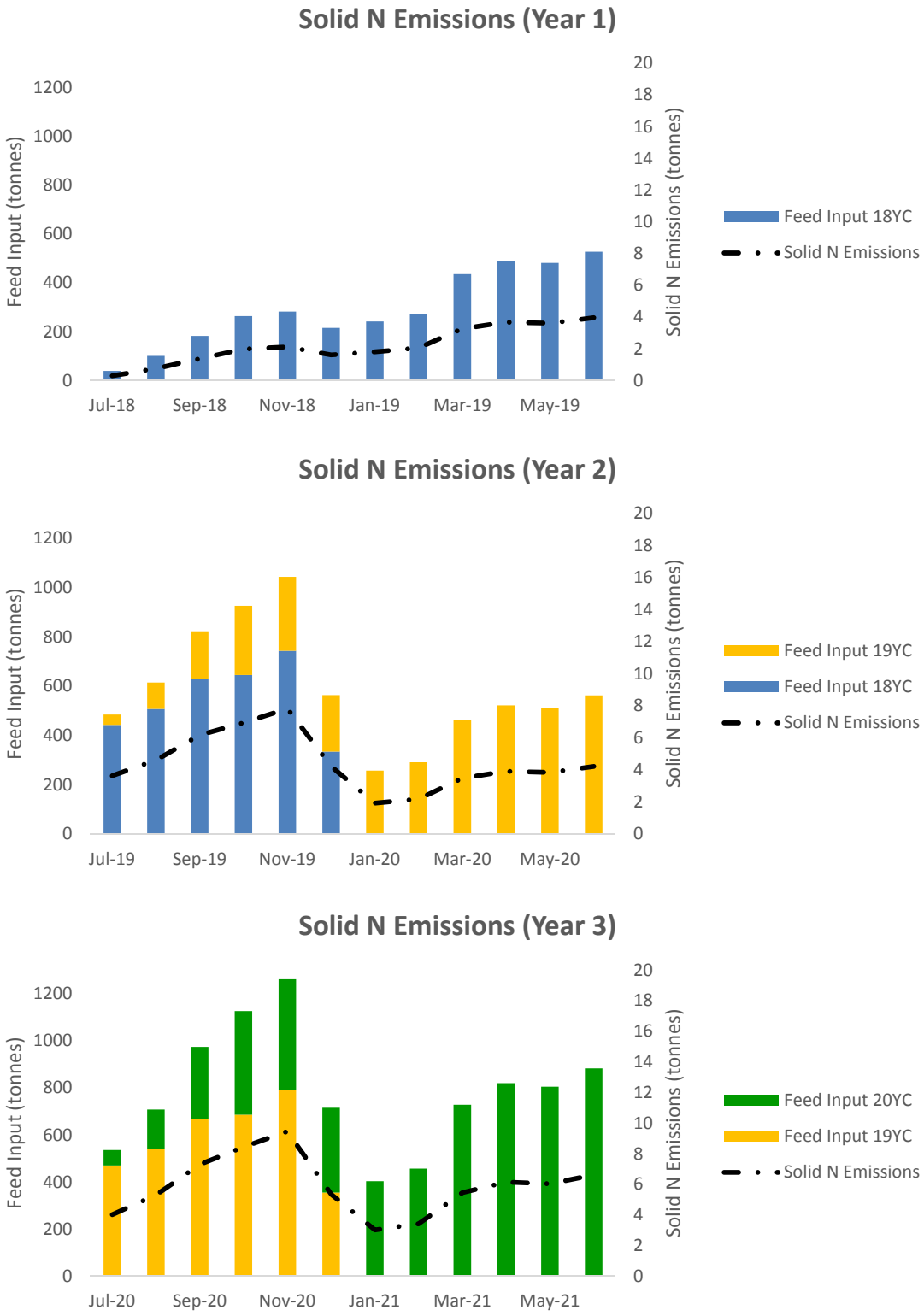


Figure 6.7 Solid nitrogen emissions for first three years of staged production for smolt inputs

Proposed maximum production

For the purpose of this EIS, Tassal considers that the proposed West of Wedge development could potentially stock 1.8 million fish per year. However, this level of input would only eventuate with regulatory approval following an assessment of Tassal's proposed initial staged entry approach. Any increase from this initial cap in production would also need to be supported by the results of the environmental monitoring program and biogeochemical modelling studies.

The feed input to the proposed West of Wedge development, at a maximum capacity of 1.8 million smolt input per year, is expected to be 11,700 t/yr. This represents 585 t of nitrogen emissions released into the receiving environment annually, of which, 87.7 t is released as solid particulate nitrogen emissions from fish faeces and uneaten feed.

Annual emissions have been calculated to include the overlap of production cycles when two separate year classes are being accommodated within the proposed West of Wedge development zone. Figure 6.8 shows the monthly feed input (columns) where two colours (blue and gold) represent the feed input to each of the year classes. Both year classes will only be held simultaneously within the zone for six months in any 12 month period. The total monthly solid particulate nitrogen emissions are shown by the black continuous line.

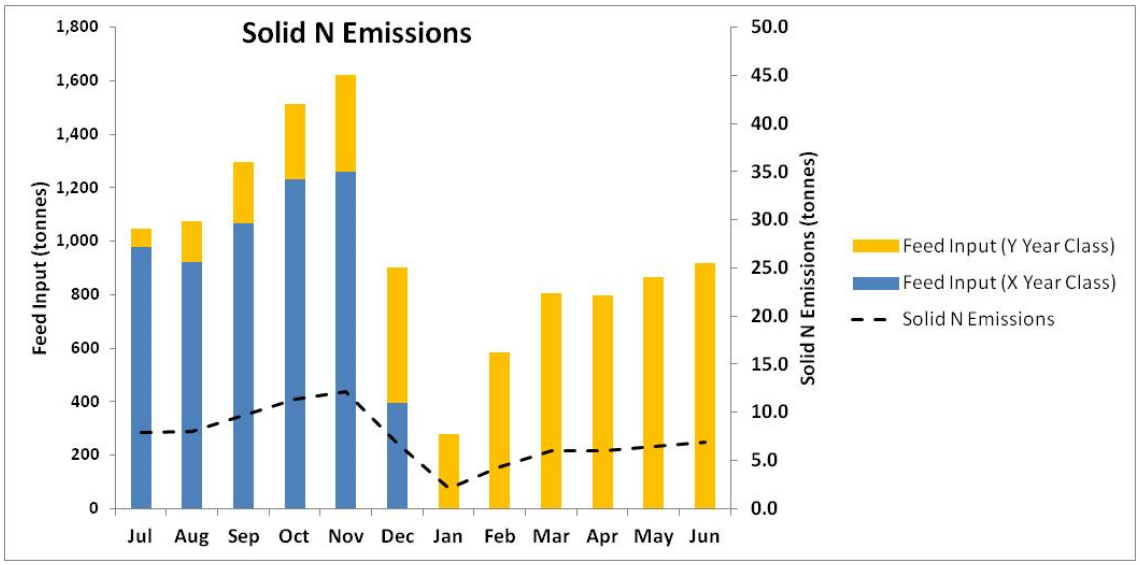


Figure 6.8 Total feed input (shown as columns) for a production cycle at the proposed West of Wedge site: note that feed input includes year class overlap. Solid nitrogenous emissions relative to feed input is shown as the solid line.

Table 30 shows the solid waste components associated with uneaten feed pellets (including fines) and faecal material derived from the proposed annual feed input. Uneaten feed represents approximately 1.5% of total feed input (see A in Table 30). Of this amount, approximately 15% by weight is released as solid particulate inorganic nitrogen to the surrounding environment (see B in Table 30) (Arzul et al. 2002).

The largest contributor to solid waste generation from farmed salmon is faecal material, and the amount and composition of this waste component is determined by the indigestible components of the feed diet. For typical Atlantic salmon feed used during grow-out, approximately 15% of the

consumed amount becomes faecal matter (see C in Table 30), and of this amount, only a small fraction (0.6%) is included as a form of nitrogen (see D in Table 30) (Buschmann et al. 2007).

Table 30 Solid feed waste components (faeces and uneaten feed)

Feed Management (Annual)	Total Feed Input (t)	Total Uneaten Feed (t)	Total Uneaten Feed (N) (t)	Total Faecal Component (t)	Total Faecal Component (N) (t)
Proposed feed input (combined year class stocking)	**11,700**	**175.5[A]**	**26.3[B]**	**1,755[C]**	**10.5[D]**

6.1.2.2.2 *Solid effluent stream from in-situ net cleaning*

The deployment of stocked cages at the proposed West of Wedge development would require in-situ net cleaning. Current projections regarding a revised net cleaning approach suggest that each cage requires in-situ net cleaning approximately 10 times per year. This means that the expected solid emissions (based on predicted and modelled outputs from research) from net cleaning activities at the proposed West of Wedge development would be approximately 68 t/yr (2.2 t/yr N). These calculations are based on the maximum weight of material removed as net cleaning effluent determined by CFOC (2012).

Based on biomass splits that would occur as previously described, the four leases will not be fully stocked at 64 cages all year round. This is a worst case scenario and the actual volume is likely to be considerably less with newly adapted high frequency - low volume net cleaning regimes. However, pens will also be fitted with the new K-Grid net technology; a netting material that has been shown to be less attractive to biofouling organisms than other net types (such as the monofilament nets used in the research project). In addition, the use of high pressure water jet technology is now able to more effectively remove biofouling organisms in the early life history stages of development and attachment. This modern technology is favoured over traditional vacuum methods as it is better able to remove fouling organisms prior to extensive colonisation. This is also an important strategy in relation to fish health management and improved survivorship.

Tassal conducted net wash capture trials through a locally manufactured filtration device currently used internationally. This was found to be successful if nets were heavily fouled and the vacuuming component was relied upon. With modern high frequency - low volume cleaning methods adopted, the use of filtration is deemed ineffective and unnecessary. The vacuuming method is successfully implemented around the world in areas where antifoulant treated nets are used. The success of this alternative method is mainly due to longer periods between cleaning events, different compositions of attachment organisms and higher volumes of biofouling present at the time of cleaning.

6.1.2.3 Evaluation of potential effects

The proposed West of Wedge development involves the establishment of four new marine farming leases accommodating 16 pen bays per lease. This site will be maintained as a production site, where fish will be grown to harvest size.

According to Cromey et al. (2002), observable macrofaunal community responses to marine farming emissions occurred at carbon deposition rates of approximately 3.3 gC/m^2/day. Sowles et al. (1994) considered a rate of 2.5 gC/m^2/day as an acceptable level of benthic enrichment. Other studies such as, Hargrave (1994) and Gillibrand et al. (2002) concluded that long term benthic loading of <2 gC/m^2/day may have little impact on benthic conditions. For the purpose of this EIS, a conservative value of 2 gC/m^2/day was applied as a threshold level to assess the area potentially impacted by faeces and uneaten feed deposition.

The software package DEPOMOD v2.4.1 was used in this instance to model the benthic footprint from faeces deposition and feed wastage. The DEPOMOD platform has a modular design with three major components, a grid generation module, particle trajectory model and a resuspension model. The three modules work together to integrate empirical field data to produce a series of spatially referenced model outputs. For more information on the DEPOMOD platform refer to Appendix 16.

The DEPOMOD modelling for the proposed West of Wedge development was undertaken on the basis of maximum feed input, however it is expected that actual volumes of feed will be more conservative. The following assumptions were also used as input into the model, these are:

- <1.5% feed waste
- 79% digestibility rate
- 20% carbon content of faeces

The complete sequence of modelled benthic effects over the course of one full production cycle (18 months) is included in Appendix 16. This includes the introduction of stock to lease area 1 in the month of July and subsequent splitting and transfer to lease area 2 after 6 months of grow-out. Fish within both lease areas (1 & 2) are then grown to harvest size over the following 12 months to complete the production cycle. The depositional pattern described above is replicated for each subsequent year class, noting that there is a six month fallow period between the introduction of year classes. As stocking occurs on an annual basis, there is a consistent overlap and rotation between stocking regimes across the four lease areas. Refer to Figure 6.1 for a summary of the planned stocking regime at the proposed zone.

The average daily output gC/m^2/day over a 542 day production cycle for one lease area at the proposed West of Wedge development is shown in Figure 6.9. This figure represents the maximum depositional footprint expected within each of the four lease areas and shows the extent of emissions from the proposed feed input. Whilst the DEPOMOD output shows that areas directly beneath the cages are subject to emissions >2 gC/m^2/day, the gradient of impact beyond the cage edge represents sediments which would not be considered to be significantly degraded (i.e. <2 gC/m^2/day) (Gillibrand, et al. 2002).

It is likely that the effects of particulate nitrogen emissions could lead to short term changes in sediment condition within and around lease areas resulting in impacts such as changed infaunal assemblages, increased nutrient loading and enrichment of sediments. The proposed West of Wedge development is situated in an offshore exposed location where the water is deeper than other sites where Tassal typically farm. Sediment accumulation beneath cages is reduced at sites where current velocity is high (such as West of Wedge) and the balance between natural flocculation of particulates and depositional equilibrium is more likely to be maintained (Milligan and Law 2005). Therefore, it is considered that additional organic loading would not lead to irreversible changes to the substrates and fauna but would only result in minor adverse impacts to the receiving environment within the lease area. Regular fallowing and rotational stocking management will also assist in sediment remediation.

Macleod et al. (2014) studied the long term environmental impacts to sediment biology and chemistry at a salmon finfish farm located in North West Bay, Tasmania, 10 years after it was vacated. Whilst there were some minor differences in parameters between this vacated farm site and other sites not subject to the effects of finfish farming, there were no obvious signs that marine farming activities (prior to the 10 year recovery period) had a permanent effect on the ecology or sediment chemistry within the lease.

The proposed West of Wedge development is situated in an offshore location in exposed, deeper water than typically farmed at traditional sites within south east Tasmania. Sediment accumulation beneath cages is reduced at sites where current velocity is high (such as West of Wedge), and where benthic faunal assemblages can more effectively assimilate particulate emissions and nutrient loads than in shallower, more sheltered bays.

Overall, it is considered that the proposed West of Wedge development would not result in any significant environmental impact to the broader ecosystem of Storm Bay.

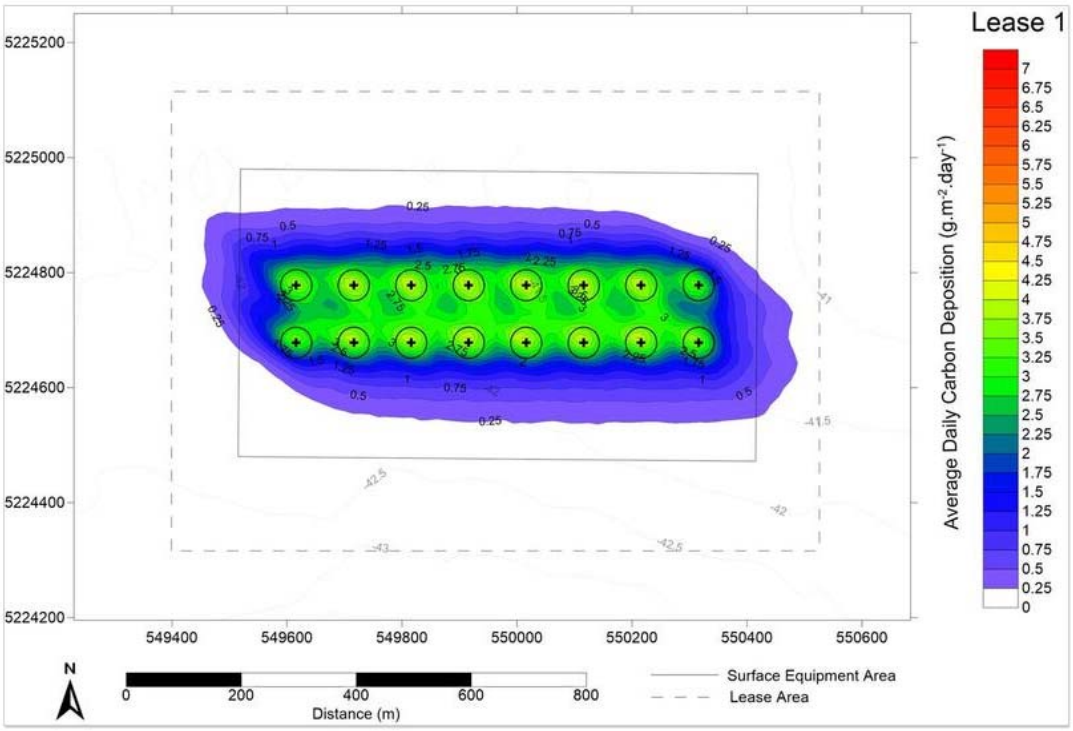


Figure 6.9 Average daily carbon depositional footprint for one of the proposed West of Wedge leases

6.1.2.4 Other effects of farming operations

6.1.2.4.1 *Physical/structural disturbance of substrates and fauna*

As this is a new marine farming development, there is currently no mooring infrastructure housed at the proposed West of Wedge site.

The proposed 16 pen bay grid mooring systems at each of the four leases will require 72 x 5 ton blocks. These blocks will be doubled up on each mooring line and joined by taut chain. On the back of each of these doubled up blocks there will be a 1.5 t anchor which will prevent any movement once fixed in position. This will mean there will be a total of 36 x 1.5 ton anchors on each of the four mooring grids. Appendix 12 shows the proposed layout of each of these leases and mooring systems in relation to the zone boundaries.

6.1.2.5 Mitigation Measures

The range of mitigation measures to ensure that impacts to the substrate are maintained at acceptable levels includes:

- compliance with Schedule 3V of the Licence Conditions (Salmonid finfish annual video surveys – see Appendix 13)
- in-situ net cleaning is carried out in line with Net Cleaning Best Practice Guidelines (see Appendix 5)
- internal feed management practices to minimise feed wastage
- depositional modelling to be used as a management tool for impacts to sediments
- fallowing principles (see section 6.1.2.5.3)
- specific regulatory management controls (see section 6.1.2.5.4)

6.1.2.5.1 *Fish feeding regimes/feed wastage minimisation*

Feed control is constantly being improved by Tassal and remains a focus for the company. The use of strict feeding regimes and conversion targets are critical for production and environmental performance, and the minimisation of feed wastage. Surface and underwater cameras are used to monitor feeding rates at all marine farming leases. This form of visual monitoring assists with minimising feed wastage and unnecessary organic loads to the substrates. Pellet catching devices are also periodically used to assess effectiveness of camera depth and angle. Routine ROV surveys can also detect the presence of feed wastage. In addition, divers report the presence of any uneaten feed within and underneath cages. Tassal's feed management performance and its effect on the environment are also subject to third party audit through ASC certification.

Routine ROV inspections beneath cages, within leases and around lease boundaries are an important monitoring tool for determining environmental impacts and depositional patterns on the substrate. This visual data along with feed, stocking and net wash data are all used in combination to manage the fallowing and stocking rotations at all of Tassal's farming sites. This reporting requirement is outlined in Schedule 3V (see Appendix 13).

6.1.2.5.2 *In situ net cleaning protocols*

Refer to section 6.1.1.4.2.

6.1.2.5.3 *Fallowing capacity and management given increase in fish numbers*

The proposed West of Wedge development will be used as a production site where smolt will be introduced to the leases and grown out to harvest size.

Fallowing of pen bay positions is undertaken regularly to allow sediments to recover and for the level of organic enrichment caused by farming (i.e. faeces and net washing) to be metabolised by natural benthic processes. At the proposed West of Wedge site fallowing of leases will be a minimum of 6 - 12 months after each production cycle. Tassal conducts internal ROV surveys and continues to update depositional modelling to determine optimal fallowing regimes and to adjust stocking schedules based on the environmental characteristics and recovery capacity of individual farm sites.

Excess build-up of farm detritus beneath leases has the potential to affect not only benthic and environmental health, but also fish health and farm performance. This is one of the major factors driving Tassal to manage benthic impacts responsibly and sustainably for the long term. Tassal manages farm sites on an individual basis to maintain the best conditions possible within its lease areas, understanding that previous stocking levels and site characteristics (such as depth and current flow) also affects the ability of sediments to recover from the impacts of farming.

6.1.2.5.4 *Statutory Environmental Monitoring and Management Program*

Refer to section 6.1.1.4.2 for details of the proposed program.

6.1.2.5.5 *Regulatory Controls*

Management Controls contained within the Tasman Peninsula and Norfolk Bay MFDP area include requirements for monitoring and reporting of environmental aspects. Management Controls include:

- **Management Control 3.1.1** There must be no significant visual, physio-chemical or biological impacts at or extending 35 metres from the boundary of the lease area, as specified in the relevant marine farming licence.
- **Management Control 3.1.2** Environmental parameters must be monitored in the lease area, 35 metres outside the boundary of the marine farming lease area and at any control site(s) in accordance with the requirements specified in the relevant marine farming licence.
- **Management Control 3.2.1** The Secretary may, from time to time, determine the total permissible dissolved nitrogen output, within specified periods, attributable to marine farming operations within a specified area covered by this Plan.
- **Management Control 3.2.2** A specified area may constitute:
    - An area or multiple areas covered by this plan, or
    - All the area covered by this plan
- **Management Control 3.2.3** For the purpose of assessing quantities of dissolved nitrogen output attributable to licensed finfish marine farming operations, the Director may use any method that the Director is satisfied delivers a proper measure of total dissolved nitrogen output from finfish marine farming operations.

- **Management Control 3.2.4** On making a determination under 3.2.1, the Director is to apportion the TPDNO, or a portion of the TPDNO, between the leaseholders licensed for finfish marine farming operations within that specified area or if a lease is sub-leased, any sub-lease holders within the specified area.

- **Management Control 3.2.3** If the Secretary makes a determination under clause 3.2.1, the Secretary is to apportion the total permissible dissolved nitrogen output between those lessees within the specified area.

- **Management Control 3.2.4** The Secretary is to give notice in writing to lessees within the area specified in 3.2.1 of any determination the Secretary makes under 3.2.1 and 3.2.3.

- **Management Control 3.2.5** Lessees must comply with any written notice given by the Secretary under 3.2.4.

- **Management Control 3.3.1** The maximum permissible stocking density of salmonid fish is 15 kg/m3 of caged volume unless otherwise specified in the marine farming licence.

- **Management Control 3.3.2** Maximum permissible stocking densities for other finfish species may be specified in licence conditions.

- **Management Control 3.3.3** Lessees must ensure that farmed areas are fallowed as soon as practicable if bubbles of hydrogen sulphide and/or methane gasses form in the sediment and rise to the surface without physical disturbance of the seabed.

- **Management Control 3.3.4** Stocked finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.

- **Management Control 3.4.2** Lessees must keep the following records for each lease area held by the lessee and retain these records for a period of 5 years;

    - **Management Control 3.4.2.1** Stock biomass within the lease area on a monthly basis.

    - **Management Control 3.4.2.2** The type, origin and dry weight of food placed into the lease area on a monthly basis.

    - **Management Control 3.4.2.3** The names and quantities and date of use, of all chemicals which have been used on the lease area. This must include, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

    - **Management Control 3.4.2.4** Location (to a degree of precision to the satisfaction of the Secretary), size and stocking rates of all cages.

    - **Management Control 3.4.2.5** The duration that individual cages are held in a particular location.

- **Management Control 3.4.5** Environmental data is to be collected at each finfish lease area and analysed to specific standards and in accordance with the requirements for collection, reporting and analysis as specified in the relevant marine farming licence.

Further, marine farming licence conditions specify the specific requirements for monitoring and reporting (see Appendix 13).

6.1.2.6 Overall effect following implementation of mitigation measures

Tassal's initial staged approach to production will enable a more comprehensive understanding of how sediment chemistry and biology is impacted by emissions from finfish farming at initial conservative levels. The proposed environmental monitoring program and modelling studies will be used to evaluate these impacts and inform adaptive management strategies and appropriate stocking levels.

Tassal undertakes annual video surveys of the benthic environment within and outside of all marine farming leases. As part of regulatory licence conditions, there must be no significant visual, physico-chemical or biological impacts at or extending beyond 35 m from the boundary of the lease area. Internal visual assessments are routinely undertaken to assess sediment condition and to determine optimal stocking and fallowing strategies specific to the farming zone.

The accumulation of the solid waste component from the proposed operation will be restricted to within the lease area and will be adequately assimilated by natural processes within the sediment and through established rotational stocking and fallowing regimes. Water depth, sediment characteristics and site exposure all play a role in the rates of degradation and recovery of oceanic based farming sites. This understanding coupled with the use of video survey work and depositional modelling will enable Tassal to continue to better understand the extent of its environmental impacts and improve farm management in line with modern farming practices.

The impact of this feed input will result in localised, reversible impacts to sediment condition beneath the cages and within lease areas. These impacts are not anticipated to result in unacceptable or adverse effects to the broader ecosystem and will continue to be managed through the regulatory management controls listed above in section 6.1.2.5.4.

6.1.3 Marine Vegetation

6.1.3.1 Recognised effects of farming emissions on marine vegetation

Marine farming operations have the potential to impact on marine vegetation if those operations are sited over or adjacent to marine flora.

Physical damage may be caused by the placement of marine farming structures directly on top of vegetation. Such structures could include moorings.

Shading from marine farming structures may reduce light to an extent where the growth or survival of marine vegetation is impacted. Deposition of fish feed and excretory products are also known to effect macroalgal growth.

In marine coastal waters, the two most important elements promoting algal growth are nitrogen and phosphorous in their dissolved forms, both of which are released into the receiving environment from

feed inputs to salmon farms, however it is assumed that nitrogen is more likely to be limiting for growth in marine conditions than phosphorous (Sanderson et al. 2008, Mente et al. 2006).

Overall, approximately 5% of the total feed input is released into the environment as a form of nitrogen, of which 85% is released as dissolved nitrogen, and 15% in its particulate form (Ross and Macleod 2013). Most of the dissolved nitrogen is excreted by fish as ammonium, which is a preferred source of nitrogen for phytoplankton and other marine plant species.

Nutrient loading may increase the abundance of algal epiphytes which has the potential to smother marine vegetation. In 2009, a UTAS honours project used macroalgae as a bioindicator of nutrient level changes in southern Tasmanian waters to determine whether aquaculture leases are impacting on nutrient levels in adjacent waters (Oh 2009). This study found that aquaculture farms could potentially have some impact on macroalgal assemblages up to several hundred metres away.

In 2015, a study was undertaken to examine the potential effects of salmon farming on rocky reef communities. FRDC Project 2014/042 'Understanding broad scale impacts of salmonid farming on rocky reef communities' included two main components:

- analyses of subtidal macroalgal community survey data (1992-2015) at the Ninepin Point, Tinderbox and Maria Island Marine Protected Areas and;

- characterisation of macroalgal community assemblages through the establishment of 26 monitoring sites from Maria Island to Actaeon Island in south east Tasmania.

Results from this study showed that there was no consistent directional pattern of change in macroalgal community assemblages over time – or any indication that salmon farms were having a direct impact to ecosystem structure or function. The study also showed no evidence of reduced ealth of macroalgal communities across sampling sites. It is likely that differences in community assemblages encountered across sampling sites could be broadly linked to wave exposure and the generalised scheme of Tasmanian algal assemblages devised by Edgar (1984).

Additional research in this area is currently being undertaken by IMAS (FRDC Project 2015/024) to determine the specific environmental conditions that might adversely impact macroalgal reef systems, including potential broadscale effects from soluble nutrient emissions on the structure and function of natural marine macroalgal assemblages.

The impact from soluble nutrient emissions on macroalgal assemblages from marine farming is not restricted to negative impacts alone; there are known instances where increased macroalgal growth can occur as a result of increased nutrient supply from point source nutrient additions. For instance, Giant Kelp Marine Forests of South East Australia (Giant Kelp) has been shown to respond favourably to the supply of nutrients from sewage outfalls and other nutrient sources (Edyvane 2003, Parsons 2012).

Whilst there are conflicting reports in the global scientific literature as to whether nutrients from salmon farming adversely affect macroalgal communities, studies undertaken locally suggest that the complex nature of the structure and function of macroalgal assemblages makes it difficult to discern any direct influence of aquaculture.

6.1.3.2 Expected levels of farming emissions

6.1.3.2.1 *Soluble nutrient emissions from stock/feed/faeces*

For this first three years of Tassal's staged entry approach to the proposed West of Wedge development feed input levels will commence at 3530 t in Year 1 increasing to 9409 t in Year 3. The soluble nitrogen emissions associated with these levels of feed input range from 150 to 400 t respectively. These levels are consistent with an initial proposed industry-wide cap of 30,000 t/yr production in Storm Bay.

For the purpose of this EIS, Tassal considers that the proposed West of Wedge development could potentially stock 1.8 million fish per year. However, this level of input would only eventuate with regulatory approval following an assessment of Tassal's proposed initial staged entry approach. Any increase from this initial cap in production would also need to be supported by the results of the environmental monitoring program and biogeochemical modelling studies.

At this potential maximum capacity, the feed input to the proposed West of Wedge development is expected to be 11,700 t/yr. This represents 585 t of nitrogen emissions released into the receiving environment annually, of which 497.2 t is released annually as soluble nitrogen emissions, predominantly as ammonium excreted by farmed fish.

6.1.3.3 Soluble effluent stream from in-situ net cleaning

See section 6.1.1.2.3.

6.1.3.4 Evaluation of potential effects

Modelled simulations describing the dispersion of farm-derived dissolved nutrients from the proposed West of Wedge development show that low concentrations of nutrients are dispersed along the southwestern coastline of the Tasman Peninsula. These concentrations are at levels which are <1% of total farm inputs and are not expected to adversely affect marine vegetation communities along this coast.

For more information refer to section 6.1.1.3.

6.1.3.5 Mitigation measures

There is an increasing interest in developing a monitoring program in Tasmania to assess macroalgal biodiversity and examine how patterns of distribution and community structure are affected at the broadscale level by external nutrient influences, both natural and anthropogenic. Industry based research studies to assess potential nutrient response criteria for sub-tidal and intertidal macroalgal assemblages south east Tasmania will be undertaken to monitor changes to these communities and determine potential sources of impacts. More detail regarding potential monitoring approaches is included in Appendix 20.

6.1.3.5.1 *Monitoring and management response*

Through FRDC Project 2014/042 '*Understanding broad scale impacts of salmonid farming on rocky reef communities*', 26 broadscale ecological monitoring sites have been established between Maria Island

and Actaeon Island in south east Tasmania. Of these, five subtidal monitoring sites (GK 1-5 in Figure 6.10) are located in close proximity to the proposed West of Wedge development and would be re-surveyed at regular intervals (i.e. biannually) to measure any changes to macroalgal community assemblages relative to the ecological baseline established in 2015 (Valentine, et al. 2016). The full range of proposed macroalgal monitoring stations within Storm Bay is included in Appendix 20.

A mandatory macroalgal and water quality monitoring program will be developed using information from the IMAS modelled outputs of soluble nutrient dispersions to identify those areas most likely to be affected by impacts.

Figure 6.10 Eastern Storm Bay – Tassal monitoring locations for water quality (WQ Sites 1-4), giant kelp (GK 1-5) and the IMAS Storm Bay monitoring station (IMAS WQ Site 5). The proposed West of Wedge development is enclosed by the yellow border.

6.1.3.5.2 *In-situ net cleaning protocols*

See section 6.1.1.4.4.

6.1.3.6 Statutory Environmental Monitoring and Management Program

Refer to section 6.1.1.4.2 for details of the proposed program.

6.1.3.7 Overall effect following implementation of mitigation measures

As the proposed West of Wedge development represents the establishment of a new marine farming zone, emissions are likely to impact upon the marine environment in the immediate vicinity of the new zone. However, as the nearest macroalgal assemblages adjacent to the West of Wedge development are located approximately 1.6 km from the lease boundaries, the potential for adverse environmental effects from the proposed development is considered to be low based on modelled outputs which suggest that the receiving environment is highly dispersive in nature. The results of the environmental monitoring program during the initial staged entry approach, including assessment of macroalgal

assemblages along rocky reefs, will be used to assess the level of potential impact prior to any consideration of future increased stocking levels.

Overall, it is considered that there is a low risk that the proposed development will result in any significant environmental effects on marine vegetation communities within the Storm Bay/West of Wedge Island area, particularly macroalgal communities along the fringing reefs to the east of the proposed West of Wedge development.

6.1.4 Birds

6.1.4.1 Migratory bird species listed under international agreements (e.g. JAMBA/CAMBA/ROKAMBA)

There are a number of migratory birds that occur within Tasmania during the year that are listed under international bilateral agreements (e.g. Japan-Australia Migratory Bird Agreement - JAMBA, China-Australia Migratory Bird Agreement -CAMBA, and Republic of Korea-Australia Migratory Bird Agreement - ROKAMBA). Being the most southerly point of the East Asian-Australasian Flyway, Tasmania is an important destination for many migratory species from the Northern Hemisphere that spend the summer months in the Southern Hemisphere (see Table 31).

Table 31 Birds protected under bilateral agreements (JAMBA, CAMBA and ROKAMBA) through the EPBC Act

Scientific Name	Common Name	CAMBA	JAMBA	ROKAMBA
Diomedea exulans	Wandering Albatross		X	
Oceanites oceanicus	Wilson's Storm Petrel		X	
Puffinus carneipes	Fleshy-footed Shearwater		X	X
Puffinus griseus	Sooty Shearwater	X	X	
Puffinus tenuirostris	Short-tailed Shearwater		X	X
Stercorarius parasiticus	Arctic Jaeger		X	X
Sterna albifrons sinensis	Little Tern	X	X	X
Sterna caspia	Caspian Tern	X	X	
Actitis hypoleucos	Common Sandpiper	X	X	X
Arenaria interpres	Ruddy Turnstone	X	X	X
Calidris acuminata	Sharp-tailed Sandpiper	X	X	X
Calidris alba	Sanderling	X	X	X
Calidris canutus	Red Knot	X	X	X
Calidris ferruginea	Curlew Sandpiper	X	X	X
Calidris melanotos	Pectoral Sandpiper		X	X
Calidris minuta	Little Stint			X
Calidris ruficollis	Red-necked Stint	X	X	X

Calidris tenuirostris	Great Knot	X	X	X
Charadrius leschenaultii	Greater Sand Plover	X	X	X
Charadrius mongolus	Lesser Sand Plover, or Mongolian Plover	X	X	X
Charadrius veredus	Oriental Plover, or Oriental Dotterel		X	X
Gallinago hardwickii	Latham's Snipe	X	X	X
Gallinago megala	Swinhoe's Snipe	X	X	X
Gallinago stenura	Pin-tailed Snipe	X	X	X
Heteroscelus brevipes	Grey-tailed Tattler	X	X	X
Limnodromus semipalmatus	Asian Dowitcher	X	X	X
Limosa lapponica	Bar-tailed Godwit	X	X	X
Limosa limosa	Black-tailed Godwit	X	X	X
Numenius madagascariensis	Eastern Curlew	X	X	X
Numenius minutus	Little Curlew, or Little Whimbrel	X	X	X
Numenius phaeopus	Whimbrel	X	X	X
Pluvialis dominica	Lesser Golden Plover	X	X	
Pluvialis fulva	Pacific Golden Plover	X	X	X
Pluvialis squatarola	Grey Plover	X	X	X
Tringa nebularia	Common Greenshank	X	X	X
Tringa stagnatilis	Marsh Sandpiper, or Little Greenshank	X	X	X
Xenus cinereus	Terek Sandpiper	X	X	X
Ardea ibis	Cattle Egret	X	X	
Haliaeetus leucogaster	White-bellied Sea-Eagle	X		
Hirundapus caudacutus	White-throated Needletail	X	X	X
Ardea alba	Great Egret	X	X	

6.1.4.2 Roosting, nesting and feeding sites

Tasmania's coastal fauna support significant populations of birds that are dependent on the beach and foreshore areas for breeding and the littoral zones, mudflats and estuaries for feeding and roosting. Although situated well offshore in exposed waters, the zone boundary for the proposed West of Wedge development lies approximately 1.8 km off Wedge Island, an important breeding and nesting site for the Little Penguin and Short-tailed Shearwater. The island is home to approximately 20,000-25,000 pairs of Short-tailed Shearwaters interspersed with approximately 150 pairs of Little Penguins,

particularly in the north and to the south east of the island (Brothers et al. 2001). Therefore, maintaining and protecting this sanctuary for bird life is considered to be a key initiative. Tassal will continue to work with Birdlife Tasmania and develop appropriate mitigation strategies to prevent unnecessary habitat degradation and reduce potential interactions between birds and the proposed development.

6.1.4.3 Potential Impacts

6.1.4.3.1 *Impacts on marine farms*

Predation by birds can be a significant problem for finfish culture, particularly when smolt are first introduced into the marine environment. Similar problems may also exist with the consumption of feed pellets by birds. If neither of these situations is managed effectively, the potential for an increased incidence of interactions with birds can impact upon farm operational practices and efficiencies.

6.1.4.3.2 *Impacts on birds*

Potential general impacts on birds from salmon farming activities comprise of:

- Habitat loss - marine farming activities and related debris may restrict access to inter-tidal feeding and shoreline habitat or feeding, roosting and nesting sites through a process of habitat alienation.

- Behavioural change - home ranges may alter with an increased reliance on marine farms for foraging activity.

- Entanglement and bird strike - birds may be killed or injured by entanglement in bird netting or through collisions with farm infrastructure.

Consultation with BirdLife Tasmania identified a number of specific potential impacts on birds within the Storm Bay region from the proposed West of Wedge development including the following:

- Birds such as cormorants, gulls, terns, penguins, eagles and oceanic birds (albatrosses, petrels, etc.) may view the proposed development as a potential food source, including opportunistic scavenging. It is expected that some bird species (gulls) would congregate at the farming site.

- The proposed zone may be seen as a convenient staging point for bush birds that fly across the Storm Bay region (including some woodland species) and they may become entangled in the equipment, nets, etc. Collisions with marine farm infrastructure are also identified as a potential threat.

- Nocturnal illumination may disorient birds, and particularly during twilight or low-light or low-visibility periods (i.e. fog and mists) resulting in birds striking equipment and infrastructure.

- Any increase in marine debris from fish farms on foreshores may potentially reduce available habitat and/or habitat quality to birds in these foreshore areas, reducing opportunities for nesting and/or feeding.

- Marine debris poses additional risks to birds from entanglement and ingestion, resulting in increased mortalities. BirdLife Tasmania has been working collaboratively with Tassal to advise

and assist in the coordination of regular clean-up activities by, and supporting/facilitating community groups who wish to remove debris from foreshore areas as a means of mitigating or removing the threat to birds posed by the presence of marine debris (see Figure 6.11).

6.1.4.4 Mitigation Measures

Tassal imposes upon all staff a range of stringent bird protocols to mitigate potential interactions with birds around its marine farms. These protocols provide guidance to Tassal's marine operations staff to assist with the passive exclusions of birds from sea cages, removal of trapped birds and reporting of any entanglements of birds in exclusion nets to the DPIPWE.

6.1.4.4.1 *Bird netting and other exclusion mechanisms*

The attraction of birds to marine farms can be decreased by removing opportunities for birds to scavenge around marine farms. To prevent bird predation on smaller farmed fish and the opportunity to scavenge feed pellets, Tassal currently deploys bird nets over all pens containing fish. Birds could potentially gain access to stocked fish and feed through holes in netting and in places where the netting has not been securely fastened to the cage handrail. Birds can become entangled in the netting whilst attempting to enter or exit the cage. Tassal has developed a detailed Wildlife Interaction Plan that includes bird management and exclusion mechanisms.

At the proposed West of Wedge development, Tassal will use black netting with a mesh size less than 115 mm covering each pen, fastened to the handrail and supported by buoyant 'mouse wheel' bird stand in the centre of the pen.

This netting configuration has proven to be very effective at excluding birds and other wildlife from stocked pens. Bird netting will continue to be routinely inspected by Tassal staff and repairs undertaken immediately upon identification of damage. This practice minimises the number of birds that are able to enter a cage and become entangled if trapped within the cage environment. Tassal is trialling company designed bird escape hatches installed at every farm site around the state. This equipment allows the safe passage (via a landing platform) of birds from within a salmon pen. These are particularly useful at high exposure sites where weather damaged bird nets may allow access through holes in nets.

6.1.4.4.2 *Protocols for managing bird entanglements*

Tassal has invested considerable cost and effort to reduce interactions with birds, and has developed a Code of Best Practice (COBP) for Bird Interactions (Tassal Bird Protocols). This document was developed in conjunction with the Royal Society for Protection of Cruelty to Animals (RSPCA), BirdLife Tasmania and World Wildlife Fund for Nature (WWF). It covers exclusion measures, entanglements, birds trapped in pens, removal procedures, record keeping and bird identification. Section 6.1.4.4.3 below also describes internal auditing procedures undertaken by Tassal's Wildlife Management Officer to continue to improve on operational procedures that have the potential to reduce the incidence of bird entanglements.

6.1.4.4.3 *Maintenance regime for inspection and repair of bird nets and other exclusion devices*

Tassal bird nets are maintained in as good condition as practically possible; small holes are repaired by Tassal operational staff in-situ. If this is not possible, nets are removed, replaced and repaired on land.

Tassal's Wildlife Management Officer conducts quarterly audits at farm sites for:

- bird netting – particularly holes (points of ingress for birds)
- number of birds in pen
- number of birds released
- bird species
- number of entanglements/bird deaths

These monitoring data are included within Tassal's annual sustainability reporting framework.

6.1.4.4.4 *Marine debris clean-ups*

Tassal conducts regular marine debris clean-ups of the shorelines surrounding its operations as a part of the Shoreline Clean-up Program in conjunction with community groups. This is done with the cooperation and advice of BirdLife Tasmania to ensure that nesting shorebirds are protected from disturbance during their breeding season (see Figure 6.11).

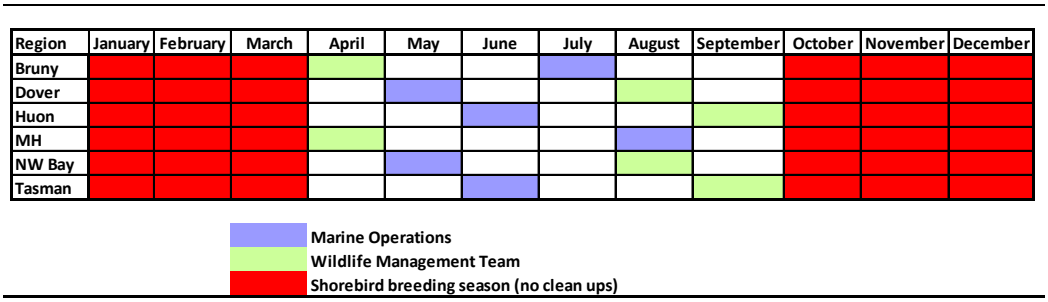


Figure 6.11 Tassal shoreline clean-up schedule

6.1.4.4.5 *Regulatory Controls*

Management Controls contained within the Tasman Peninsula and Norfolk Bay MFDP include requirements for monitoring and reporting of environmental aspects. Management Controls include:

- **Management Control 3.13.10** Lessees must ensure any predator control of protected wildlife (within the meaning of the *Wildlife Regulations 1999*) is conducted with the approval of the manager of the Nature Conservation Branch of the DPIWE or any other person acting on that person's behalf and in the case of seals in accordance with relevant seal interaction management protocols of the DPIWE.

- **Management Control 3.13.11** Where bird netting is deployed lessees must ensure that nets are made of netting of a maximum 115mm square mesh and conform to the visual controls at section 3.9. Existing marine farming lease areas must conform to this requirement by 1January 2008. New lease areas must conform from the date of approval of this Plan.

- **Management Control 3.13.12** Lessees must ensure that avifauna entangled in bird netting is removed as soon as is practicable following entanglement.

- **Management Control 3.13.15** Lessees must ensure that bird netting is maintained clear of the water to ensure that it does not become a hazard to marine fauna.

6.1.4.5 Overall effect following implementation of mitigation measures

As the proposed West of Wedge development has not been established, there are no recorded interactions between birds and marine farming activities. However, because the proposed development occurs along a more exposed coastline, it is possible that a range of different species (i.e. marine seabirds such as gulls, shearwaters, penguins, gannets, albatrosses, petrels and cormorants) may occur, or their habitat may occur, within these waters.

The proposed amendment would provide 64 cages (at peak stocking) within the proposed zone and it is anticipated that some interactions with birds will occur. The current wildlife control measures employed by Tassal have observed a continued decrease in the numbers and types of bird entanglements and mortalities through improved maintenance procedures, the use of better equipment and netting material, the development of formal wildlife handling and management protocols, and the implementation of a more effective feeding system. However, additional consultation with BirdLife Tasmania may be required if high numbers of petrels, gulls and cormorants are attracted to the proposed sites regularly, or if sightings of raptors (i.e. White-bellied Sea Eagles and/or Wedge-tailed Eagles) occur within close proximity to farming operations.

The proposed amendment will not involve the use of marine vessels outside of daylight hours, apart from possible intermittent small vessel activities involved with security procedures. Therefore the potential for birds to become disoriented at night by the use of floodlights on vessels, or collide with marine farming infrastructure as a result of this disorientation is considered to be low.

In addition, the proposed amendment will not include the development of a land base to service the proposed West of Wedge leases, and will not impact on natural coastal foreshore features or important roosting or breeding sites for local bird populations.

Tassal proposes to adopt and improve upon the mitigation measures and protocols that have been implemented successfully elsewhere within the Eastern Farming Zone to minimise potential negative interactions with birds.

Following implementation of these mitigation measures, it is considered that the proposed amendment will not have a significant or adverse impact on birds in the Storm Bay region.

6.1.5 Marine Mammals

6.1.5.1 Potential Impacts

Seals are the only marine mammals that have had interaction with the Eastern Farming Zone. These interactions include sea cage breaches and relocations. The practice of relocating seals will cease in December 2017 and other seal management measures, primarily exclusion, will be employed in any development at the West of Wedge site.

Dolphins and whales have not been previously recorded as interacting with marine farming activities in the area.

6.1.5.1.1 *Impacts on marine farms*

Seal interactions are a significant issue for the finfish aquaculture 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 subsequent 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 the company
- workplace health and safety issues – aggressive seals may cause injury to personnel employed on marine farms

6.1.5.1.2 *Impacts on marine mammals*

Potential impacts on marine mammals may include:

- behavioural management may cause animals to experience stress
- modification of behaviour in seals that habituate to marine farms, which may alter, for example, foraging behaviours
- potential for marine mammals such as whales and dolphins 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 Tasmania in March 2011
- potential for dolphins, whales and seals to become entangled in netting or farm infrastructure resulting in injury or death. These figures are reported annually in Tassal's Sustainability Report (see Appendix 1).

6.1.5.2 Mitigation Measures

6.1.5.2.1 *Details of Tassal's marine mammal interaction plan*

As part of Tassal's commitment to operating in an environmentally sustainable manner the company has developed a Wildlife Interaction Plan (WIP). This document covers bird and marine mammal management strategy for all Tassal operations. Tassal has taken a proactive approach to managing key environmental issues as they arise.

6.1.5.2.2 *Seal exclusion*

Taking away the potential for scavenging by seals reduces their attraction to aquaculture farms. Tassal's primary means of controlling seal predation is through the use of heavily weighted and tensioned cage nets fastened to the handrail above the water. Seal jump fences extending above the cage handrail and aerial seal netting may also be used to exclude seals from entering fish cages. The removal of mortalities from fish cages in a timely fashion also takes away the attraction for seals.

Tassal currently use heavily weighted and tensioned cage netting (K-Grid net technology) at their farming regions to restrict access by seals to stocked fish below the waterline.

Tassal is committed to the use of passive seal deterrents and exclusion infrastructure, and employs a dedicated Wildlife Management team who regularly consult with researchers, experts and government authorities to manage seal exclusion responsibly and effectively. All Tassal marine cages are rigged in accordance with DPIPWE seal management protocols and will be continually improved as new methods are developed.

Tassal has worked closely with Plastic Fabrications Pty Ltd to develop a new aerial seal net that are currently used at the Eastern Farming Zone. Nets are inspected at least weekly by divers for holes and to ensure that they are correctly tensioned by the weighting system. Tassal is not proposing to use predator nets on its cages at any farming zones, including the Eastern Farming Zone.

6.1.5.2.3 *DPIPWE seal management protocols*

DPIPWE seal management protocols

The Wildlife Management Branch of DPIPWE, in consultation with the Salmonid Aquaculture industry and other relevant stakeholder groups, developed a management framework to address the risk posed to both seal and human interests from interactions associated with Salmonid marine farming activities. The Seal Management Framework 2014 and Minimum Requirements 2014A addresses circumstances, procedures and protocols under which it is appropriate to apply negative conditioning (methods to deter seals from salmonid marine farming infrastructure) to persistent seals or to manage seals that have been determined as posing a significant threat to human safety by means of euthanasia.

Selected staff and all divers employed at the proposed West of Wedge development will be trained in seal management protocols. Seals that persist to repeatedly enter a secure pen pose WH&S risks to staff. These seals will be managed in accordance with DPIPWE protocols as established through the Seal Management Framework 2014 and Minimum Requirements 2014A. The main WH&S risks are caused by biting and include disease transfer, infection of wounds and crush injuries.

6.1.5.2.4 *Whale and dolphin interactions*

The proposed West of Wedge development will be the most exposed site within the Eastern Farming Zone therefore, the likelihood of interactions with dolphins and whales is considered possible. For this reason, details of any interactions will be recorded (the guidelines for observing cetaceans can be found in Appendix 18). From this data a more detailed understanding of the nature and cause of possible interactions can be extrapolated and appropriate mitigation measures can be adopted for the proposed West of Wedge development.

Tassal is also developing a Code of Best Practice for Cetaceans interactions to ensure information and observations on whale/dolphin movements can be collected and analysed for ongoing management of potential interactions across all Tassal marine farming sites. In addition, Tassal will have entanglement recovery kits available at the proposed West of Wedge development to assist with the unlikely event of a whale or dolphin entanglement.

6.1.5.2.5 *Regulatory Controls*

The following regulatory controls are contained in the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005:

- **Management Control 3.13.9** Lessees must notify the Nature Conservation Branch of the Department of Primary Industries, Parks, Water & Environment in the event that any marine mammals are found entangled in marine farming equipment.
- **Management Control 3.13.10** Lessees must ensure any predator control of protected wildlife (within the meaning of the Wildlife Regulations 1999) is conducted with the approval of the Manager of the Nature Conservation Branch of the Department of Primary Industries, Parks, Water & Environment or any other person acting on that person's behalf and in the case of seals in accordance with relevant seal interaction management protocols of the Department of Primary Industries, Parks, Water & Environment.
- **Management Control 3.13.13** Feeding of seals must not occur in any marine farming zones or marine farming lease areas covered by the marine farming development plan.
- **Management Control 3.13.14** Baited trap lines or "tease lines" may only be deployed by an officer employed in the Nature Conservation Branch of the Department of Primary Industries, Parks, Water & Environment or officers or a person(s) who holds a permit to do so under the Wildlife Regulations 1999.
- **Management Control 3.13.15** Lessees must ensure that bird netting is maintained clear of the water to ensure that it does not become a hazard to marine fauna.

6.1.5.3 Overall effect following implementation of mitigation measures

The proposed West of Wedge development is expected to attract seals and due to the exposed nature of the proposed site there is a possibility of interactions with whales and dolphins.

The likelihood of interactions occurring with whales and dolphins is considered low. Both of these cetaceans are sound navigators and are highly unlikely to become entangled in properly tensioned nets and mooring lines. There is some evidence that the frequency of Southern Right Whale sightings has increased in south east Tasmanian waters in recent years, and Tassal is conscious of the need to monitor for the presence of large marine mammals in Tasmanian waterways, particularly during winter months when Southern Right Whales may be calving or migrating through Tasmanian waters. As previously stated, Tassal is in the process of developing a Code of Best Practice for Cetacean interactions to ensure that information and observations on whale movements can be collected and analysed for ongoing management of potential interactions. In addition, at the proposed West of Wedge development recordings of whale and dolphin interactions will be taken for the first 12 months of operation.

While seal management at most farms continues to be a challenging occurrence on a regular basis, the most effective way in dealing with these mammals is through the implementation of active exclusion controls. In practical terms, this is being achieved through the deployment of K-Grid nets throughout the marine farming zones, deployment of more effective (i.e. seal-proof) aerial netting, systematic inspections and maintenance of sea cages and nets by divers, and continued attempts to better understand seal (and other marine mammal) behaviour.

6.1.6 Threatened Species

A number of listed threatened and migratory species and one threatened ecological community under the EPBCA and TSPA have been identified in this EIS as either occurring, or their habitat occurs, within the proposed new zone (i.e. within 5 km from the boundary of the proposed zone) and are shown in Table 24 (see section 5.2.6).

Some of these species have been recorded as being present within and around the waters of Storm Bay adjacent to the proposed zone (e.g. BirdLife Tasmania unpublished data), whilst other species may be considered to occur within this area on the basis that suitable habitat exists for the purpose of breeding, foraging or feeding. For some species, the area surrounding the proposed zone may represent part of a migratory route.

6.1.6.1 Potential impacts on threatened species, communities and habitats listed under the EPBCA, the TSPA and the NCA

Although a number of communities and species have been identified in this EIS on the basis of their inclusion within national and state conservation instruments, the list of species provided in Table 24 (see section 5.2.6) can be broadly categorised into six broad species groups:

- Birds of prey (such as the White-bellied Sea Eagle)
- Coastal and Oceanic Seabirds (such as the Little Penguin and Shy Albatross)
- Woodland Birds (such as the Swift Parrot)
- Marine Mammals (such as the Southern Right Whale and Long-nosed Fur Seal)
- Fishes (Red and Spotted Handfishes)
- Marine Invertebrates (such as Gunn's Screw Shell and the Live-bearing Seastar)

Each of these species groups may be susceptible to specific impacts from finfish farming in Storm Bay, and a range of mitigation measures are proposed to reduce these impacts to acceptable levels. There is a greater likelihood that the more exposed location at the proposed West of Wedge location may involve interactions with wildlife that have not historically been encountered at more sheltered farming sites. For instance, the proposed West of Wedge development is located within waters frequented by some oceanic seabirds with established nesting sites at Macquarie Island. Tassal has liaised with recognised experts to develop wildlife programs aimed at monitoring the presence (including any interactions) and behaviours of marine mammals and birds in Storm Bay.

General potential impacts on threatened species within the Storm Bay region west of Wedge Island may include the following.

- Entanglement - marine farming equipment such as bird netting and mooring lines have the potential to entangle birds, sharks and marine mammals 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. Some examples of direct impact on habitat may include the deployment of mooring blocks (benthic species), rows of pens restricting access (pelagic species), or smothering from solid waste (benthic species).

- Behavioural change - the presence of marine farms may cause some threatened species to alter their behaviour, particularly foraging behaviour in species such as seals and birds.

- Predation – potential predation of threatened species and/or threatened species prey by escaped salmonids.

- Alteration of breeding behaviour – the presence and intensity of marine farming activities may interrupt breeding and reduce breeding success.

- Reduction of the integrity of an ecological community – assisting invasive species that are harmful to listed ecological communities to become established or causing the mobilisation of pollution into an ecological community that kills or inhibits the growth of species within the community.

- Other effects - noise, lighting, waste and vessel movements all have the potential to impact on threatened species through potential behavioural changes, direct interactions or by the physical presence of artificial structures and associated infrastructure.

There are several listed threatened/migratory species and one listed threatened ecological community that may potentially be subject to specific impacts from the proposed West of Wedge development as listed in Table 24. Listed threatened terrestrial plant, reptile, mammal, frog and insect species have not been assessed for potential impacts because the proposed development does not involve any land-based development activities or the erection of artificial structures on land. The species listed below have been selected on the basis that they are known to occur within the proposed development site and surrounding areas (within 5 km radius) and/or have been recorded in the Tasmanian Natural Values Atlas within the extent of this area. These are:

- White-bellied Sea Eagle

- Wedge-tailed Eagle

- Spotted Handfish

- Red Handfish
- Southern Right Whale
- Humpback Whale
- Killer Whale
- Long-nosed Fur Seal
- Giant Kelp Marine Forests of South East Australia
- Great White Shark
- Gazameda gunnii
- Shy Albatross
- Wandering Albatross
- Sub-Antarctic Fur Seal
- Blue Whale

Whilst these species have been selected on the basis of their potential likelihood to interact with marine farming activities in Storm Bay, the range of potential impacts and threats would also apply to other species within each of the broad categories listed above. For instance, the threats and mitigation measures described for the Shy and Wandering Albatrosses would apply to the range of coastal and oceanic seabirds listed in Table 24. The same would also apply for threats and mitigation measures for the remaining five species categories (i.e. marine mammals, fishes, birds of prey, invertebrates and woodland birds).

6.1.6.1.1 *White-bellied Sea-Eagle (Haliaeetus leucogaster)*

The White-bellied Sea-Eagle occurs in Tasmania as a single population containing fewer than 1000 individuals and has a restricted distribution, usually occurring and nesting within 5 km of the coast, estuaries or large inland lakes (Threatened Species Section 2006). They occur on most of the islands of Bass Strait and are believed to possess the ability to island-hop between Tasmania and the mainland. Large estuaries and convoluted coastlines are the favoured sites for both nesting and foraging as these provide a greater interface between land and water. Population density is lower on the west and south coasts, possibly due to the lack of suitable forest habitat sheltered from high winds. This species is commonly observed within marine coastal waters of south east Tasmania, and nesting sites have been recorded (on multiple locations) within 5 km of the proposed amendment (Tasmanian Natural Values Report). There have been no recorded negative interactions between White-bellied Sea Eagles and current marine farming operations in the Eastern Farming Zone. White-bellied Sea Eagles are listed as Marine and Migratory (CAMBA) under the EPBCA and Vulnerable under the TSPA.

Key potential threats to the species from activities associated with the proposed amendment 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. A management practice recommended in the Threatened Tasmanian Eagles Recovery Plan requires buffers of 500 m and 1000 m line of sight to protect nests from disturbance arising from human activities during the breeding season. A nesting site has been recorded on the southern tip of Wedge Island approximately 2.5 km from the proposed development.

Marine Debris

White-bellied Sea-Eagles may potentially be affected by marine farming-derived debris located within the water column or on shorelines within the Storm Bay region. White-bellied Sea-Eagles may become entangled in marine debris resulting in injury or death. It is likely that the proposed West of Wedge development will result in an increase of marine debris in surrounding waters and along the foreshore in the areas downstream and downwind. The scale of increase in Storm Bay will require careful management to ensure that these more exposed operations do not result in any increase in marine debris in the marine environment. Additional shore monitoring by Tassal operational staff will be undertaken during the winter months and post storm events to monitor marine debris within and around the proposed lease area.

Foraging

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 aerial netting deployed on all sea cages and the large size of stock relative to typical prey (Wiersma and Richardson 2009). Whilst the proposed West of Wedge development represents a new activity in this area, any reduction in 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

Residential, tourist and industrial developments and recreational pursuits pose a potentially significant threat to White-bellied Sea-Eagles through the reduction (alienation or fragmentation) of available habitat (Threatened Species Section 2006) and significant reduction in habitat quality. The coastline to the east of the proposed amendment is relatively undeveloped and it is unlikely that the proposed marine farming development will result in a significant loss of habitat for any White-bellied Sea-Eagle populations located near the lease area.

6.1.6.1.2 *Wedge-tailed Eagle (Aquila audax fleayi)*

The Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*) is an endemic subspecies and is listed as Endangered under the TSPA and the EPBCA. The Wedge-tailed Eagle occurs as a single population of fewer than 1000 individuals (Threatened Species Section 2006). Wedge-tailed Eagles are landscape hunters with a wide distribution throughout Tasmania but prefer to nest in tall open forests. There are no nesting sites nearby to the proposed development, however, nesting sites are common within

the tall forests of the Tasman Peninsula adjacent to Storm Bay. The Tasmanian Wedge-tailed Eagle has been subject to Recovery Plans since 1992. Recovery actions have included increasing public awareness of the Wedge-tailed Eagle's conservation value, educating the public about the eagle's importance and consulting with farmers to protect nesting sites and reducing disturbances near nesting sites during breeding.

Key potential threats to the species from activities associated with the proposed amendment may include:

- nest disturbance
- marine debris
- modification of foraging behaviour
- depletion of habitat

Nest Disturbance

Nesting habitat includes a range of old-growth native forests (Threatened Species Section 2006). This habitat occurs along the Tasman Peninsula. Medium and high levels of disturbance during nesting, such as forest harvesting and road building have been known to adversely affect the success of breeding birds (Bell and Mooney 1999). The proposed amendment does not include shore based operations or disturbance within forests and is unlikely to adversely affect the breeding success of Wedge-tailed Eagles within the Tasman Peninsula and surrounding areas.

Marine Debris

Wedge-tailed Eagles may potentially be affected by marine farming-derived debris located on the shorelines to the east of the proposed West of Wedge development. Wedge-tailed Eagles may become entangled in marine debris resulting in injury or death. The proposed amendment is a significant development that has the potential to increase marine debris in surrounding waters and along the foreshore in the areas downstream and downwind. This issue requires careful management, and Tassal has undertaken to engage BirdLife Tasmania to assist in the development of practical measures to prevent the possibility of marine debris impacting upon raptors that forage and feed within the Storm Bay region. Additional shore monitoring by Tassal operational staff will be undertaken during the winter months and post storm events to monitor marine debris within and around the proposed lease area.

Foraging

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 (Bell and Mooney 1999). Whilst the proposed amendment represents a new activity in this area, any reduction in available marine habitat is unlikely to impact on the foraging behaviour or capacity of Wedge-tailed Eagles to forage and obtain adequate levels of prey.

Depletion of habitat

Residential, tourist and industrial developments and recreational pursuits pose a potentially significant threat to Wedge-tailed Eagles through depletion, alienation or fragmentation of available habitat (Threatened Species Section 2006) and significant reduction in habitat quality. It is unlikely that the

proposed development will result in a significant loss of foraging and nesting habitats for Wedge-tailed Eagles located in the Storm Bay region.

6.1.6.1.3 *Southern Right Whale (Eubalaena australis)*

The Southern Right Whale is currently listed as endangered under both the EPBCA and TSPA because they have undergone a severe reduction in numbers as a result of commercial whaling activities in the 19th and 20th centuries. There has been recent evidence of some population increase in southern Australian waters, however the current abundance is well below the estimated historic abundance. Southern Right Whales only occur in the Southern Hemisphere – they have a circumpolar distribution between 16°S and 65°S. Southern Right Whales from Australian populations probably forage between about 40°S and 65°S, generally south of Australia. In the region of the Sub-tropical Front (41°–44°S) they mainly consume copepods, while at higher latitudes (south of 50°S) krill is the main prey item. The migratory paths between calving and feeding areas are not well understood.

Calving usually takes place in sheltered coastal waters of southern Australia in the winter months. Nursery grounds are occupied from May to October in shallow coastal waters, and there is an increasing incidence of female whales giving birth and nursing calves in southern Tasmanian waters in recent years. Female Southern Right Whales exhibit strong calving site fidelity, generally returning to the same location to give birth and nurse offspring (Department of Sustainability et al. 2012). While Southern Right Whales have been sighted in south eastern Tasmanian coastal waters and estuaries, there have been no recorded negative interactions between Southern Right Whales and current marine farming operations in the Eastern Farming Zone.

Key potential threats to the species from activities associated with the proposed amendment may include:

- entanglement
- vessel disturbance, including noise pollution
- habitat modification

Entanglement (ropes and marine debris)

Entanglement can harm or kill individual whales, and can reduce the fitness of an individual whale by restricting mobility and impairing breathing, swimming or feeding ability. Entanglement causes physical damage (e.g. nets and lines cutting through the skin and blubber thus exposing the animal to infection and amputation or death). Entanglements in Australian waters primarily come from commercial fishery equipment and marine debris. In the Protected Matters Report, Southern Right Whales are the only cetacean where breeding is likely to occur within 5 km of the proposed amendment. Despite the increased presence of this species in recent years in southern Tasmanian coastal waters, it is considered unlikely that this species will be affected by the proposed amendment. Interactions between Southern Right Whales and marine farming activities have not been recorded in the Eastern Farming Zone, despite their known occasional presence in these waters. It is considered unlikely that the proposed development will result in the entanglement of Southern Right Whales. Nevertheless, Tassal will monitor for their presence and report the incidence of Southern Right Whales to the DPIPWE as they are observed during the course of marine farming operations.

Vessel disturbance, including noise pollution

Vessel disturbance can occur in the form of collisions or by disrupting the behaviour of animals. Southern Right Whales appear to be the primary whale species involved in vessel collisions in the southern hemisphere. Vessel collision can lead to mortality or significant injury. Southern Right Whales are naturally conspicuous by virtue of their size. Rosenbaum (2014) highlights the need for further research into the potential anthropogenic effects of industrial activities (i.e. hydrocarbon production and exploration, shipping traffic and fisheries) on whales and other cetaceans and suggests the development of nationally and regionally relevant policies and targeted mitigation measures to prevent the potential for impacts at the individual and population level. Tassal proposes to monitor for the presence of this species and will reduce or halt vessel or marine farming activities if whales are sighted within 500 m of the proposed lease.

Marine farming operations involve significant movement of vessels ranging in size from outboard dinghies to large feed delivery and harvest vessels. The nature of the waters around the proposed development are considered to be somewhat exposed, yet sheltered enough to allow Southern Right Whales to be observed in nearby waters should they be present. There are no recorded interactions between Southern Right Whales and marine farming activities in the Eastern Farming Zone, hence it is considered highly unlikely that the proposed development will result in any collisions with or disturbance of Southern Right Whales that may inhabit or transit through the waters surrounding the proposed West of Wedge development. Tassal will adhere to the DPIPWE whale and dolphin viewing guidelines when in transit should a whale be present in the area.

Habitat modification

Habitat modification through the development of infrastructure such as ports, marinas, aquaculture facilities, and ocean/marine energy production facilities could lead to the physical displacement of Southern Right Whales from their preferred (breeding) habitats or disruption to normal behaviour. Animals may also encounter chemical pollution in the form of sewage and industrial discharges, run off from onshore activities, and accidental spills. In their feeding grounds they are most at risk from bioaccumulation of human-made chemicals such as organochlorines. The proposed development will occupy a surface area no greater than 180 hectares. It is unlikely that this increase in area within the waters of Storm Bay is of an order to impact upon the status of Southern Right Whale populations.

6.1.6.1.4 *Spotted Handfish (Brachionichthys hirsutus)*

The Spotted Handfish is a small endemic handfish inhabiting inshore demersal zones of coastal embayments and estuaries, with a narrow geographic and depth distribution. It is currently restricted to the lower Derwent Estuary and adjoining bays and channels in southern Tasmania; inhabiting unconsolidated substrata ranging from well sorted coarse sand and shell grit, to areas of fine sand and silt.

Spotted Handfish populations have reduced significantly since its discovery and this species is now critically endangered under the EPBCA and TSPA. Some records of specimens have been taken well beyond the current known geographic range, from Coles Bay on the east coast to the Cygnet Estuary in the south. Specimens reach up to 120 mm in length, and occur at depths from 1 - 60 m, but are more commonly observed between 5 - 15 m by SCUBA divers (Bruce et al. 1998, Last et al. 2007).

The Natural Values Atlas includes 336 observations recorded since 1999, with most sightings occurring in the lower Derwent River Estuary from the Tasman Bridge south to South Arm. Observations have also been recorded in the northern regions of Storm Bay and within the D'Entrecasteaux Channel, to the south east of Simpsons Point. Confirmed sightings of Spotted Handfish not listed in the Natural Values Atlas have been recorded as far south as Flathead Bay in the D'Entrecasteaux Channel.

Key potential threats to the species from activities associated with the proposed amendment may include:

- reduction in habitat quality and quantity

Reduction in habitat quality and quantity

The main potential stressor from finfish farming within the proposed zone relates to emissions from farming activities which has the potential to impact on the habitat directly beneath farms, as well as outside of the lease boundary, although only to the extent to which significant or adverse effects to the surrounding environment do not occur. Potential habitat modification may include changes to the nature of sediments (such as decreased particle size or siltation). The strong level of endemism displayed by the Spotted Handfish suggests that this species is likely to be sensitive to habitat modification, potentially leading to displacement or fragmentation of individuals or populations.

6.1.6.1.5 *Red Handfish (Thymichthys politus)*

The Red Handfish is confined to south east Tasmania where it has a very restricted and fragmented distribution. The species inhabits mixed sand and rocky reef habitats at depths of between 2-20m. The largest known population, estimated at about 12 individuals, occurs inshore in Frederick Henry Bay near Hobart, where it is in close proximity to coastal settlements. The Natural Values Atlas includes 14 Red Handfish observations recorded from 1950-2014, with the majority of sightings (8 observations) occurring off Primrose Sands in Frederick Henry Bay. Sightings in south east Tasmania have also been recorded off the Actaeon Islands (2 observations), and the Forestier Peninsula (2 observations) off Tasmania's east coast.

Key potential threats to the species from activities associated with the proposed amendment may include:

- reduction in habitat quality and quantity

Reduction in habitat quality and quantity

Similar to the Spotted Handfish, the main potential stressor from finfish farming within the proposed zone relates to emissions from farming activities. However, as Red Handfish are usually observed in habitats fringing rocky reef outcrops, potential impacts from farm emissions to macroalgal assemblages could potentially cause loss of individuals or loss of habitat. The strong level of endemism displayed by the Red Handfish suggests that this species is likely to be sensitive to habitat modification, potentially leading to displacement or fragmentation of individuals or populations.

6.1.6.1.6 *Humpback Whale (Megaptera novaeangliae)*

The Humpback Whale is listed as vulnerable under the EPBCA and endangered under the TSPA. It can be found worldwide, but with apparent geographical segregation. Each year Australian humpback whales migrate from the Southern Ocean summer feeding grounds to sub-tropical winter calving grounds. The northern and southern hemisphere populations appear to be distinct given temporal migration separation (Department of the Environment and Heritage 2005).

Humpback Whales migrating through Australian waters currently occupy tropical calving grounds along the mid and northern parts of the east and west coasts of Australia, and feeding grounds in the Southern Ocean. The majority of Humpback Whales in Australian waters migrate north to tropical

calving grounds from June to August, and south to the Southern Ocean feeding areas from September to November. The exact timing of the migration period can change from year to year and may be influenced by water temperature, the extent of sea-ice, predation risk, prey abundance and location of feeding ground (Department of the Environment and Heritage 2005).

Feeding is likely to be related to krill density and primarily occurs in Southern Ocean waters south of 55°S. However, several opportunistic feeding areas have also been found off the coast of Australia. The available information suggests that a portion of the east coast population disperses into the South Pacific including New Caledonia, Tonga and other western South Pacific Islands.

It is not currently possible to define habitat critical to the survival of Humpback Whales. The flexibility and adaptability of the species' habitat requirements are not known, and it is not clear if all the currently used areas are critical to survival or whether the loss of one of these areas could be sustained. Habitat important (and potentially critical) to the survival of humpback whales is defined as those areas known to seasonally support significant aggregations of whales, and those ecosystem processes on which humpback whales rely - in particular known calving, resting and feeding areas, and certain sections of the migratory pathways (Department of the Environment et al. 2009).

Whilst Humpback Whale sightings have occurred within Storm Bay, there have been no recorded negative interactions between Humpback Whales and current marine farming operations in the Eastern Farming Zone.

Key potential threats to the species from activities associated with the proposed amendment may include:

- entanglement
- vessel disturbance, including noise pollution
- habitat modification

Entanglement (ropes and marine debris)

Observations for Southern Right and Humpback Whales have been recorded in the Tasmanian Natural Values Atlas Report within 5 km of the proposed development West of Wedge, therefore the proposed amendment area is considered to provide suitable habitat for these species. As described above for Southern Right Whales, entanglement in mooring lines or as a direct result of marine debris can harm or kill individual whales, and can reduce the fitness of an individual whale by restricting mobility and impairing breathing, swimming or feeding ability. Entanglement causes physical damage (e.g. nets and lines cutting through the skin and blubber thus exposing the animal to infection and amputation or death). It is considered unlikely that this species will be affected in any way by the proposal. Interactions between Humpback Whales and marine farming activities have not been recorded in the Eastern Farming Zone, despite their known presence in surrounding waters. It is considered unlikely that the proposed development will result in the entanglement of Humpback Whales.

Vessel disturbance

Humpback Whales are likely to be affected in a manner similar to the vessel disturbance impacts identified for the Southern Right Whales above. However, high levels of boating traffic have been found to cause female humpback whales and calves to leave traditional inshore resting areas in favour of offshore waters (DEH 2005). There are currently no recorded interactions between Humpback

Whales and marine farming activities in the Eastern Farming Zone and it is considered unlikely that the proposed amendment will result in any disturbance to or collisions with Humpback Whales that may transit through, or temporarily reside in waters surrounding the proposed amendment.

Similar to Southern Right Whales above, Tassal proposes to monitor for the presence of this species during marine farming operations and will reduce or halt vessel or marine farming activities if whales are sighted within 500 m of the proposed leases. Tassal will adhere to the DPIPWE whale and dolphin viewing guidelines when in transit should a whale be present in the area.

Habitat modification

Habitat modification through the development of infrastructure such as ports, marinas, aquaculture facilities, and ocean/marine energy production facilities could lead to the physical displacement of Humpback Whales from their preferred habitats or disruption to normal behaviour. The annual migration of Humpback Whales covers a distance up to 10 000 km from their summer feeding grounds to their sub-tropical winter breeding grounds. It is unlikely that the addition of 180 ha to the waters of Storm Bay will significantly impact on the habitat requirements for Humpback Whale populations, or affect their patterns of migration.

6.1.6.1.7 *Killer Whale (Orcinus orca)*

The Killer Whale is probably the most cosmopolitan of all cetaceans and may be seen in any marine region, occurring throughout all oceans, between equatorial regions and polar pack ice zones, and have even been observed in the River Derwent in 2010 and 2015, and the D'Entrecasteaux Channel in 2016. Their abundance is usually greatest in coastal waters and cooler regions where productivity is high (Dahlheim & Heyning 1999; Jefferson et al. 1993). In Australia, Killer Whales have been recorded in all states, with concentrations generally occurring around Tasmania. The total population size of Killer Whale is unknown, both globally and in Australian waters. Killer Whales within Australian waters are not believed to represent distinct populations. To date, no subspecies are currently recognised.

Killer Whales are found in a range of different habitats, however their preferred habitat covers oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters. Whales are most often seen along the continental slope and on the shelf, particularly near seal colonies. Killer Whales have regularly been observed within the Australian territorial waters along the ice edge in summer (Thiele & Gill 1999).

Key potential threats to the species from activities associated with the proposed amendment may include:

- entanglement
- vessel disturbance, including noise pollution
- habitat modification

Entanglement (ropes and marine debris)

The Tasmanian Natural values Atlas includes 177 observations of Killer Whales in waters off Tasmania since 1977. Most of these observations have been recorded off south east Tasmania. Killer whales are regular visitors to Tasmanian inshore coastal waters, presumably in search of feed during their seasonal migratory route. Killer whales have been prone to entanglements in Australian waters primarily due

to commercial fishery equipment and marine debris. Whilst observations of Killer Whales have been recorded in Storm Bay, it is considered unlikely that the West of Wedge development would result in the entanglement of Killer Whales. As described above, Tassal is committed to working with the relevant wildlife authorities to assist with monitoring of Killer Whale populations should any sightings occur within and around the proposed zone.

Vessel disturbance, including noise pollution

Similar to Southern Right and Humpback Whales above, Tassal proposes to monitor for the presence of this species during marine farming operations and will reduce or halt vessel or marine farming activities if whales are sighted within 500 m of the proposed leases. Tassal will adhere to the DPIPWE whale and dolphin viewing guidelines when in transit should a whale be present in the area.

Habitat modification

Killer Whales occur throughout all oceans and contiguous seas. Whilst the proposed West of Wedge development represents a shift in farming practices to more exposed waters, it is unlikely that the proposed zone would significantly impact on the habitat requirements for Killer Whale populations, or affect their seasonal pattern of migration.

6.1.6.1.8 *Long-nosed Fur-seal (Arctocephalus forsteri)*

The Long-nosed Fur-seal is listed as rare under the TSPA and is found in West Australia, South Australia, New Zealand and Tasmanian waters. In Tasmania they are mainly found residing on the west and south coasts. Only a small number of Long-nosed Fur seals breed on remote islands off the south coast. The total population in Tasmania may be as low as only several thousand and they have not re-populated traditional areas such as Bass Strait. About 100 pups are born annually. Australia-wide, the population is estimated to be 58 000 individuals.

It is very difficult to differentiate between the Australian Fur-seal and the Long-nosed Fur-seal. The Long-nosed Fur-seal is slightly smaller than the Australian fur seal and are best distinguished from this species by their much darker colouration. For more positive identification, a suite of other morphological and behavioural characteristics are used as diagnostic features.

The Long-nosed Fur-seal's main prey includes Redbait and Jack Mackerel and myctophid species. Unlike the Australian Fur-seal, it also consumes seabirds such as Little Penguins (*Eudyptula minor*) and Shearwaters (*Puffinus spp.*).

Seal interactions (Australian and Long-nosed Fur-seals) are a significant issue for the Tasmanian finfish farming industry, and will continue to be so while seals are attracted to marine farms which are seen as a source of food. Tassal manages this issue by excluding seals from entering the cages through the use of specifically designed nets and weighting systems. The company's ongoing transition to K-Grid net technology will further reduce the potential for seals to enter salmon cages, and this may assist in mitigating against habituate behaviour and the attraction of seals to marine farms.

Potential threats to the species from activities associated with the proposed amendment may include:

- entanglement and entrapment
- marine debris
- modified foraging behaviour

Entanglement and entrapment

By the very nature of finfish aquaculture techniques, equipment and infrastructure deployed in marine waters, netting and ropes can potentially cause entanglement and entrapment of seals, resulting in injury or death. Ropes and nets that are poorly maintained provide points of potential entanglement and entrapment. Seal mortalities (including mortalities to Long-nosed Fur-seals) have historically occurred as a result of entanglement and entrapment during the development of the Tasmanian Salmon farming industry. Between 2010 and 2012, there were 1-5 seal deaths annually from accidental entanglement throughout Tassal's farming operations in the Eastern Farming Zone.

Marine debris

Commercial fishing and aquaculture activities are known to cause injury and death to seals from marine debris, predominantly through net material that may become entangled around seals. Long-nosed Fur-seals may potentially be affected by marine farming-derived debris located within the water column or on shorelines around the waters off Wedge Island.

Modified foraging behaviour

Long-nosed Fur-seals are attracted to fish farms and will extend their foraging range to include fish farms. This issue continues to be managed using predator exclusion devices and the use of approved seal deterrents.

6.1.6.1.9 *Giant Kelp Marine Forests of South East Australia*

Giant kelp (*Macrocystis pyrifera*) forests in Australia are found in temperate south eastern waters on rocky reefs where conditions are cool and relatively nutrient rich. The Giant Kelp Forests of South East Australia ecological community is defined as giant kelp growing typically at depths greater than eight metres below sea level and forming a closed or semi-closed surface or sub-surface canopy (Threatened Species Scientific Committee 2012). The Giant Kelp Marine Forests of South East Australia ecological community is listed as endangered under the EPBCA, a determination made because the ecological community has undergone substantial decrease in geographic distribution to the extent that regeneration is unlikely within the near future, even with human assisted intervention (Threatened Species Scientific Committee 2012).

The Giant Kelp Marine Forests of South East Australia is a unique ecological community that extends from the ocean floor to the ocean surface and exhibits a 'forest-like' structure with a diverse range of organisms occupying its benthic, pelagic and upper-canopy layers. The ecological community is characterised by a closed to semi-closed surface or subsurface canopy of *Macrocystis pyrifera*.

M. pyrifera is the only species of kelp able to provide this three dimensional structure from the sea floor to the sea surface, so if giant kelp plants are lost or removed, the ecological community no longer exists.

The key threats to this ecological community include increasing sea surface temperatures, changes in nutrient availability in warmer waters, changes in weather patterns and large scale oceanographic conditions, and associated range expansion of invasive species that can have a catastrophic impact on the ecological community. These are all driven by climate change. Other threats include impacts on water quality from land-based activities and aquaculture and potential loss from catastrophic storm events (Threatened Species Scientific Committee 2012).

Giant kelp populations are relatively abundant in south eastern Tasmania, and giant kelp stands occur in close proximity (>1 500 m) to the east of the proposed West of Wedge development. The distribution of *M. pyrifera* off Wedge Island was surveyed in July 2013 and January 2015 (Aquenal and Marine Solutions, 2015).

Potential threats to the species from activities associated with the proposed amendment may include:

Impacts on water quality

Marine farming emissions contribute to nutrient loads and can potentially impact upon water quality parameters, such as decreased dissolved oxygen and increased ammonium concentrations. In pelagic ecosystems these effects can extend hundreds of metres from farm sites (CSIRO Huon Estuary Study Team 2000) (HES), and may impact on macroalgal community composition in reef habitats. Such effects would be considered relatively broadscale in comparison to other benthic impacts of fish farms.

The main water quality issue associated with potential impacts on the Giant Kelp Marine Forests of South East Australia arise from soluble emissions and the associated elevated levels of nutrient concentrations (particularly ammonium) that could potentially affect the underlying ecological structure and function within these communities if the structural integrity of Giant kelp plants is compromised as a result of the proposed amendment.

Based on the range of studies undertaken to examine the impacts of soluble emissions from marine farming activities, this EIS considers that nutrient concentrations above ambient levels can occur up to 500 m from the proposed lease boundary. However, the proposed West of Wedge development is located in waters that are exposed and well mixed, more so than other marine farming sites in the Eastern Farming Zone. Hence, the potential effects of soluble nutrient emissions on *Macrocystis pyrifera* communities will be diminished by the flushing and dilution effect from prevailing environmental conditions.

Table 28 in section 6.1.1.3.4 lists a range of studies that have investigated broadscale environmental effects from salmon farming, and some of these have targeted intertidal and subtidal macroalgal assemblages. The main point to note from these studies is that elevated nutrient levels and detectable environmental effects can extend at scales of hundreds of metres from the farms. Whilst studies of Valentine et al. (2016) and Crawford et al. (2011) both showed no clear trend in the abundance of dominant intertidal macroalgae with distance from salmon farms, Oh (2009) found that detectable effects of salmon farming on subtidal macroalgal assemblages could extend from 100 m - 400 m from the lease areas.

6.1.6.1.10 *Great White Shark (Carcharadon carcharius)*

The Great White Shark is a large apex predator with a distribution in Australian waters that extends from central Queensland around the south coasts to north-west Western Australia. Typically, White Sharks inhabit inshore coastal waters around rocky reef systems and coastal bays, as well as waters of the outer continental shelf and slope areas. Within Australia, most of the White Shark movements recorded by the CSIRO have occurred between the coast and the 100 metre depth contour. Both adults and juveniles have been recorded diving to depths of 1000 metres (Bruce et al. 2006; Bruce & Bradford 2008).

Key potential threats to the species from activities associated with the proposed amendment may include:

- entanglement/bycatch in commercial and recreational fishing gear
- modification of foraging behaviour

Entanglement and bycatch in commercial fishing gear

When the White Shark was first nominated for listing in 1996, approximately 500 individual mortalities occurred annually, due to human activities in Australian waters. Key threats to White Shark populations were identified as bycatch in commercial fishing gear (i.e. accidental capture in long-lines, shark nets and gillnets) and entanglement from beach protection measures. Since this time, incidental mortality of White Sharks has reduced, however, there are still a significant number of interactions occurring with a range of different fishing methods around Australia (i.e. Southern and Eastern Scalefish and Shark Fishery – South East Trawl, Victorian State Snapper Fishery, South Australian Tuna Farming Industry and the Tasmanian Scalefish fishery).

Modification of foraging behaviour

There has been no evidence that finfish farming in Tasmanian coastal waters has the potential to attract White Sharks. However, as the proposed West of Wedge development is to be located in waters of a more exposed nature than usual, there is the potential for interactions with White Sharks if this location is within their preferred habitat.

6.1.6.1.11 *Gazameda gunnii*

Gazameda gunnii is a member of the benthic infauna community (i.e. living within sediments rather than occurring visibly on the surface of the seabed). Commonly referred to as Gunn's Screwshell, *Gazameda gunnii* is a turretelid gastropod which is endemic to Australia. Its distribution has been recorded from Cape Moreton (Queensland) southwards to northern and eastern Tasmania. *Gazameda gunnii* is a relatively small gastropod with a size range commonly between 30-40 mm, but has been measured up to 69 mm in length. It has been recorded at depths ranging from 8 to at least 140 m, and lives in sandy mud, and gravelly sand.

Gazameda gunnii is listed as vulnerable in Schedule 4 of the *Threatened Species Protection Act 1995*. Five *Gazameda gunnii* shells were detected across the 120 sampling sites as part of the West of Wedge Zone Assessment in 2016 (see Appendix 11), including a single live specimen and four dead shells. A number of old and eroded *Gazameda sp.* shells were also recorded during the zone assessment, but these shells could not be reliably identified as they also resembled the closely related *G. tasmanica*. In addition, two live *Gazameda gunnii* specimens, one dead shell and one eroded shell fragment were recorded from a previous zone assessment undertaken west of Wedge Island in 2014 (IMAS, 2014).

Information on the distribution of *Gazameda gunnii* in Tasmanian waters is limited. Consultation with the Natural Values Atlas reveals nil records in Tasmanian waters, however, there is evidence that low numbers of specimens of *Gazameda gunnii* have been recorded in the D'Entrecasteaux Channel and Storm Bay through postgraduate studies (University of Tasmania) and in the conduct of other marine environmental assessment activities (IMAS, 2014).

Key potential threats to the species from activities associated with the proposed amendment may include:

- Habitat loss

- Physical disturbance from installation of mooring infrastructure

Habitat loss

There is the potential for marine sediments directly beneath stocked cages, and beyond the cage footprint but still within the lease area, to be modified through depositions associated with fish faeces and uneaten feed pellets. The degree of impact to sediments is influenced largely by the rate of water exchange, water depth, sediment characteristics, feed management systems, the physical characteristics of feed, pen size and pen separation distance. Based on the environmental characteristics of the site, depositional modelling predictions, Tassal's feed management systems and the proposed pen structure on the leases, the concentration of organic enrichment on the benthic environment is considered to be limited to within lease boundaries. Consequently, the impact to *Gazameda gunnii* is considered to be minimal with any potential displacement only occurring within the lease areas.

Physical disturbance from installation of mooring infrastructure

The most likely impact to any *Gazameda gunnii* individuals inhabiting the proposed zone relates to potential impacts from the installation of mooring infrastructure directly upon marine sediments. More recent information on the distribution of *Gazameda gunnii* in south eastern Tasmanian waters suggests that this species may be more common than originally considered when this species was listed under the TSPA (Grove and de Little, 2014). Population numbers are considered to be low within its range and the risk of physical impacts to live animals is considered extremely low.

Based on these potential threats to the *Gazameda gunnii* Tassal referred to DPIPWE to determine if a 'permit to take' was required. DPIPWE provided advice in relation to potential impacts to *Gazameda gunnii* populations in Storm Bay. Based on the information available DPIPWE determined that no permit is required under the TSPA.

6.1.6.1.12 *Shy Albatross (Thalassarche cauta steadi)*

The Shy Albatross is the only albatross endemic to Australia and Tasmania, with colonies limited to three islands: Albatross Island off Tasmania's north-west, and Mewstone and Pedra Branca off the Tasmanian south coast (Brothers, et al. 2001, Aquenal, 2011). These breeding sites have been declared as Nationally Critical for threatened albatrosses and are recognised as critical to the survival and genetic viability of these species nationally and globally. The Shy Albatross is listed as vulnerable under both the EPBCA (and as a Marine and Migratory Species) and the TSPA.

The total breeding population is currently around 14 000 (Alderman, et al. 2011). Adults remain close to their breeding colonies year-round, whereas juvenile birds – predominantly from the Mewstone colony – have been recorded foraging at sites as distant as southern Africa (ACAP 2009, Alderman, et al. 2010).

Although numbers of Shy Albatross have been increasing through the 20th century, the species is still vulnerable to incidental mortality associated with commercial fishing (Gales 1998). Around 10% of the feeding and foraging grounds off Tasmania and the entire foraging zone around Pedra Branca and Mewstone are fished commercially by longline fishing vessels (Brothers, et al. 1998) and the species is among the most frequently killed by longlines in the AFZ (Brothers 1991; Gales 1993).

Key potential threats to the species from activities associated with the proposed development may include:

- entanglement in, and ingestion of, fishing equipment (including marine debris)
- collisions with anthropogenic structures
- olfactory attraction

Entanglement and ingestion (marine debris)

Shy Albatrosses may potentially be affected by marine farming-derived debris located within the water column in the Storm Bay region. Marine debris poses the possible risk of entanglement or ingestion, resulting in injury or death. Despite no known interactions between marine farming operations and albatrosses in Australia, the proposed West of Wedge development is a significant development. Therefore, Tassal has undertaken to engage BirdLife Tasmania to assist in the development of practical measures to remove the potential marine debris causing incidental mortality to albatrosses in the Storm Bay area.

Collisions with man-made structures

There are number of anthropogenic structures associated with marine farming operations, such as sea cages, feed barges and large vessels. The foraging range of albatrosses is wide and it is likely that the waters surrounding the proposed West of Wedge development would, at times, be included in the Shy Albatross' foraging range. The Shy Albatross feeds in waters over the continental shelf, including harbours and bays (Garnett and Crowley 2000) and follows fishing vessels in flocks (Brothers et al. 1998, Gales 1998, Marchant and Higgins 1990).

It is possible that marine farming activities may attract Shy Albatrosses at the proposed West of Wedge development during foraging and feeding activities in Storm Bay; the most likely scenario is albatrosses attracted to the area scavenging food. To date, no interactions have been recorded where marine farming activities have caused direct mortality or injury to albatrosses. It is considered unlikely that incidental mortality events would occur in the waters of the proposed development, but the likelihood would increase if large vessels (with artificial deck lighting) were attending the proposed West of Wedge leases during night-time, hours of low light or during foggy/misty conditions when illumination can result in disorientation of the birds. Ongoing consultation with Birdlife Tasmania will continue to be an important part of Tassal's management of potential risks to this species.

Foraging – olfactory cues

Shy Albatrosses rely on olfactory cues to pinpoint sources of food. The proposed West of Wedge development could attracted migratory seabirds such as the Shy Albatross, due to concentrated smell sources such as mortality bins on dive vessels. As is current management practices at Tassal marine sites, mortality bins are covered and sealed with plastic bin liners to limit both visual and olfactory cues to seabirds and seals.

6.1.6.1.13 *Wandering Albatross (Diomedea exulans)*

The Wandering Albatross is a migratory seabird species listed as vulnerable under the EPBCA and endangered under the TSPA. With a circumpolar distribution throughout the Southern Ocean this species has also been regularly recorded in oceanic waters off Southern Australia and south-east Tasmania including Storm Bay. Wandering Albatross spend most of their life in flight, only landing to breed and feed. Primarily feeding at night, the Wandering Albatross diet consists of squid, fish, jellyfish and other cephalopods but they are also known to be scavengers feeding on floating waste and food

scraps from vessels. Studies have found that albatrosses rely heavily on their sense of smell (olfactory) to pinpoint food over vast ocean distances (Nevitt 1999). Wandering albatrosses are known to fly over hundreds of kilometres of ocean to find food.

Key potential threats to the species from activities associated with the proposed development may include:

- entanglement in, and ingestion of, fishing equipment (including marine debris)
- collisions with anthropogenic structures
- olfactory attraction

Entanglement and ingestion (marine debris)

Wandering Albatrosses may potentially be affected by marine farming-derived debris located within the water column in the Storm Bay region. Marine debris poses the possible risk of entanglement or ingestion, resulting in injury or death. Despite no known interactions between marine farming operations and albatrosses in Australia, the proposed West of Wedge development is a significant development. Therefore, Tassal has engaged with BirdLife Tasmania to assist in the development of practical measures to remove the potential marine debris causing incidental mortality to in the Storm Bay area.

Collisions with man-made structures

There are number of anthropogenic structures associated with marine farming operations, such as sea cages, feed barges and large vessels. The foraging range of albatrosses is wide and it is likely that the waters surrounding the proposed West of Wedge development would, at times, be included in the Wandering Albatross' foraging range.

It is possible that marine farming activities may attract Wandering Albatrosses at the proposed West of Wedge development during foraging and feeding activities in Storm Bay; the most likely scenario is albatrosses attracted to the area scavenging food. To date, no interactions have been recorded where marine farming activities have caused direct mortality or injury to albatrosses. It is considered unlikely that incidental mortality events would occur in the waters of the proposed development, but the likelihood would increase if large vessels (with artificial deck lighting) were attending the proposed West of Wedge leases during night-time, hours of low light or during foggy/misty conditions when illumination can result in disorientation of the birds. Ongoing consultation with Birdlife Tasmania will continue to be an important part of Tassal's management of potential risks to this species.

Foraging – olfactory cues

Wandering Albatrosses rely heavily on olfactory cues to pinpoint sources of food. The proposed West of Wedge development could attracted migratory seabirds such as the Wandering Albatross, due to concentrated smell sources such as mortality bins on dive vessels. As is current management practices at Tassal marine sites, mortality bins are covered and sealed with plastic bin liners to limit both visual and olfactory cues to seabirds and seals.

6.1.6.1.14 *Sub-Antarctic Fur Seal (Arctocephalus tropicalis)*

The Sub-Antarctic Fur Seal is listed as endangered under the TSPA. The nearest breeding colony is located on Macquarie Island but individuals range widely with occasional sightings along Tasmania's

coastline. The Macquarie Island population was estimated at between 90 and 130 mature individuals in the mid 1990's, however, DNA analysis has indicated there are critically low levels of pure Sub-Antarctic Fur-seals. It is estimated that less than ten purebred Sub-Antarctic fur-seal pups are born per annum on Macquarie Island, with the Island population increasing steadily at approximately 8% per year. The Sub-Antarctic Fur-seal is distinguishable from the Australian and Long-nosed Fur-seals due to its distinctive colouration - chocolate brown with a contrasting yellow face and chest, with long white vibrissae. However, for more positive identification, a suite of other morphological and behavioural characteristics are used as diagnostic features. This species are opportunistic, pelagic foragers feeding mainly at night on fish, squid and octopus at a range of depths.

Potential threats to the species from activities associated with the proposed amendment may include:

- entanglement and entrapment
- marine debris
- modified foraging behaviour

Entanglement and entrapment

By the very nature of finfish aquaculture techniques, equipment and infrastructure deployed in marine waters, netting and ropes can potentially cause entanglement and entrapment of seals, resulting in injury or death. Ropes and nets that are poorly maintained provide points of potential entanglement and entrapment. Seal mortalities have historically occurred as a result of entanglement and entrapment during the development of the Tasmanian Salmon farming industry. Between 2015 and 2016, there has been only one seal death from accidental entanglement in Tassal's Eastern Farming Zone.

Marine debris

Salmon farming activities are known to cause injury and death to seals from marine debris, predominantly through net material that may become entangled around seals. Sub-Antarctic Fur-seals may potentially be affected by marine farming-derived debris located within the water column or on shorelines around the waters off Wedge Island.

Modified foraging behaviour

Fur seals are attracted to fish farms and will extend their foraging range to include fish farms. This issue continues to be managed using predator exclusion devices and the use of approved seal deterrents. However, due to the special distribution of Sub-Antarctic Fur-seals it is considered unlikely that modified foraging will occur.

6.1.6.1.15 *Blue Whale (Balaenoptera musculus)*

The Blue Whale is listed as endangered under the TSPA. This species typically has grey skin with mottled patterns and are known to grow to over 30 m in length. Sightings in Australian waters are rare and generally widespread around the continent. Much of the continental shelf and coastal waters have no particular significance to the whales and are used only for migration and opportunistic feeding. Migratory routes of the Blue whale are not well documented, however, it is known that some migrate to Australian waters during the winter months, while others remain in Antarctic waters year-round. No sightings of Blue whales have been recorded in the Storm Bay area.

Potential threats to the species from activities associated with the proposed amendment may include:

- entanglement
- vessel disturbance, including noise pollution
- habitat modification

Entanglement (ropes and marine debris)

Entanglement can harm or kill individual whales, and can reduce the fitness of an individual whale by restricting mobility and impairing breathing, swimming or feeding ability. Entanglement causes physical damage (e.g. nets and lines cutting through the skin and blubber thus exposing the animal to infection and amputation or death). Entanglements in Australian waters primarily come from commercial fishery equipment and marine debris. Interactions between Blue whales and marine farming activities have not been recorded in any farming operations and it is considered extremely unlikely that the proposed development will result in the entanglement of any Blue whales. Nevertheless, Tassal will monitor for their presence and report any incidences to DPIPWE as they are observed during the course of marine farming operations.

Vessel disturbance, including noise pollution

Vessel disturbance can occur in the form of collisions or by disrupting the behaviour of animals. Vessel collision can lead to mortality or significant injury. Rosenbaum (2014) highlights the need for further research into the potential anthropogenic effects of industrial activities (i.e. hydrocarbon production and exploration, shipping traffic and fisheries) on whales and other cetaceans and suggests the development of nationally and regionally relevant policies and targeted mitigation measures to prevent the potential for impacts at the individual and population level. Tassal proposes to monitor for the presence of this species and will reduce or halt vessel or marine farming activities if whales are sighted within 500 m of the proposed leases.

Marine farming operations involve significant movement of vessels ranging in size from outboard dinghies to large feed delivery and harvest vessels. There are no recorded interactions between Blue whales and Tassal farming operations in Tasmania, hence it is considered extremely unlikely that the proposed West of Wedge development will result in any collisions with or disturbance of Blue whales that may inhabit or transit through the waters surrounding the proposed development. Tassal will adhere to the DPIPWE whale and dolphin viewing guidelines when in transit should a whale be present in the area.

Habitat modification

Habitat modification through the development of infrastructure such as ports, marinas, aquaculture facilities, and ocean/marine energy production facilities is unlikely to lead to the physical displacement of Blue whales. Animals may encounter chemical pollution in the form of sewage and industrial discharges, run off from onshore activities, and accidental spills. In their feeding grounds they are most at risk from bioaccumulation of human-made chemicals such as organochlorines. Southern Tasmanian waters are not known to be a significant foraging area for blue whales, however opportunistic feeding may occur. The proposed development will occupy a surface area no greater than 180 ha. It is unlikely that this increase in area within the waters of Storm Bay is of an order to impact upon the status of Blue whale populations.

6.1.6.1.16 *Mitigation Measures*

6.1.6.1.17 *White-bellied Sea-Eagle*

Marine Debris

Tassal currently participates in a program involving the collection of marine debris from shorelines around the Eastern Farming Zone. To reduce the potential for disturbance, marine debris collections will only be undertaken during the non-breeding season to avoid disturbance to nesting birds. As the proposed amendment represents a new marine farming development, BirdLife Tasmania will be engaged to provide additional expert advice on minimising the potential impacts to raptors (and other birds) that forage within Storm Bay.

Foraging

No additional mitigation measures are deemed necessary for the proposed amendment.

Nest disturbance

No additional mitigation measures are deemed necessary for the proposed amendment.

Reduction in habitat quality and quantity

No additional mitigation measures are deemed necessary for the proposed amendment.

6.1.6.1.18 *Wedge-tailed Eagle*

Marine Debris

The mitigation response addressing the potential impacts to Wedge-tailed Eagles from marine debris as a result of the proposed amendment is identical to the mitigation response described above for White-bellied Sea-Eagles.

Nest disturbance

No additional mitigation measures are deemed necessary for the proposed amendment.

Modification of foraging behaviour

No additional mitigation measures are deemed necessary for the proposed amendment.

Reduction in habitat quality and quantity

No additional mitigation measures are deemed necessary for the proposed amendment.

6.1.6.1.19 *Spotted and Red Handfishes*

Reduction in habitat quality and quantity

There are no recorded observations of Red or Spotted Handfishes within and around the proposed West of Wedge development. Hence, the likelihood of either species being present within this area is

considered to be low, but their presence should not be discounted on the basis that information gaps for this species include precise information on habitat, distribution, abundance and other threatening process.

No additional mitigation measures are deemed necessary for the proposed amendment.

6.1.6.1.20 *Southern Right Whale*

Refer to section for 6.1.5.2 general mitigation measures. No specific mitigation measures are proposed for this species, however, vessel and farming activities will be reduced or halted if whales are sighted within 500 m of farming operations.

In addition, based on expert opinion from a northern hemisphere study (it was found that red/orange colours are more visible to cetaceans (Payne, 1986). Therefore, Tassal will explore the potential of using orange/red shaded mooring lines where possible at the site. Entanglement response kits will also be kept on-site in the unlikely case of whale entanglement.

6.1.6.1.21 *Humpback Whale*

Refer to section 6.1.5.2 for general mitigation measures. No specific mitigation measures are proposed for this species however, vessel and farming activities will be reduced or halted if whales are sighted within 500 m of farming operations.

In addition, based on expert opinion from a northern hemisphere study it was found that red/orange colours are more visible to cetaceans (Payne, 1986). Therefore, Tassal will explore the potential of using orange/red shaded mooring lines where possible at the site. Entanglement response kits will also be kept on-site in the unlikely case of whale entanglement.

6.1.6.1.22 *Killer Whale*

Refer to section 6.1.5.2 for general mitigation measures. No specific mitigation measures are proposed for this species, however, vessel and farming activities will be reduced or halted if whales are sighted within 500 m of farming operations.

In addition, based on expert opinion from a northern hemisphere study it was found that red/orange colours are more visible to cetaceans. Therefore, Tassal will explore the potential of using orange/red shaded mooring lines where possible at the site. Entanglement response kits will also be kept on-site in the unlikely case of whale entanglement.

6.1.6.1.23 *Long-nosed Fur-seal*

Refer to section 6.1.5.2 for general mitigation measures. No specific additional mitigation measures are proposed for this species.

6.1.6.1.24 *Giant Kelp Marine Forests of South East Australia*

Impacts on water quality

The proposed development is located approximately 1.4 km from the nearest stand of *Macrocystis pyrifera*. At this distance from the source of soluble emissions, it is very unlikely that the species or the Giant Kelp community (threatened under the EPBCA) would be negatively affected by water quality impacts, or small elevations in background ammonium levels. However, known Giant kelp stands within close proximity to the proposed development (see Figure 6.10) will continue to be monitored as part of Tassal's broadscale environmental monitoring program.

No specific mitigation measures are proposed for this threatened ecological community.

6.1.6.1.25 *White Shark*

Entanglement and bycatch in commercial fishing gear

No additional mitigation measures are deemed necessary for the proposed amendment.

Modification of foraging behaviour

No additional mitigation measures are deemed necessary for the proposed amendment.

6.1.6.1.26 *Gazameda gunnii*

Habitat modification

No additional mitigation measures are deemed necessary for the proposed amendment.

Physical disturbance from installation of mooring infrastructure

No additional mitigation measures are deemed necessary for the proposed amendment.

6.1.6.1.27 *Shy and Wandering Albatross*

Marine Debris

Tassal currently participates in a program involving the collection and monitoring of marine debris from shorelines around the Eastern Farming Zone. To reduce the potential for disturbance, marine debris collections will only be undertaken during the non-breeding season to avoid disturbance to nesting birds. As the proposed amendment represents a new marine farming development, BirdLife Tasmania will be engaged to provide additional expert advice on minimising the potential impacts to raptors (and other birds) that forage within Storm Bay.

Collisions with man-made structures

Tassal will minimise light spill for nocturnal illuminations on pens and infrastructure. For on-shore facilities, use of light globes at the yellow/red end of the visible spectrum will be considered. Should any collision events be recorded through farming operations within the Storm Bay area, Tassal will continue to liaise with BirdLife Tasmania to ameliorate any residual risks or negative impacts and develop solutions to prevent further collisions and interactions.

Foraging – olfactory cues

As is current practice at all Tassal marine sites, mortality bins are covered and sealed with plastic bin liners to limit both visual and olfactory cues to seabirds.

6.1.6.1.28 *Sub-Antarctic Fur Seal*

Refer to section 6.1.5.2 for general mitigation measures. No specific additional mitigation measures are proposed for this species.

6.1.6.1.29 *Blue Whale*

Refer to section 6.1.5.2 for general mitigation measures. No specific mitigation measures are proposed for this species, however, vessel and farming activities will be reduced or halted if whales are sighted within 500 m of farming operations.

In addition, based on expert opinion from a northern hemisphere study it was found that red/orange colours are more visible to cetaceans (Payne, 1986). Therefore, Tassal will explore the potential of using orange/red shaded mooring lines where possible at the site.

6.1.6.2 Overall effect following implementation of mitigation measures

6.1.6.2.1 *White-bellied Sea-Eagle*

Following mitigation the risk to this species from the proposed development is considered low. The proposed amendment is unlikely to contribute to the decrease in the White-bellied Sea-Eagle population in the Storm Bay region.

6.1.6.2.2 *Wedge-tailed Eagle*

Following mitigation the risk to this species from the proposed development is considered low. The proposed amendment is unlikely impact on the Wedge-tailed Eagle population in the Storm Bay region.

6.1.6.2.3 *Red and Spotted Handfishes*

The proposal is very unlikely to pose a threat to these species.

6.1.6.2.4 *Southern Right Whale*

The proposal is very unlikely to pose a threat to this species.

6.1.6.2.5 *Humpback Whale*

The proposal is very unlikely to pose a threat to this species.

6.1.6.2.6 *Killer Whales*

The proposal is very unlikely to pose a threat to this species.

6.1.6.2.7 *Long-nosed Fur-seal*

Seals continue to be an ongoing challenge to marine farming operations with daily interactions recorded throughout the south-east of the state. Large investments are made to exclude and deter seals from affecting marine operations and stock. In addition, the use of non-lethal deterrents reduces negative seal interactions and their habituation towards fish farms. Despite the range of efforts employed to reduce these interactions, the risk of injury or mortality remains a possibility. However, this risk should be considered low due to the mitigation measures employed and recent improvements to predator-proof fish netting (i.e. use of K-grid design nets) used to prevent and exclude seals from entering cages.

6.1.6.2.8 *Giant Kelp Marine Forests of South East Australia*

The proposal is very unlikely to pose a threat to this species.

6.1.6.2.9 *White Shark*

The proposal is very unlikely to pose a threat to this species.

6.1.6.2.10 *Gazameda gunnii*

The proposal is unlikely to impact upon the population status of *Gazameda gunnii* and per advice from DPIPWE no permit to take under the TPSA is required.

6.1.6.2.11 *Shy and Wandering Albatross*

Following mitigation the risk to this species from the proposed development is considered low. The proposed amendment is unlikely to contribute to the decrease in the Shy or Wandering Albatross populations. However, Tassal will continue to liaise with BirdLife Tasmania in order to underpin the development of appropriate management and data collection activities to ensure that these risks remain at low levels.

6.1.6.2.12 *Sub-Antarctic Fur Seal*

Seals continue to be an ongoing challenge to marine farming operations with daily interactions recorded throughout the south-east of the state. Large investments are made to exclude and deter seals from affecting marine operations and stock. In addition, the use of non-lethal deterrents reduces negative seal interactions and their habituation towards fish farms. Despite the range of efforts employed to reduce these interactions, the risk of injury or mortality remains a possibility. However, this risk should be considered low due to the mitigation measures employed and recent improvements to predator-proof fish netting (i.e. use of K-grid design nets) used to prevent and exclude seals from entering cages.

6.1.6.2.13 *Blue Whale*

The proposal is very unlikely to pose a threat to this species.

6.1.7 Geoconservation

6.1.7.1 Effects on sites of geoconservation significance or natural processes

As stated in section 5.1.5, a desktop search of the LISTMap was undertaken and indicates that there are two listed geoconservation sites located in the surrounding area (LISTMap[6] 2016); Wedge Island and Roaring Beach.

6.1.7.2 Mitigation Measures

The land base servicing the proposed West of Wedge development would be the existing shore base at Badger Cove, so there would be no construction work conducted in the area. All marine debris (including marine debris) is collected and removed from shorelines adjacent to Tassal's active marine farming leases as a component of the Shoreline Clean-up program (see Figure 6.11).

6.1.7.3 Overall effect following implementation of mitigation measures

The proposed West of Wedge development is not expected to impact negatively on either site of geoconservation significance.

6.1.8 Chemicals

6.1.8.1 Proposed usage of chemicals including antifoulants, therapeutants (such as antibiotics) and disinfectants

6.1.8.1.1 *Antifoulants*

Tassal stopped using antifoulants on cage netting at all their farming zones in 2013.

6.1.8.1.2 *Therapeutants*

Tassal records details of specific antibiotics used, and has records for the Eastern Farming Zone dating back to 2006.

As part of Tassal's Fish Health Management Plan, 100% of smolt are vaccinated against the main bacterial diseases. This practice has dramatically reduced Tassal's total antibiotic use.

In FY2012 Tassal's company-wide antibiotic use was less than 2% of total use in 2009. Any salmon treated with antibiotics must go through a lengthy withdrawal period of between 90 – 120 days to ensure the antibiotic is cleansed from their system. Prior to harvest, any group that may have had antibiotics is tested for residues. Tassal complies with the Australian New Zealand Food Standards Code for residue levels.

Antibiotics will only be prescribed as required to address illness and animal welfare issues. It is not possible to forecast antibiotic use, but it is expected that use will remain low if not absent due to

[6] LISTMap (2016). http://maps.thelist.tas.gov.au/listmap/app/list/map Data accessed: 28th June 2016.

improved husbandry practices and effective vaccines. Should a significant new bacterial disease emerge, antibiotics may be required to control stock losses and welfare issues while a vaccine is developed.

6.1.8.1.3 *Fuels*

Diesel, unleaded petrol and oil based lubricants are used by Tassal, mostly to run work boats. For vessels used at the proposed West of Wedge development, Tassal will refuel at the Badger Cove sheltered wharf land base to minimise the risk of spills. Spill kits are located at all chemical storage areas, fuel-fill stations and areas where chemicals are used.

6.1.8.1.4 *Disinfectants*

Disinfectants are used in aquaculture to control spread of disease organisms. Disinfectants can potentially harm local flora and fauna if released in large amounts to waterways. Disinfectant footbaths are located at all land-based facilities and contain diluted disinfectant in several litres of water. Disinfectants are also used on farm equipment before transfer between sites. The disinfectant is diluted in water and sprayed sparingly in a controlled manner. The majority of disinfectant use by Tassal takes place at its land base operations with proper wash down facilities.

Harvest infrastructure is cleaned and disinfected after each harvest using recommended concentrations of cleaning agents and disinfectants. All disinfection wash down water is contained on the harvest vessel and discharged to a shore-based WWTP after harvest is completed.

6.1.8.2 Recognised localised and system-wide effects of chemical usage on water quality, the benthic environment and other fauna

The proposed West of Wedge development will not use copper based antifoulant on fish nets.

Generally the effects of disinfectants on the marine environment are poorly studied (Burridge et al. 2010); however any disinfectants and cleaning agents used on Tassal sites are required to be water soluble and of low toxicity. Virkon is an oxygen based disinfectant containing simple organic salts and organic acids. The active ingredient decomposes in the environment, breaking down to form the harmless compounds, potassium salts and oxygen. Three quarters of the ingredients of Virkon are inorganic which decompose to naturally occurring simple inorganic salts. The remaining organic compounds are classified as readily biodegradable by OECD and EU standards (Virkon MSDS).

6.1.8.3 Public health risks

There are no anticipated public health risks from the use of chemicals.

To address the issue of risks to human health associated with the consumption of medicated escapee Atlantic salmon containing antibiotic residues the Tasmanian Department of Health and Human Services engaged Food Standards Australia and New Zealand (FSANZ) in 2007 to undertake a risk assessment for Oxytetracycline (OTC) levels in both wild fish and farmed medicated Atlantic salmon (FSANZ 2013). OTC is a prescribed antibiotic used in salmon farming. The study examined the OTC residue levels from the flesh of several fish species 10, 15 and 70 days post treatment, and related the highest found residue levels in these samples to the acceptable daily intake (ADI) for OTC in humans (0.03 milligrams per kilogram of body weight per day). The report by FSANZ concluded that, based on the residual levels observed in the fish tested, there was no public health risk for any Australian

population group associated with the consumption of farmed salmon or wild fish caught near salmonid farming areas. For more information on antibiotics refer to section 3.5.3.

6.1.8.4 Mitigation Measures

6.1.8.4.1 *Proponent management plan specific to the management of chemicals and environmental consequences of usage and chemical waste management*

Tassal has a detailed Dangerous Goods and Hazardous Substances Procedure and Waste Management Plan created specifically for the management of chemicals and environmental consequences of usage and chemical waste management.

Tassal keeps Dangerous Goods and Hazardous Substances registers for all of its Marine Farming, Hatchery and Processing sites. Each substance listed has a current Safety Data Sheet kept in hard copy on site and electronically on Tassal's intranet. Regular audits are carried out by Tassal's WHS department in line with their internal safety systems that are independently certified to AS 4801:2001 and OHSAS 18001:2007.

Spill kits are located at all chemical storage areas, on every vessel and barge, fuel-fill stations and areas where chemicals are used. All Tassal employees are appropriately trained in the use of spill kits. Tasmania also has a State Emergency Plan that includes resources that can be deployed to contain and clean up large spills if required. Some chemicals used in aquaculture are classified under the *Environmental Management and Pollution Control Act 1994* as controlled wastes which require disposal by an appropriate licensed contractor. Commercial arrangements exist with approved waste service providers for all waste materials ensuring disposal in accordance with the appropriate regulations.

All chemicals are stored in bunded areas with the capacity to hold 110% of the volume of the largest container. This ensures that any spill that may occur is appropriately contained and the risk of spill to the environment is minimised.

All boats and equipment are serviced regularly and inspected daily with thorough start-up and shut-down procedures completed to ensure that any issues are identified early and remedial action can be taken.

No antibiotics are stored on site. Should antibiotics be required, medicated feed would be prepared at the feed mill and transported to the region in fully contained plastic bags.

Tassal will continue to comply with the regulatory controls outlined below.

6.1.8.5 Regulatory Controls

Tassal complies with management controls as stipulated in the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005. Relevant controls are:

- **Management Control 3.4.2** - Lessees must keep the following records for each lease area held by the lessee and retain these records for a period of 5 years:
    - **Management Control 3.4.2.3** The names and quantities and date of use of all chemicals which have been used on a lease area. This must include, but is not

confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

- **Management Control 3.4.3** - Lessees must provide to the Manager, Marine Farming Branch, Department of Primary Industries, Water and Environment the records detailed at 3.4.2 at the request of the Secretary.

- **Management Control 3.4.4** - Lessees must notify the Manager, Marine Farming Branch, Department of Primary Industries, Water and Environment within 48 hours of using any therapeutants including antibiotics but excluding vaccines. Information provided to the Manager, Marine Farming Branch must include:

    - **Management Control 3.4.4.1** The names of therapeutants
    - **Management Control 3.4.4.2** The date of use
    - **Management Control 3.4.4.3** The location (to a degree of precision to the satisfaction of the Secretary) and identification of the specific cage / cages in which therapeutants have been placed
    - **Management Control 3.4.4.4** The quantities of therapeutants placed into specific cages

- **Management Control 3.6.1** - All chemicals use must comply with the requirements of the Agriculture and Veterinary Chemicals (Control of Use) Act 1995.

From Schedule 3V Marine Farming Licence Conditions Relating To Environmental Management of a Finfish Farm. Relevant controls are:

- **Condition 1.6** Levels of antibiotics, or chemical residues derived from farm therapeutic use, present in sediments within or outside the Lease Area, are not to exceed levels specified to the licence holder by prior notice in writing by either the Director or the Chief Veterinary Officer, Tasmania.

- **Condition 1.7** Prior to any stock being treated with therapeutants, the licence holder must advise the Director, and provide a copy of any medication authority specific to stock treatment that has been issued. The licence holder must comply with requirements to undertake any reasonable residue testing prescribed by the Director.

6.1.8.6 Overall effect following implementation of mitigation measure

The proposed West of Wedge development is not expected to result in large quantities of chemicals being used and/or stored on the leases. The mitigation measures put in place as detailed above in section 6.1.8.4 are designed to mitigate risk and any potential impacts from chemical use, spillage, or waste from fish farms. While there would be an increase in vessel movements in the area and the carriage of chemicals associated with new farm activities in the proposed West of Wedge development area, the risk control measures in place will ensure that the net impact from the chemicals carried on vessels and those used on the farm would be negligible.

6.1.9 Species Escapes

Tassal has records of escape events for all of their Marine Farming Zones dating back to January 2000. Over this 16 year period there has only been one significant escape event within the Tasman Peninsula and Norfolk Bay MFDP Area. This event was in December 2007 and recorded 20 500 fish. Tassal reports all escape events in their annual Sustainability Report.

6.1.9.1 Recognised ecological effects of escaped stock

There are no wild salmon populations in Tasmania and the farmed populations of salmon are composed of all females, thus making reproduction in the wild impossible. Research also indicates that escaped Atlantic salmon do not successfully forage outside of the pens and do not thrive in the wild (Steer and Lyle 2003).

Thorstad et al. (2008) have documented 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.

Marine farming practices, farm designs and equipment specifications are designed to avoid the release of fish. However, despite the best of intentions and practices, the occasional escape of salmonids is an unavoidable impact of finfish marine farming operations.

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 numbers of escaped fish in these countries are relatively 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.

Sea cage farming of salmonids (rainbow trout) in Tasmania commenced in the 1970s 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 located 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 lost condition, supporting the contention that escaped fish do not appear to thrive in the wild (Steer and Lyle 2003). Some of the fish examined however, did have prey items in their stomachs that indicated 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 lab analysis techniques to determine if escaped salmonids in Macquarie Harbour feed on native fauna. They established that one Atlantic salmon (13 sampled) and one rainbow trout (38 sampled) had successfully fed on native fauna post escape. It was concluded that in general, escaped salmonids do not switch to feed on native fauna but because of the limited sample size, results were not conclusive and there was still no definitive answer regarding the fate of salmonid escapees in Tasmania. Bell, et al. (2016) also found no evidence of Atlantic salmon or rainbow trout on native fauna or fish pellets in Macquarie Harbour.

In an international context, Tasmanian farmed salmonid species are free of all the major infectious bacterial and viral diseases that cause significant management issues in other salmon farming regions. In addition, there is as yet no record of the presence of salmon lice on Tasmanian salmonids. There has been no evidence to date that farmed Tasmanian salmon are responsible for transmission of diseases to either native species or wild salmonid populations. To date there has been no formal survey work conducted to assess the level of presence of escaped farmed salmonids in the Eastern Farming Zone. While there is the potential for disease transfer from escaped fish, the low level of disease in farmed salmonids combined with relatively low loss rates from recent years means such a risk is very low.

A number of social and economic impacts both negative and positive may also be associated with escaped salmonids, but there has been little work done to estimate these issues. 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.

Jensen et al. (2010) provide further detail on the causes, consequences and prevention of escapes from a Norwegian context.

6.1.9.2 Spread of disease from escaped fish

There have been no significant escape events within the Eastern Farming Zone in the last eight years. The rarity of escape events combined with the fact that there are no major diseases present in Tassal's salmon, means there is a low risk associated with the spread of disease from escaped fish.

6.1.9.3 Mitigation Measures

6.1.9.3.1 *Risk minimisation strategies*

Tassal aims to eliminate stock escapes from their marine farms within areas that can be controlled and to minimise the risk in areas where it cannot. As stated in section 3.4.1, the proposed mooring system has undergone engineering design based on a technical report by Aquastructures and is in accordance with NS 9415:2003.

The proposed West of Wedge development is not expected to vary from similar leases within the Eastern Farming Zone in regards to impact from species escapes. Tassal intends to utilise K-Grid mesh technology at the proposed West of Wedge development. This mesh type has proven successful with no breaches recorded within any Tassal Farming Zones. The implementation of Tassal's escape prevention measures has resulted in a significant decrease in escape events.

6.1.9.3.2 *Protocols for managing escape events*

Tassal has developed and implemented an Escape Prevention and Response Protocol company wide. This plan incorporates escape prevention, net inventory, weighting systems, smolt input and harvest operations as well as inventory management and incidental losses.

This process also included the development of Tassal's Escape Response Kits. These kits contain equipment for containment or attempted recapture and include a written procedure for their use. They have been successfully used in the marine farming environment, with positive feedback from operational staff.

6.1.9.3.3 *Regulatory Controls*

Tassal complies with management controls as stipulated in the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005. Relevant controls are:

- **Management Control 3.12.1** Lessees must not intentionally release into State waters fish of the species authorised in the relevant marine farming licence unless authorised to so by that licence.
- **Management Control 3.12.2** Lessees must report to the manager marine farming any significant incident of fish escapes within 24 hours of becoming aware of the escape. A significant escape is defined as any loss of licensed species to the marine environment in excess of 1000 individuals at any one time.
- **Management Control 3.12.3** Lessees must recover escaped fish when and in a manner as directed by the Secretary.

Tassal has achieved Aquaculture Stewardship Council (ASC) certification across all of their marine operations, including the Eastern Farming Zone. Compliance with the ASC standard is audited by a third party Certification Body annually. The following criteria of the ASC salmon standard relate to species escapes:

- **ASC Criteria 3.4.1** Maximum number of escapees in the most recent production cycle = 300.
- **ASC Criteria 3.4.2** Accuracy of the counting technology or counting method used for calculating stocking and harvest numbers = ≥ 98%.
- **ASC Criteria 3.4.3** Estimated unexplained loss (EUL) of farmed salmon is made publically available.
- **ASC Criteria 3.4.4** Evidence of escape prevention planning and related employee training, including: net strength testing; appropriate net mesh size; net traceability; system robustness; predator management; record keeping and reporting of risk events; and worker training on escape prevention and counting technologies.

6.1.9.4 Overall effect following implementation of mitigation measures

The proposed West of Wedge development is not expected to vary from the other leases within the Eastern Farming Zone in regards to impact from species escapes. Tassal intends to utilise K-Grid mesh technology at the proposed leases. The implementation of Tassal's escape prevention measures has resulted in a significant decrease in escape events. This process has been validated by third party audit through ASC certification process which has an entire component dedicated to the management of escapes.

6.1.10 Disease

Amoebic Gill Disease (AGD) is the main fish health issue in the Eastern Farming Zone. However, it is well managed by Tassal through their AGD management plan. The plan aims to reduce freshwater bathing incrementally through application of research and development outcomes and results of the selective breeding program. Success of this program has been seen in the 2014YC where there was an average of 8-9 baths across all regions, a reduction from 11-12 in 2011. Tassal's research and development is supported by CSIRO through a collaborative research agreement (CRA). This program is commercial-in-confidence and supported by FRDC.

Other pathogens found in the Eastern Farming Zone prior to 2010 were Enteric Vibriosis (SGS), Yersiniosis and Rickettsiosis. They are not currently an issue in this zone.

Harmful algal blooms (HAB) and jellyfish presence is regularly monitored through daily algal trawls and associated observational on-ground work. Tassal has an internal algal and jellyfish response protocol to assist in reducing the potential impacts of these species to fish health and welfare. There are farm management practices that can assist during HABs, but their efficacy is dependent on the species of algae. Training and education in this realm is very important to accurately identify harmful algal species.

In 2013 and 2015, at Creeses Mistake and MF193 Badger Cove leases respectively, Pilchard Orthomyxovirus-like (POMV) was isolated in smolt. POMV is likely transmitted through pilchard populations. The disease has been known to cause high mortality with isolated outbreaks in the Eastern

zone. Tassal has not treated with antibiotics with these outbreaks, and has not used antibiotics in the Eastern Farming Zone since 2009 (see section 3.5.3).

6.1.10.1 Recognised ecological effects of disease

There have been no reported fish kills in wild fish populations within the Eastern Farming Zone attributed to disease agents from farmed salmon. Therefore, it is highly unlikely that the presence of any disease agents in farmed salmon in the Eastern Farming Zone will have the capacity to manifest in natural marine ecosystems.

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

Risk assessment for potential biosecurity threats, particularly those originating from nearby salmonid growing companies, would follow the TSGA Biosecurity Program (Appendix 19). These management measures which address specific threats and spreading of diseases, are in place to reduce risk to acceptable levels as a joint agreement between all salmonid companies in Tasmania.

The main surveillance strategies for signs of disease and management of any potential biosecurity threat in marine farms is outlined in Section 9.2 of the TSGA Biosecurity Program (see Appendix 19). These management strategies are implemented through each company's specific internal procedures and guidelines.

The Tasmanian Fish Health Surveillance Program (TFHSP) supports disease monitoring as a joint program between the Tasmanian Salmonid Industry and Tasmanian Government. Section 8.9 outlines the communication and reporting protocols in which each company's veterinarian is routinely notified of any significant issues as agreed in the program and according to the Animal Health Act 1995. This program supports open communication between industry and government for early notification of any disease events. It aims to provide a coordinated salmonid disease surveillance program for the whole of Tasmania.

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 and salinity which impact the pathogens survival. Different pathogens will survive for differing periods 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

6.1.10.3.1 *Fish health strategies*

Tassal's focus on disease monitoring and early detection places a high importance on incorporating stock inspections into routine farming activities such as mortality collection, weight checks and harvests. Tassal has technical officers positioned at each farming zone responsible for being the first responders to disease outbreaks. Tassal's technical officers and dive crews are trained and competent in fish health and assist in collection of samples for diagnostics, with guidance from Senior Manager Fish Health who is a registered veterinarian. This provides timely response in disease outbreak situations.

Tassal is actively involved in the Tasmanian Salmonid Health Surveillance Program, a joint program between the Tasmanian Salmonid Industry and the Tasmanian Government. This program provides passive disease surveillance through regular submission of fish diagnostic samples and testing for specific disease agents of concern. Sites have a tailored surveillance program which is prescribed with regard to historical disease trends.

Prior to translocation of stock, Tassal also ensures that checks are performed and a history of health is gathered to determine if there are any risks to receiving leases. These checks include sampling of moribund animals to determine disease status (endemic disease), deformity checks and parasite

checks. In addition, Tassal marine operations prioritise the segregation of year classes in farming leases in order to further reduce the chance of disease proliferation.

Tassal's Farm Disease Management and Biosecurity Protocol is designed to limit the transmission of existing or exotic pathogens between or within control zones as well as develop a proactive 'biosecurity culture'. The Protocol is based on a two-tiered system of alert depending on the disease status of individual pens, leases or farming zones, with changing actions and monitoring processes throughout.

Tassal has also implemented a Fish Health Management Plan (FHMP) which consists of a combination of compliance, best practice, and regulation through management controls and Marine Farming licence conditions. The FHMP addresses detailed, standard operating procedures to prevent disease from entering the region, to prevent the spread and impact of disease in farming regions and to respond to emergency disease situations. The FHMP is scheduled to be reviewed annually; however this will occur more frequently if required.

Additionally, Tassal has a Zero Harm to Fish program which offers a framework for health and welfare of stock. Any fish incidents, hazards or mortality events are escalated and mitigation/changes made throughout operations and followed up to reduce the risk of future disease outbreaks.

6.1.10.3.2 *Regulatory Controls*

Tassal complies with management controls as stipulated in the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005. Relevant controls are:

- **Management Control 3.7.2** All mortalities arising in connection with marine farming operations must be disposed of at a site that has the necessary approvals to receive this material.
- **Management Control 3.7.3** The licence holder must ensure that blood resulting from the harvesting of fish is fully contained and not allowed to enter the marine environment unless authorised in writing by the Chief Veterinary Officer.
- **Management Control 3.8.1** Lessees must notify the Department of Primary Industry, Water and Environment of any suspicion of a notifiable disease in accordance with the *Animal Health Act 1995*.
- **Management Control 3.8.2** Lessees must remove dead fish from cages in accordance with any direction from the Secretary.
- **Management Control 3.8.3** Lessees must ensure that all salmonid fish species introduced into the plan area by leaseholders are vaccinated in accordance with any vaccination protocol plan as specified by the Secretary.

6.1.10.4 Overall effect following implementation of mitigation measures

Impact from disease related issues is not expected to increase as a result of the proposed West of Wedge development.

6.1.11 Waste Streams Disposed on Land

6.1.11.1 Mortalities including effect of mass mortality events

Mortalities are collected from pens and transported in bins to Tassal's rendering and processing plant on Tasmania's east coast to produce fish meal, fish protein hydrosylate, and fish oil. Severely decomposed mortalities (10 - 20%) are segregated at the processing plant and taken to an approved composting facility.

During times of mass mortalities, fish are removed from pens as soon as possible and treated as above.

The proposed zone is not expected to produce higher mortality than the numbers produced from other zones currently. Mortalities can represent between 5% and 10% of biomass annually, which is highly dependent on the specific farm conditions and environment. The proposed West of Wedge development is located such that it is expected that less than average mortalities will occur due to the oceanic nature rearing environment combine with high exposure and water turnover.

6.1.11.2 Dilapidated or broken equipment

Clean unserviceable nets are given away for reuse where possible or suitable sections reused for repair of other nets. Due to their plastic composition nets are 100% recyclable and the company has a program in place to support this through a Tasmanian owned business. Farm pens, which are constructed predominantly of plastic and steel, and general equipment has traditionally been disposed of at the local landfill. A recycling avenue is now available for all polypropylene materials which will be used where practical. Steel recycling is also available to all Tassal farming regions. Cage and feed pipe is often sold or given away as drainage pipe with a Tasmanian based company also recycling these pipes.

6.1.11.3 Soluble and solid waste streams from land-based maintenance of antifouled nets

There will not be any copper antifouled nets used at the proposed West of Wedge development as Tassal has phased out the use of this treatment on nets for all marine farming operations.

6.1.11.4 Bloodwater

Bloodwater is treated at the fish harvest processing factory at Dover in the WWTP. This plant is an EPA authorised waste water treatment facility that has a marine discharge permit for treated effluent. Bloodwater from the harvest vessel is stored on board and pumped to shore when docked at the Dover factory.

6.1.11.5 Black and grey water from on-site barges and other installations

Black and grey waste from feed barges is pumped out on a routine basis by the feed delivery vessel. This waste is discharged to an approved disposal point on-shore.

6.1.11.6 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 and the populations of stock within the cage and in adjacent cages.

Potential impacts on the natural and human environment include:

- organic enrichment of the water column and the seabed from putrefying fish
- spread of disease to wild fish
- changes in water quality
- odour issues affecting public amenity.

Potential impacts on stock populations within a cage and on adjacent cages include:

- spread of disease and parasites
- lowering of DO (and impact on other water quality physico-chemical parameters) due to microbial degradation of putrefying fish
- stress on existing stock 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 shorelines of Wedge 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 and grey 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.

Other General Waste

The inappropriate disposal of other general wastes has the potential to become marine debris which can then impact on marine wildlife and wash up on the shorelines as rubbish.

Harvesting Operations

Bloodwater from harvesting has the potential to organically enrich surrounding waters and potentially spread disease amongst fish stocks if released into the marine environment.

6.1.11.7 Mitigation Measures

Tassal has developed a comprehensive Marine Operations Waste Management Plan and Waste Management Policy. These have been developed to support Tassal's Environmental Policy and recognise that Tassal has a legal responsibility to ensure that waste does not enter the marine environment.

The Marine Operations Waste Management Plan and Waste Management Policy are reviewed and advised internally on an annual basis. This review process is undertaken to assess the efficacy prior to being audited as part of third party audit regimes undertaken by Tassal.

The management plan was written to address the following objectives:

- target zero waste entering the marine environment
- establish procedures and operating mechanisms that focus on managing the loss of farm materials into the marine environment
- establish chains of responsibility at the farm level
- establish monitoring procedures.

The target waste types that this plan is based around are:

- rope – primary concern
- feed pipe – primary concern
- cigarette butts
- domestic waste
- netting offcuts
- cardboard and paper
- used Personal Protective Equipment (PPE).

The plan ensures that all Tassal vessels are fitted with a secure and sealed rubbish bin and this is serviced as part of the daily boat start up protocol. As with all Tassal Management Plans this is monitored and reviewed to assess the efficacy and audited as part of third party audit regimes undertaken by Tassal.

Mortalities are removed from the cages promptly on a regular basis, collected in bags within sealed bins for off-site transport.

The black and grey water from the feed barge is pumped out and is monitored and routinely removed by the feed delivery barge.

6.1.11.7.1 *Regulatory Controls*

Tassal complies with management controls as stipulated in the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005. Relevant controls are:

- **Management Control 3.7.1** Lessees must dispose of wastes from:
    - harvesting;
    - processing of produce;
    - removal of fouling organisms;
    - production; and
    - in accordance with relevant Acts or regulations and trade waste agreements and in a manner that the Secretary is satisfied will not cause an unacceptable effect on the ecology of the marine environment or nearby shorelines.
- **Management Control 3.7.2** All mortalities arising in connection with marine farming operations must be disposed of at a site that has the necessary approvals to receive this material.
- **Management Control 3.7.3** Bloodwater resulting from harvesting produce must not be released into the marine environment unless otherwise authorised by the Secretary.
- **Management Control 3.7.4** Lessees must fallow or comply with limits upon the use of a lease area if unacceptable benthic impacts specified in the relevant marine farming licence are identified through routine monitoring.

6.1.11.8 Proponent management plan to manage mass mortality events

An industry wide mass mortality contingency plan is currently being developed. Mortality retrieval by divers and airlift systems are currently used in the event of high mortality events. Disposal of mortalities is carried out as described in section 6.1.11.1.

6.1.11.9 Overall effect following implementation of mitigation measures

With proper management of wastes, including staff education, collection, containment, and prompt and efficient removal of wastes from the new proposed zone, the overall impacts to waste streams from farming activities are expected to be minimal to negligible.

6.1.12 Introduced Marine Species

Previous studies by Aquenal (Aquenal 1999) around the Eastern Farming Zone identified the introduced marine pest (IMP) species *Maoriculpus roseus (*New Zealand screw shell) during the initial environmental baseline assessment. Subsequent annual ROV surveys of substrate condition from 2000 – 2009 inclusive have recorded the presence of *Asterias amurensis* (northern Pacific seastar) on 2 occasions and *Metacarcinus novaezelandiae* (Pie crust crab) on one occasion. The IMAS Environmental Assessment of the marine farm zone extension undertaken at Creeses Mistake in 2013 identified *M. roseus* as the only introduced marine species located within the survey area. This species is widespread throughout sandy substrates in south eastern Australia. Impacts from the New Zealand screw shell mainly affect sandy substrates where large aggregations of live specimens and dead shells can form dense blankets over the seafloor, displacing native scallop and other shellfish species (Edgar 2008).

The impact of the northern Pacific seastar on soft sediment habitats in Tasmania has been the subject of extensive research (Aquenal 2008). This species occurs along Tasmania's east coast from Banks Strait in the north east to Recherche Bay in the south. Results from experimental manipulations and detailed observations of feeding have demonstrated a large impact of the northern Pacific seastar on bivalve populations, particularly those species that live on or just under the sediment surface. The northern Pacific seastar appears to be a generalist predator with strong food preferences, but can readily switch to other prey species if the abundance of preferred prey becomes low. At high densities, the northern Pacific seastar has the potential to impact a large variety of taxa, with significant and broad effects on soft sediment communities. While the northern Pacific seastar also occurs on rocky reef in sheltered habitats, its impacts on these communities remain poorly understood.

The pie crust crab is a species of crab found around New Zealand and South Eastern Australia. This species usually hides in coastal sands, leaving the top of its shell (carapace) exposed. It is a nocturnal predator and feeds on shellfish. The extent of impacts from the pie crust crab on native marine species remains largely unknown (Edgar 2008).

6.1.12.1 Assessment of the likelihood for introduced marine pest translocation by activities associated with the proposed zones

An EIS compiled by the DPIPWE in 2007 suggests several issues regarding potential translocation vectors for introduced marine pests in the aquaculture industry, namely:

- inappropriate disposal of marine farming debris from aquaculture leases
- fouling on farm boats and ballast water discharge transferred between sites, and
- translocation of fish pens around the state that may be fouled

As there will be no change in Tassal's adherence to biosecurity protocols as a result of the proposed West of Wedge development, it is expected that there will be minimal risks associated with the potential for translocation or spread of introduced marine pests in the Eastern Farming Zone.

Tassal has strict and documented internal biosecurity protocols in place and adheres to state regulations and management controls mitigating the risks associated with the potential for IMP incursions within the Eastern Farming Zone.

6.1.12.2 Potential Impacts

The translocation of introduced marine pests has the potential to alter ecological balances of marine communities. Introduced marine pests also have the potential to harm fish stocks by predation and through the creation of toxic algal blooms.

6.1.12.3 Mitigation Measures

Restricting the translocation and spread of introduced marine species is a priority for Tassal. Internal biosecurity protocols have been implemented that require full disinfection and decontamination of all equipment and boats between designated sites and stock year classes within the Eastern Farming Zone.

The following measures are employed by Tassal to minimise the risk of introduced marine species translocation:

- The use of an on-site harvest vessel. This eliminates pen movements to and from processing sites and reduces the risk of fish pens acting as a vector for IMP translocation.
- Antifouling paint is used on all farm boats. This inhibits potential IMP growth on hulls and hence decreases the likelihood of translocation by this means.
- Biosecurity protocols separate the use of most equipment between regions and any equipment that is passed between regions is thoroughly disinfected prior to transportation.
- All farming debris and broken machinery is collected and suitably disposed of on land which reduces the risk of introduced marine species translocation.
- On-going surveillance associated with compliance video surveys and inspection of farm infrastructure.

With the above mitigation measures continuing to be employed company wide, the proposed West of Wedge development is not anticipated to lead to an increase in the risk of introduced marine species translocation.

Annual ROV compliance survey databases record the presence of introduced marine species in and around lease areas as part of the annual video surveys.

6.1.12.3.1 *Regulatory Controls*

Regulatory Controls contained within Marine Farming Licence Conditions for the leases of the Eastern Farming Zone include environmental records and reporting requirements. Applicable conditions include:

- **Licence Condition 2.2** The Licence Holder must notify the Director in writing of the presence of any unusual or uncharacteristic marine flora or fauna found within the Lease Area (including any introduced marine pests). (email: mfarming.environment@dpipwe.tas.gov.au).
- **Licence Condition 2.5** The Licence Holder must give prior written notice to the Director and Chief Veterinary Officer of any proposal to move or re-deploy marine

farming equipment from a Marine Farming Development Plan (MFDP) area located in one geographic region to a MFDP located in another geographic region. Geographic regions include the south-east, north and west of the state (email: mfarming.environment@dpipwe.tas.gov.au).

6.1.12.4 Overall effect following implementation of mitigation measures

In conjunction with existing biosecurity practices and implementation of the above mitigation measures, the potential for the spread or translocation of introduced marine species as a result of the proposed amendment is considered low.

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

The proposed West of Wedge development is characterised as an exposed site. Water depth at the proposed site is approximately 40-50 metres and is subject to large swells and high wave action from prevailing on-shore winds. The seafloor throughout this area is predominantly sand of medium to large particle size, characteristic of exposed oceanic conditions.

As a result there are no sand bars or structures that will be impacted or influenced by the proposed West of Wedge development.

6.1.13.2 Mitigation Measures

As there is no expected effect of structures on sediment dynamics regarding channels and sandbars in proximity to the proposed West of Wedge development. As a result, no mitigation measures are required.

6.1.13.3 Overall effect following implementation of mitigation measures

As there is no expected effect of structures on sediment dynamics regarding channels and sandbars in proximity to the proposed West of Wedge development, no mitigation measures are required and therefore no overall effects predicted.

6.1.14 Climate Change

6.1.14.1 Sea level rise

Possible sea level rise is unlikely to have any effect on salmon growing operations at the proposed West of Wedge development. Sea level rises are more likely to affect coastal infrastructure and landforms, neither of which are associated with proposed marine operations.

Tassal is aware of predictions regarding global and local sea level rises, however due to the negligible effect sea level rise is expected to have on salmon growing operations; a detailed assessment of the

potential effects associated with sea level rise has not been taken into account, nor is it considered necessary by Tassal.

6.1.14.2 Changes in weather patterns (rainfall and wind)

Winter wind speeds increasing by up to 5% and summer rainfall decreasing by 5% (Battaglene et al. 2008) are noted within Tasmania's four salmon growing zones. Wind and rainfall changes of this magnitude are not expected to have any effect on salmon growing operational responses at the proposed West of Wedge development; therefore no consequent environmental effects on the environment by the industry are expected in response to this issue.

6.1.14.3 Water temperature and chemistry

A report by the Tasmanian Aquaculture and Fisheries Institute and CSIRO Climate Adaptation Flagship (Battaglene et al. 2008) predicts that average temperatures in southern Tasmanian waters could increase by 1 to 3°C by 2030. The probability of this temperature increase has been considered by the industry and due to its limited predicted range, current management prescriptions or procedures will not change with any significance.

To put the predicted sea temperature rise in perspective, the industry already works with an annual fluctuation in temperature of over 10°C. Tassal has developed mitigation strategies and contingencies to cope with daily temperature fluctuation, variation between zones and vertical temperature stratification within the water column.

Venturation (transferring cooler water from moderate depths – 5 to 8 m) with air is just one of the measures implemented throughout periods of warmer weather.

While it is recognised that in ocean systems 'climate change can strongly influence the distribution and abundance of marine species through changes in growth, survival, reproduction, or response to changes at other trophic levels' (Doubleday et al. 2009), the salmonid industry is well equipped to deal with the dynamic oceanic environment.

Salmonids are grown globally in various ranges of temperature and sunlight. Managing stock performance in different environmental conditions is an ongoing husbandry focus for all salmonid farmers. Therefore the potential effects of climate change on ocean temperatures is but one of many factors that Tasmanian salmonid growers already factor into their on-going business and environmental planning strategies (Pankhurst and King, 2010).

While it is clear that rising water temperatures associated with global warming will increase thermal stress and disease outbreaks (Battaglene et al. 2008), there is a general lack of knowledge about the effects of higher water temperatures and other environmental changes related to global warming on farmed salmonids. An increased research effort is required to address this knowledge gap (Battaglene et al. 2008). Tassal is a major stakeholder in the Atlantic salmon selective breeding program. The program actively targets genetic lines which have an increased temperature tolerance, among other traits.

6.1.14.4 Mitigation Measures

Tassal is preparing for climate variability and climate change and even in the face of this challenge sees potential opportunities that are emerging for Tassal and the aquaculture industry in general.

Tassal plans 15 years in advance and has a sophisticated and well maintained risk register to assist with benchmarking progress in all areas of risk mitigation.

It is difficult to predict how a changing climate will modify oceans systems; most evidence suggests that the net effect will be negative (Andre et al. 2009). The Tasmanian salmonid industry is acutely aware of the possible effects of climate change on its future sustainability. Consequently, Tassal is working closely with the local research community on a variety of issues aimed at supporting the sustainability of farmed Tasmanian salmonids in gradually warming oceans.

Challenges that may arise in relation to fish health and nutrition, can be offset by improved selective breeding for increased tolerance to higher water temperatures through the established industry breeding program.

Genetically modified organisms and the use of transgenic salmonids have been completely ruled out by industry as potential solutions to climate change (Battaglene et al. 2008).

6.1.14.5 Overall effect following implementation of mitigation measures

Tassal already manages significant annual ranges in temperature fluctuations throughout the year and has the capacity to manage further minor fluctuations in temperature due to climate change. Climate change mitigation measures are not expected to contribute to any negative effects on the environment in the proposed West of Wedge development.

In addition to developing mitigation strategies for potential risks, it is reasonable to see opportunities emerging for Tassal from climate change. As other global food productions feel the stress of climate change, it is likely that a proactive organisation like Tassal may be able to capitalise on providing a reliable source of protein well into the future.

6.1.15 Greenhouse gases and ozone depleting substances

Food producers are under increasing pressure to provide for a growing population that is demanding good quality, nutritious foods that have a minimal environmental footprint. At the same time, they face significant supply-side constraints as the costs of inputs required to produce food reach record highs.

Since 2011, Tassal has been conducting a detailed 'cradle to grave' Life Cycle Assessment (LCA) of Tassal's supply chain to gain a better understanding of the environmental impacts of producing Tassal products and to highlight areas of improvement. The LCA incorporated upstream and downstream impacts associated with the production of Tassal product and included greenhouse gas emissions, fuel use, water use and eutrophication potential. Tassal intends to perform an LCA every two reporting years.

LCA is an environmental accounting tool that quantifies the cumulative environmental impacts and natural resources embodied in a particular product or service from 'cradle-to-grave'. It provides an evidence-based approach to assist businesses in making the transition to more sustainable ways of managing their operations.

6.1.16 Environmental Management

Tassal has a robust integrated management system (TIMS) in place incorporating environment, quality assurance and workplace health and safety. Under this system Tassal has implemented environmental policies and procedures relevant to all aspects of the business.

Tassal has gained ASC certification across all of their Marine Farming Zones and Primary Processing Facility, including the Eastern Farming Zone. Gaining independent third party certification has allowed Tassal to validate its integrated management system across these areas. Annual re-certification ensures continuous improvement.

Tassal has been in partnership with WWF Australia since 2012. This partnership underpins Tassal's mission to improve environmental practices. Through this partnership Tassal aims to be the leader in responsible aquaculture production in Australia.

Tassal is demonstrating its commitment to environmental and social sustainability through the development and growth of its Environmental and Sustainability department. This department is led by the Head of Sustainability and covers wildlife management, marine and land based environmental compliance, environmental certification, fish health and community engagement.

Tassal has also introduced a System Team Leader role into all their Marine Farming Zone. This role acts as a TIMS representative on each site and is responsible for providing a link between Quality Assurance, WH&S and Environmental and Sustainability departments within Marine Operations. System Team Leaders are also responsible for all internal compliance with TIMS requirements, including monthly WH&S inspections and environmental checklists.

All Tassal employees are required to sign off on relevant environmental policies and procedures to demonstrate their understanding. The Tassal induction process includes a detailed presentation which explains the company's systems and environmental commitments and responsibilities.

Tassal has a detailed Contractor Management Procedure. This procedure details the process that must be adhered to at Tassal to ensure that contractor work is controlled and coordinated. Correct application of this procedure ensures that good coordination, cooperation, communication and alignment with facility operations exist between contractors and Tassal employees. This procedure will also ensure that the only contractors that have the highest level of safety, quality and environmental management work at Tassal.

The marine farming industry in Tasmania is regulated by DPIPWE and the EPA under the *Environmental Management and Pollution Control Act 1994 (EMPCA)*, the *Marine Farming Planning Act 1995* (MFPA) and the *Living Marine Resources Management Act 1995* (LMRMA).

Prior to commencing marine farming operations on lease areas, leaseholders are required to collect baseline environmental data on sediment biology, chemistry, current flow and habitat characteristics within and outside lease areas at various compliance and control sites.

Management controls within the Tasman Peninsula and Norfolk Bay Marine Farm Development Plan (MFDP) November 2005 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, recording and reporting requirements that are dependent on the species being licensed. For finfish licence holders, production data must either be reported or made available

for audit on request. Production data can include information on feed, smolt inputs, production planning and food conversion ratios and this can be 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 12 monthly or in accordance with their stocking and fallowing regimes. Industry 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, 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 can be broken down into two main categories:

1) any visible farm derived impact at a compliance site 35 m outside the lease boundary or;

2) 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 35 m 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.

When a breach of licence conditions is detected by DPIPWE as a result of these surveys, immediate action can be taken as required to ascertain the level and extent of the breach and the cause of the specific problem. DPIPWE 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 regulatory 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.

As discussed in section 5.1.4, Tassal commissioned a voluntary water quality monitoring program in the Eastern Farming Zone in early 2014, and established sampling stations in the vicinity of existing lease areas (i.e. Creeses Mistake and Parsons Bay), along with sites in sheltered waters (White Beach) and a more distant, exposed location west of Wedge Island. The latter site represents a reference

location where water quality characteristics are considered to be from a 'slightly to moderately disturbed system' (ANZECC 2000).

6.2 Impacts on the Human Environment

6.2.1 Visual

Tassal engaged an independent third party consultant to conduct the visual impact survey for the proposed West of Wedge development. All information provided below is available in the Environmental Dynamics Report 2016 and letter (written October 2017) as Appendix 14.

6.2.1.1 Specific visual impact assessment for proposed zone

The study followed a standard visual impact methodology for facilities proposed for regions with both landscape and seascapes, based on the *Guidelines for Landscape and Visual Impact Assessment, 2nd ed.* (Landscape Institute and Institute of Environmental Management & Assessment, 2002); and the *Guide to Best Practice in Seascape Assessment* (Countryside Council for Wales, Brady Shipman Martin, and University College Dublin, Marine Ireland/Wales INTRERREG Report No. 5, 2001). It describes land and seascapes surrounding the proposed West of Wedge development and estimates the visual impact on the various observer groups existing in the area. The method has been applied previously to the Macquarie Harbour salmon aquaculture industry EIS.

In brief, the method first assesses the impact of the proposed West of Wedge development on the local landscapes, without considering whether or not an observer is present, in order to quantify its potential visual impact. It then assesses the visual impact of the proposed development on observer groups, such as residents, bushwalkers and mariners. Tables detailing assessment criteria are included in the appendix to the visual impact study report (Appendix 14).

6.2.1.1.1 *Proposed infrastructure (including height above sea level and colour)*

Fish pens and feed barges are the most visible marine lease infrastructure. The proposed West of Wedge development will have 64 fish pens arranged over four leases in a grid mooring system. The pens used on-site have a circumference of 168 m. The perimeter of a pen is about 0.5 m high, and most of the pen is less than 1.5 m above sea level, however with anti-predator nets, pens will stand approximately 3 m high. Pens will also have a central bird stand which is approximately 4.2 m high.

Fish pens, by regulation, are grey/black in colour. From sea level, the bird net and associated stands are the most visible elements of the cage configuration; these are approximately 4.2 m at their highest point. Other visible infrastructures are cage handrails, feed pipe, and the collar of the cage itself. The visibility of these structures is largely dependent on the elevation of the observer; this effect is lessened as an observer's height approaches sea level.

Additional infrastructure consists of a feed barge on each stocked lease (i.e maximum of three barges located within the proposed development), which will be a facility permanently moored within a lease area. The proposed feed barges will consist of two design configurations (refer to section 3.4.4) which are slightly different in dimensions than traditional feed barges. Though different than traditional barges, digital modelling of these vessels determine that the changes in lease infrastructure will not

result in noticeable changes to those first established in the visual impact assessment conducted August 2016 (see cover letter in Appendix 14).

Various aquaculture service vessels will also service the proposed West of Wedge development but will not be permanent infrastructure fixtures within the lease.

Most observers of the proposed West of Wedge development would have limited views of the leases from low elevation and at distances greater than 4 km.

Figure 6.10, taken from the visual impact study report, illustrates how difficult it is to see a marine lease at such distances, even under ideal viewing conditions (note: the photographs portray an existing Tassal lease – Butlers Point; this is to give a 'real-life' visual representation of what a marine farming lease looks like from a distance).

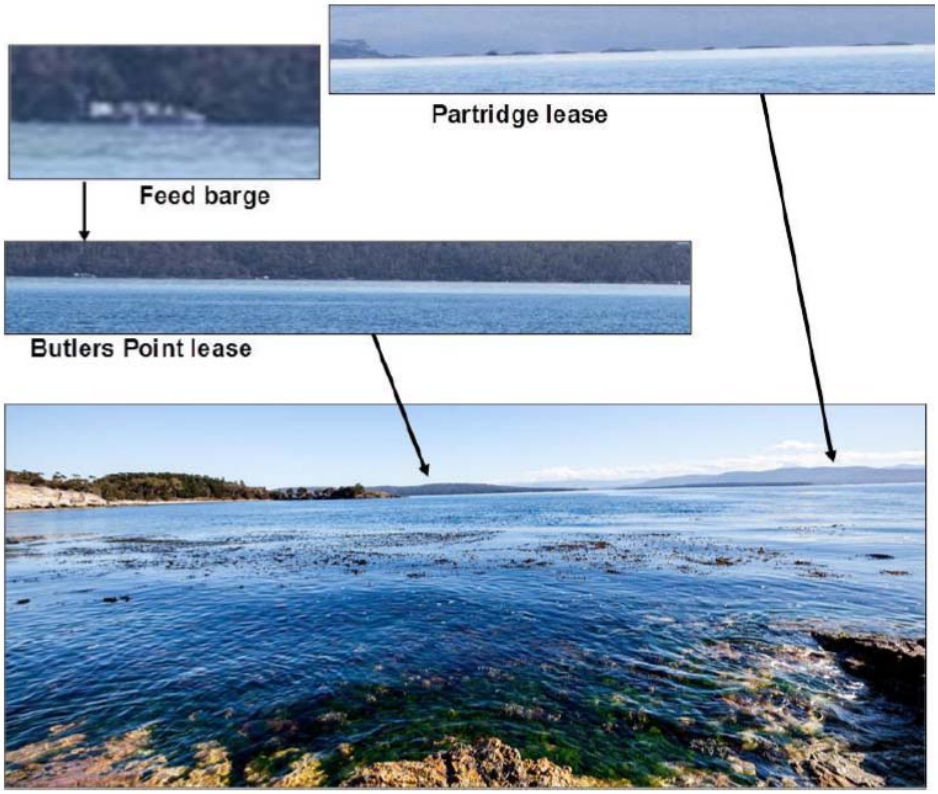


Figure 6.12 View of an observer on the shoreline of two existing marine leases. The leases are barely visible to the naked eye, but can be seen by enlarging the relevant parts of the high-resolution photograph. The Butlers Point lease is just under 4 km from the observer, and the Partridge lease is about 3.5 km from the observer.

6.2.1.1.2 *Sensitive receptors having a direct view lines to the proposed zone*

Figure 6.13 shows the location of the proposed West of Wedge development in Storm Bay. For the top half of the zone (marked by the southernmost gold strip) there is not a direct line of sight to the proposed development because of the position of Wedge Island. A direct line of sight to the is possible at locations at the southern end of the southernmost gold strip however, there are no residences on the coast south of Wedge Island making the visual impact negligible.

Moving northwards, there are only a few residences on the coast east of Wedge Island and Wedge Island completely blocks the line of sight to the proposed development for residences in the zoned marked by the green strip.

Further north, the zone marked by the next gold strip does not have a full line of sight to the proposed development because of Wedge Island. At present there are only a few residences in this zone, at the south end of White Beach Road, but a small subdivision is planned at the location.

Moving along White Beach Road, the headland blocks line of sight to the proposed development for residences in the zone marked by the green strip. Residences on the coast in the north part of Wedge Bay, from the north part of White Beach through to Apex Point (the zone marked by the gold strip), do not have a full line of sight because of Wedge Island and the headland.

There are no residences on the coast west of the Tassal shore base at Badgers Cove. However, the Roaring Beach Conservation area has a direct line of sight to the proposed West of Wedge development with potential visual impact on tourists and others that frequent this area.

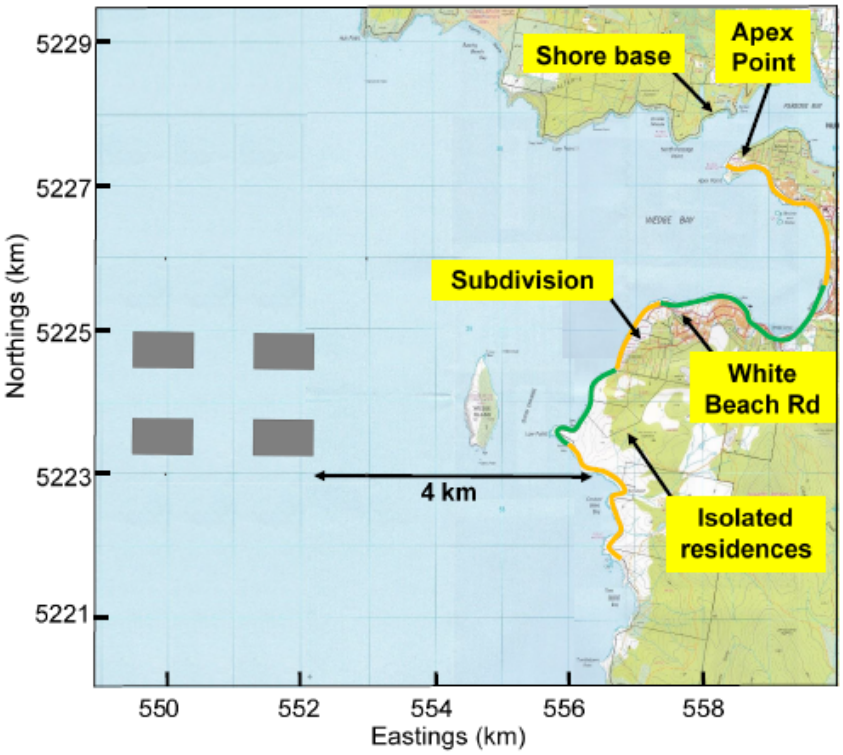


Figure 6.13 Map of the four proposed areas containing surface-located marine farming equipment, west of Wedge Island in Storm Bay. The coastal areas marked in gold have residences with at least some line of sight to the area. Coastal areas marked in green do not have a low-level line of sight to the area. There are no residences west of the shore base, or south of the isolated residences that overlook Wedge Island.

Figure 6.14 (top) shows that while many residences will have at least some line of sight to the proposed development the same residences can already see fish pens at the more sheltered Creeses Mistake lease (which is closer than the proposed development). Figure 6.14 (bottom) shows a photo of the Creeses Mistake lease taken from Apex Point at an elevation of about 40 m. Most coastal observers will be at a lower elevation than the location at which the photo of Creeses Mistake lease was taken. For all these observers at low elevations, the proposed development will appear set against a backdrop of the distant land, in turn making them difficult to see, creating a minimised visual impact. The only observers who will have direct line of sight to the proposed development are those in the vicinity of Roaring Beach, who have an open ocean view (in a SW direction) and visitors to Wedge Island, who will have a direct view of the proposed development if they climb to the higher parts of the Island.

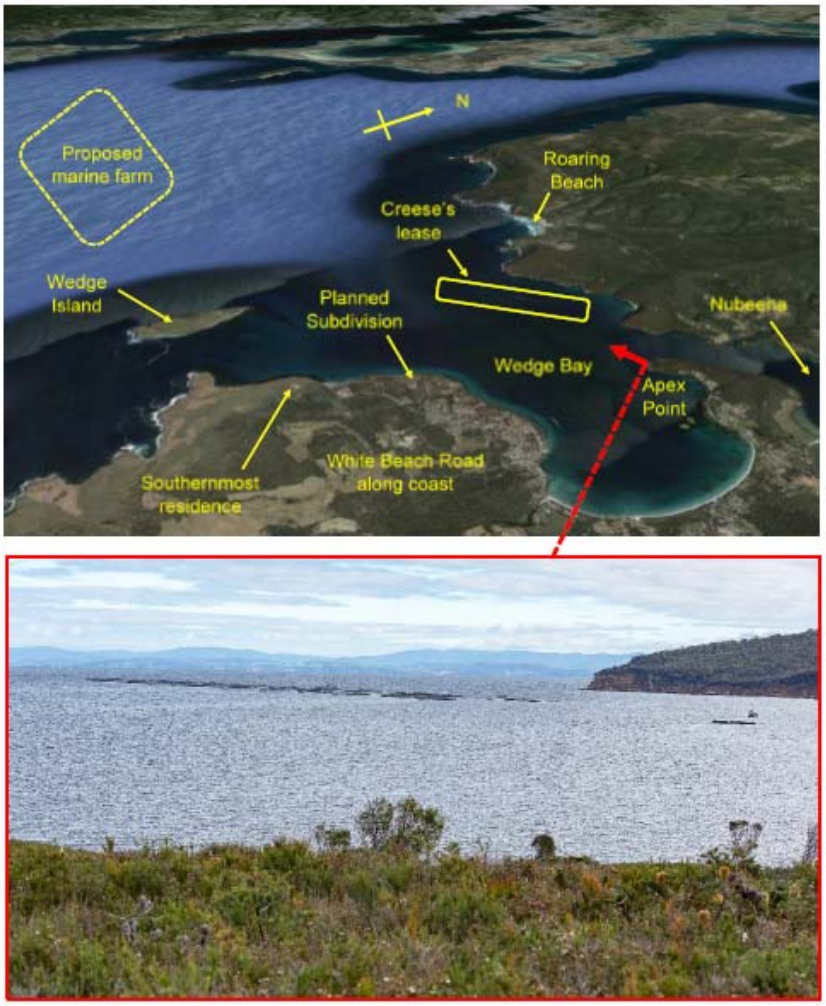


Figure 6.14 Top – Google Earth view of the proposed West of Wedge development and the surrounding area looking NW from the Tasman Peninsula. Bottom – View of the Creeses Mistake lease looking west from Apex Point, at an elevation of 40 m.

6.2.1.1.3 *Likely visual impact (include photomontages, images, plans and elevations)*

Visual impact relates to changes in available views of the landscape and the effect of these changes on a person's visual amenity. The visual impact of the proposed West of Wedge development is assessed by considering the sensitivity of an observer, or observer group, and the scale of the visual impact.

Three main observer groups were identified in three landscape regions for the West of Wedge development area:

1. Southern – residences in coastal landscape on the coast south of Wedge Island.
2. Wedge Bay – residences in the landscape associated with Wedge Bay with residences along White Beach Road through to Apex Point.
3. Northern – tourists/visitors in coastal landscape west of the Tassal shore base at Badger Cove.

The visual impact study report examines the likely impact on the visual amenity of these main observer groups and landscape regions by applying specific tables of criteria. These tables can be found Appendix 14.

Table 32 shows the result of applying the criteria to the main observer groups. The sensitivity of the southern and Wedge Bay region residents would be 'medium to high', but the scale of impact would be 'low', because the southern landscape region has only a few residences, and the change in the landscape will only be minor, especially for observers in the vicinity of the planned subdivision and White Beach Road. In the Wedge Bay landscape region, the distance to the proposed West of Wedge development means there would only be minor changes in the observer views. In the northern region, the change in the views across Storm Bay will be very minor because the distance puts the proposed West of Wedge development over the horizon, and there will be few people affected.

Table 32 Observer Impact Assessment

Region	Sensitivity	Scale of Impact	Impact
Southern	Medium to High	Low	Low to Medium
Wedge Bay	Medium to High	Low	Low to Medium
Northern	Low to Medium	Low	Negligible to Low

Figure 6.15, Figure 6.14 and Figure 6.16 show the actual view of the few residences that have a line of sight to the proposed West of Wedge development.

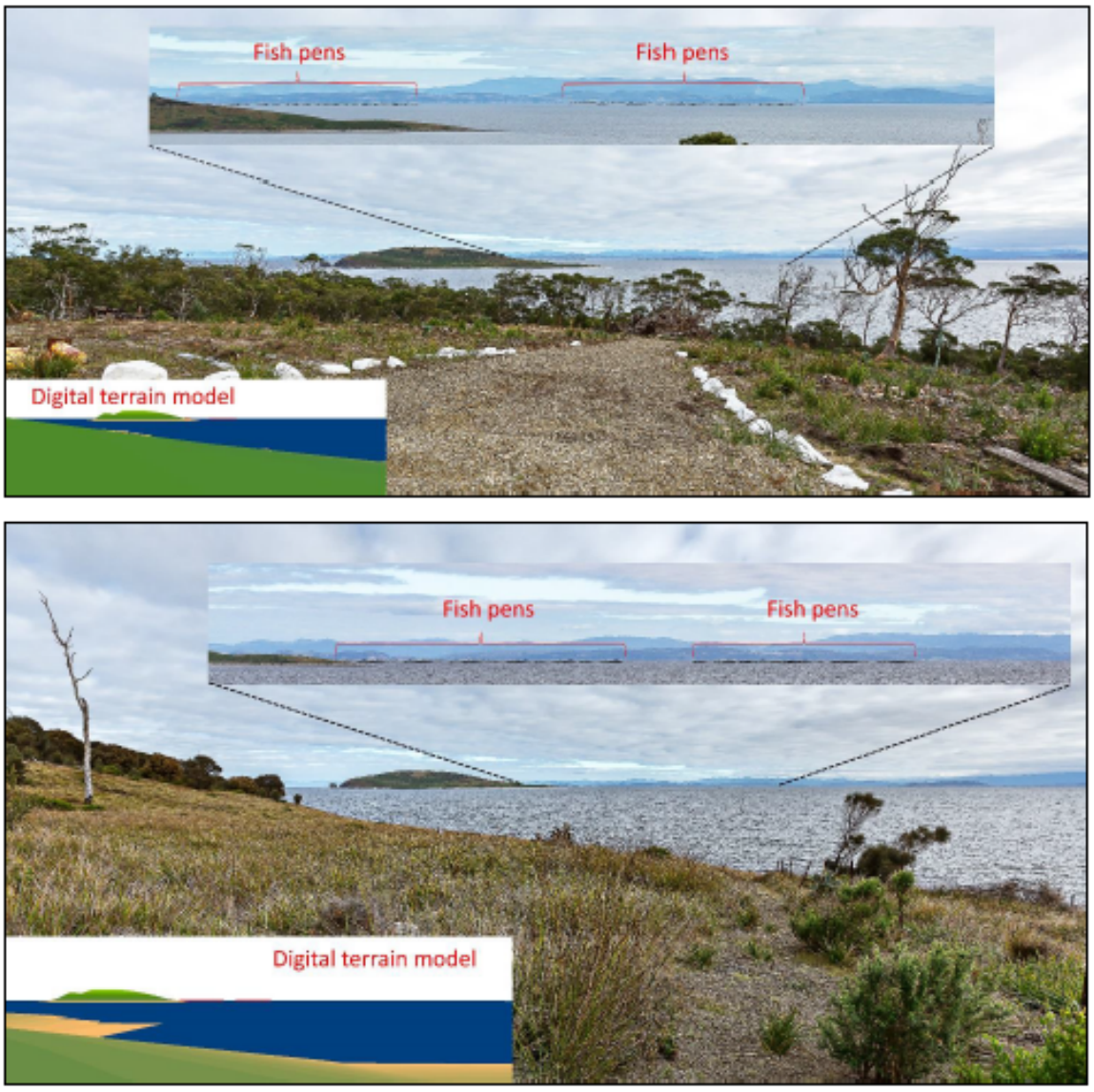


Figure 6.15 Top – view from isolated residence east of Wedge Island, at elevation of 30 m. Bottom – view from the north end of the planned small subdivision.

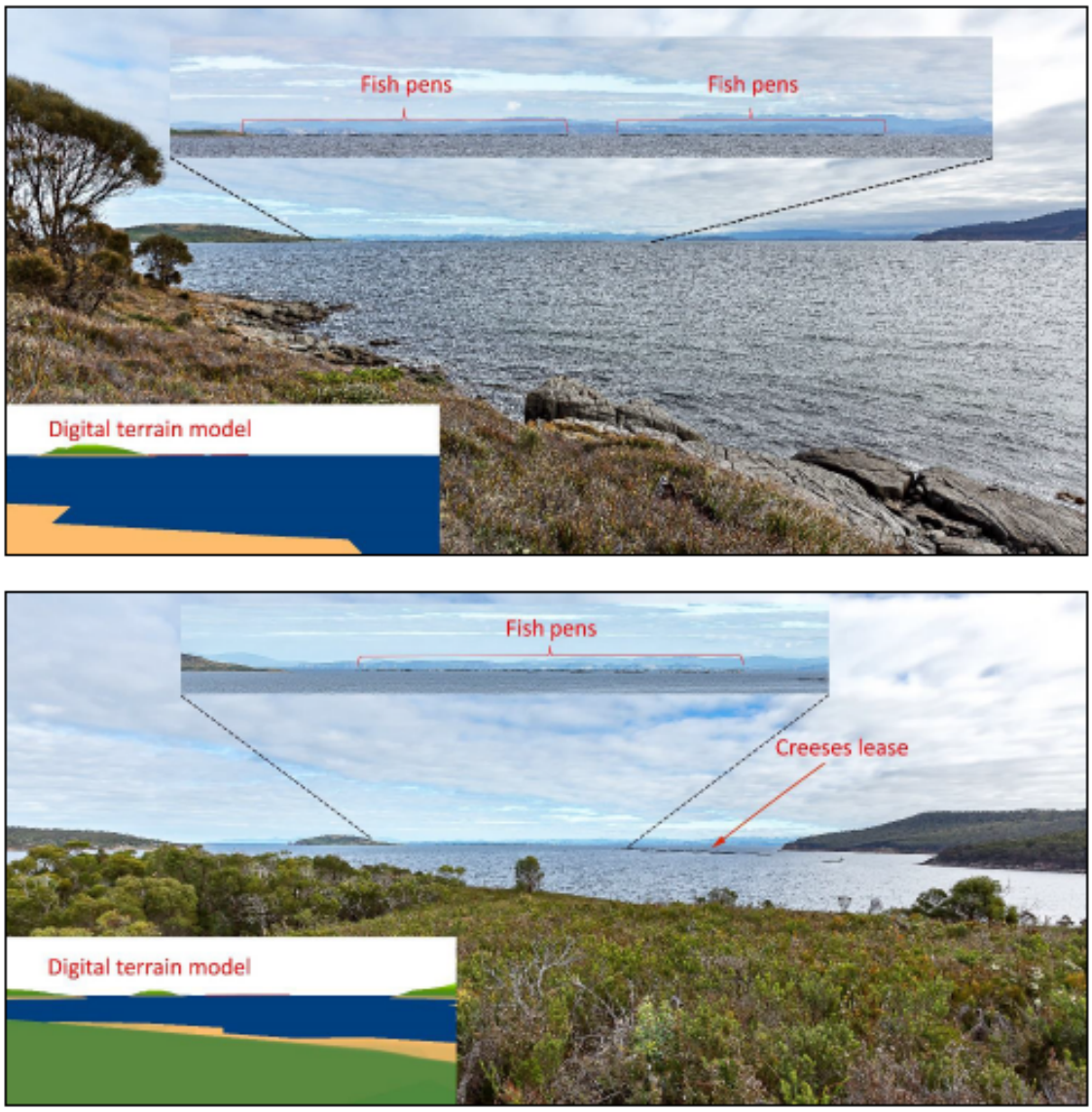


Figure 6.16 Top – view from residence on White Beach Road, north of the planned subdivision. Bottom – view from the Apex Point public reserve, at an elevation of 40 m.

In addition to the three major observer groups there are also minor observer groups including people visiting Wedge Island, mariners passing the proposed West of Wedge development and bushwalkers using tracks on the coast south of Wedge Island.

Sensitivity of these groups would vary from low to high however, the scale of impact would be low as the proposed leases are not strong visual features at a distance of 2 km.

Mariners in the immediate vicinity of the proposed West of Wedge development would experience the largest change to the existing views of the seascape. Some mariners would be used to marine farming leases, for example people on commercial vessels. Others will be on the water for recreational purposes, and may not have seen a marine lease before. Whether observers would consider the

proposed West of Wedge development to have a positive or negative impact is not a question with a simple yes or no answer. People concerned about the negative visual impact of a marine lease tend to see merit only in a land and seascape that is free of non-natural visual components.

Table 33 shows the result of applying the criteria to the three landscape regions. The sensitivity factor measures the extent to which a landscape can accommodate change without significantly affecting its character. The southern and Wedge Bay landscapes include some features of human development and usage, so a change in these landscapes could vary from low to high, resulting in a moderate classification. The northern landscape is largely free of such features, with the Roaring Beach area identified as a conservation area. A change to this landscape would result in a greater change in its character making it a high sensitivity classification.

The proposed West of Wedge development would have a moderate effect on the southern landscape at coastal locations south of Wedge Island; no effect at coastal locations due east of Wedge Island where the proposed leases would not be seen because of Wedge Island; and minor effect at coastal locations in vicinity of the new subdivision, where views of the proposed leases would be partly blocked by Wedge Island and because there are more elements in the landscape in these views potentially making the proposed leases un-noticeable by a casual observer.

In the southern and Wedge Bay landscapes the landscape impact factor would be adverse, but not enough to warrant a major adverse classification. The classification would therefore be judged to be minor adverse. The northern landscape would have a neutral impact classification because for observers on Roaring Beach the two proposed northern leases would be close or at the horizon, depending on the elevation of the observers. The proposed West of Wedge development would therefore have a negligible impact on the landscape.

Table 33 Landscape Impact Assessment

Region	Sensitivity	Scale of Impact	Impact
Southern	Moderate	Moderate to none	Minor Adverse
Wedge Bay	Moderate	Minor	Minor Adverse
Northern	High	Negligible	Neutral

6.2.1.1.4 *Overall assessment*

The visual impact study report does not say whether the visual impact of the proposed West of Wedge development is acceptable or not acceptable. Some environmental impacts can be assessed by reference to accepted standards, for example air quality and noise, but there are no formal guidelines in Tasmania regarding visual impact assessment standards.

Three landscape regions and major observer groups were identified in the visual impact study. The southern and Wedge Bay landscape values have been assessed as ordinary, while the northern landscape value has been assessed as high.

The southern and Wedge Bay landscape sensitivity factors have been assessed as moderate, while the northern landscape sensitivity landscape factors are considered high. The scale of impact for the three landscapes has been assessed as negligible to moderate. The southern and Wedge Bay landscape

impact classifications have been assessed as minor adverse, while the northern landscape is considered neutral, because the proposed northern leases are at the horizon for an observer at low elevation, and the southern leases are over the horizon.

For residents in the southern and Wedge Bay landscapes, the view of Storm Bay is a daily fixture however, so is the aquaculture usages in the area, therefore their sensitivity classification is medium to high. Observers in the northern landscape are visitors to the area, and the views along the coast are considered of primary importance, making the sensitivity classification low to medium.

The scale of impact only considers available views which makes a low impact classification appropriate for all the major observer groups. The southern landscape has only a few residences, and there will only be a minor change in the available views from White Beach Road. The distance of the proposed West of Wedge development to the Wedge Bay and northern landscapes gives these regions a low impact classification.

These sensitivity and scale of impact assessments leads to an overall observer impact classification of low to medium for observers in the southern and Wedge Bay landscapes, and a negligible to low for observers in the northern landscape.

Minor observer groups sensitivity may vary from low to high, but the scale of impact is considered low, therefore the observer impact factors for these groups would vary from negligible to medium.

6.2.1.2 Mitigation Measures

6.2.1.2.1 *Regulatory Controls*

The Tasman Peninsula and Norfolk Bay Marine Farm Development Plan (November 2005) places the following regulatory controls on licence holders (controls listed are those relevant to salmonid farms):

- **Management Control 3.9** Visual Controls
    - **Management Control 3.9.1** Lessees must ensure that all marine farming structures and equipment on marine farming lease areas conform to the following controls:
        - **Management Control 3.9.1.1** All fish cages, buoys, netting and other floating marine 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
        - **Management Control 3.9.1.2** 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
        - **Management Control 3.9.1.5** The lease area must be kept neat and tidy to a standard acceptable to the Secretary
        - **Management Control 3.9.1.7** Lessees are to ensure that light generated from marine farming operations does not cause a nuisance. The Secretary will determine what constitutes a nuisance.

6.2.1.3 Overall effect following implementation of mitigation measures

The visual impact study assumed the above mitigation measures will be applied, since they are standard requirements for all marine leases. As the proposed West of Wedge development is a new marine farming development it will be viewed as a new landscape element, and thus impact to users and residents in the areas identified in the visual impact study is considered to be minor adverse.

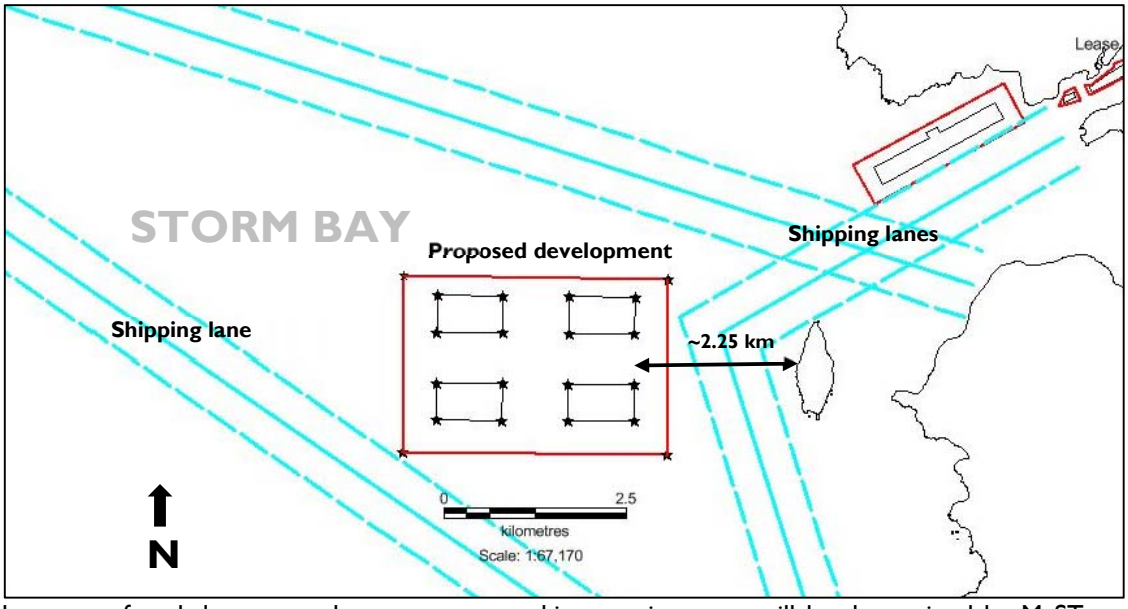
6.2.2 Navigation

The proposed West of Wedge development runs parallel to the western shoreline of Wedge Island. There are navigable passages to the east and west of the proposed areas where surface located marine farming equipment may be present (shown in

Figure 6.17). To the east, the navigable channel is approximately 2.25 km across between the east side of the two eastern surface-located marine farming equipment areas and Wedge Island (shown in

Figure 6.17). To the west, the navigable channel extends out into Storm Bay with most commercial vessels utilising the main shipping lane. (shown in Figure 4.6 and

Figure 6.17) to access the port of Hobart. The area of exclusion is expected to be restricted to 45



hectares of each lease area, however, any marking requirements will be determined by MaST and DPIPWE to ensure safety of navigation and of marine farming operations.

Figure 6.17 Navigational passages around the proposed West of Wedge development, areas depicted within the zone are the 45 hectare areas where surface located marine farming equipment may be deployed.

6.2.2.1 Results of consultation with maritime stakeholders – Tasports, MaST and local boating clubs

TasPorts have been consulted and advise that the proposed West of Wedge development will have no impact on commercial shipping.

The marine farming industry's progression to more exposed coastal waters raises a number of navigation and safety concerns both internally within the company and also for other commercial and recreational users of Storm Bay. Tassal has liaised extensively with Marine and Safety Tasmania (MaST) to address a number of these concerns and will continue to work with both MaST and key stakeholders as these proposed sites are developed.

Consultation with yachting and boating clubs (refer section 4.1.2) revealed that some recreational boaters have navigational concerns directly related to the proposed development, especially at night and when there is high wind and swell events.

6.2.2.2 Potential Impacts

Some mariners will be displaced by the proposed development, however navigation impacts are considered minor. Altering course to avoid the area containing surface marine farming equipment when under way is unlikely to add noticeable time or distance to vessels travelling the most common navigable paths.

6.2.2.3 Mitigation Measures

Tassal is committed to the safety of seafarers in all waterways where operations exist and will continue consultation with regulatory and boating organisations to work pro-actively in providing the best solution to any navigational issues that may arise. To alleviate initial concerns regarding the proposed location of the West of Wedge development, Tassal has chosen to move the location of the proposed development 400 m northwards. This creates additional distance from the recreational navigation lanes given by MaST (Figure 4.6) and attempts to minimise impacts on yacht races and recreational boat users in the area.

Licencing requirements as issued by DPIPWE require marine farming leases to be lit and marked in accordance with the *Marine Farming Planning Act 1995*.

6.2.2.3.1 *Regulatory Controls*

The Tasman Peninsula and Norfolk Bay Marine Farm Development Plan (November 2005) places the following regulatory controls on lease holders (controls listed are those relevant to salmonid farms):

Management Control 3.10 Access Controls

3.10.1 Lessees must mark the external boundaries of the lease area in whatever manner is required by the Secretary and by the relevant authority under the provisions of the *Marine and Safety Authority Act 1997.*

3.10.2 Lessees must identify the lease area in a manner specified by the Secretary.

3.10.3 Anchors and mooring lines that extend outside the lease area must be at least 5 metres below the surface at the boundary of the lease area and must not extend outside a marine farming zone.

The draft amendment proposes the following special management controls;

Zone 16 – (west of Wedge Island)

3.14.10 Within Zone 16, an area or areas that, in total, do not exceed 180 ha area is to be known as the farmed area.

The farmed area may be defined by coordinates, physical markers visible on the water surface or as otherwise specified in the relevant marine farming licence.

3.14.11 Within Zone 16, the lessee is to ensure that all marine farming equipment is contained within the farmed area, 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

3.14.12 The lessee must mark any area or marine farming equipment within Zone 16 in whatever manner is required by the Secretary and by the Marine and Safety Authority.

3.14.13 The leaseholder of any marine farming lease allocated within Zone 16 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

Proper maintenance of the leases and compliance with authorities such as MaST and the DPIPWE Marine Farming Branch will ensure that there are minimal impacts to navigating mariners resulting from the proposed West of Wedge development.

The proposed West of Wedge development is positioned such that impacts on navigation are minimised, with navigable passages on both sides of the proposed zone and between areas containing surface located marine farming equipment (during daylight hours).

6.2.3 European and Other Heritage

There are no places of heritage significance within the proposed West of Wedge development or surrounding area.

6.2.4 Aboriginal Heritage

6.2.4.1 Consideration of places within the area listed on the Tasmanian Aboriginal Site Index (maintained by Aboriginal Heritage Tasmania) including consideration of cultural landscapes

Aboriginal Heritage Tasmania (AHT) has advised that the proposed West of Wedge development would not impact on any areas of Aboriginal significance including cultural landscapes.

6.2.5 Reservations

6.2.5.1 Outcomes of consultation

Tassal has consulted with National Parks and Wildlife and the Port Arthur Historical Site Authority throughout the stakeholder consultation period. An invite was given for these groups to attend a meeting held 17 February 2017 with Tasman Council at the Tasman Peninsula. The Tasman Parks and Wildlife Regional Manager and the CEO of the Port Arthur Historical Site Authority both attend the meeting where a presentation of the proposed West of Wedge development was given. Both parties were supportive of the development.

6.2.5.2 World Heritage Area properties and values

The Tasman Peninsula accommodates the Port Arthur Historic Site and the Coal Mines Historic Site, both of which are inscribed on the UNESCO World Heritage List. Both of these sites are located in excess of 10 km from the proposed marine farming zone.

6.2.5.3 Ramsar site properties and values

There are no Ramsar sites within the proposed zone or surrounding area.

6.2.5.4 Marine Reserve properties and values

There are no Marine Reserves within the proposed zone or surrounding area.

6.2.5.5 National Park properties and values

The Tasman National Park is the only National Park that may be impacted by the proposed West of Wedge development.

The potential impacts include:

- noise
- visual amenity
- on-shore farm debris

6.2.5.6 Other Conservation Areas

Other conservation areas occurring in the vicinity of the proposed development that may be impacted include:

- Wedge Island Conservation Area
- Crooked Billet Bay Conservation Area
- Roaring Beach Conservation Area
- Apex Point Conservation Area
- North Passage Point Conservation Area
- Brother and Sister Conservation Area.

The potential impacts include:

- noise
- visual amenity
- on-shore farm debris

6.2.5.7 Mitigation Measures

As discussed in section 6.1.11.7, Tassal have a comprehensive Marine Operations Waste Management Plan and Waste Management Policy in place to minimise farm debris.

Noise is not expected to impact the amenity of the Park or other reserves due to the distance from the proposed development, however noise mitigation will be employed in order to minimise impact on other receptors and is discussed in section 6.2.6.4.

The proposed West of Wedge development is not a dominant feature in the view from the Park, walking tracks such as the Three Capes Track or other reserves. Walking tracks and other useable areas of the Park and reserves are significant distances from the proposed West of Wedge development and the vegetated Wedge Island and other coastline to the east of the proposed development obscures the horizon, and as a consequence, is predicted to somewhat limit or block the visual impact at this location (see section 6.2.1.1.3).

6.2.5.8 Overall effect following implementation of mitigation measures

Tassal does not expect any significant impacts on the Tasman National Park or the other conservations areas identified above.

6.2.6 Noise

Tassal engaged an independent third party consultant to conduct the noise impact study for the proposed West of Wedge development and followed methodology for assessing or predicting noise from marine farm leases, developed in consultation with EPA. Additional information is provided *Tassal Operations Pty Ltd: Proposed West of Wedge Island Marine Farming Zone: Noise Impact Study, August 2016* as Appendix 4.

6.2.6.1 Sources of noise

There are five main operations that produce the noise associated with the marine farming of finfish. These operations are described below.

The noise impact assessment methodology first determines the noise emissions from each operation individually, and then uses a model to predict the noise at distant locations. The assessment assumes a worst-case scenario of farming operations, whereby all the operations happen at the same time, and are all located at the eastern boundaries of the four proposed marine leases, which is closest to residents on the coast due east of Wedge Island, the west end of White Beach Road and Lory Point, north of the proposed development.

The equipment and infrastructure in the proposed West of Wedge development will be similar to that found on-site at other Tassal leases in the area.

6.2.6.1.1 *Feed barge*

A feed barge will be permanently moored at each of the four leases and will be of steel construction with feed silo storages. As discussed in section 3.4.4, the preferred feed barge would be of a 'ship-like' construction, different from the feed barges currently used at Tassal marine leases. The barge will contain a centralised feeding system, a sound proofed generator room and amenities for the work crew. Facilities will consist of an operator station, mess area, with kitchen and toilet/shower facilities; there will be no overnight accommodation on the barge. The barge will normally operate during daylight hours; i.e. working hours as listed previously in section 3.4.4.

The barge will be customised to mitigate noise emissions for the generators and the feeding system. Noise mitigation measures are designed and built to meet marine farming licence conditions, lessening the level of noise reaching receptors within the surrounding areas. With any application of deployment of a feed barge in a marine farming lease, DPIPWE requires noise predicting modelling to be carried out prior to deployment.

6.2.6.1.2 *Support vessels*

Tassal operates support vessels associated with marine farming to access the farming zones. This noise source is mainly generated during the day time period.

6.2.6.1.3 *Pen lighting*

The lighting of sea pens encourages growth at the smolt stage of development, and reduces the incidence of precocious maturation. Lights are powered by generators on the feed barge central to

each lease within the proposed West of Wedge development. The generator may be required to operate 24 hours per day depending on environmental conditions.

When in-cage sub-surface lighting is used, the standard configuration is nine 1000 Watt Metal Halide or LED lights in each pen. Typically these are deployed between June and November. Before any such lighting is deployed at the proposed West of Wedge development, the generator will be evaluated for noise output.

6.2.6.1.4 *Venturation*

Venturation is the process of raising dissolved oxygen (DO) levels in the water for fish health management purposes during the warmer summer months, by forcing air into the water using a compressor. Although venturation is not expected to be used at the proposed West of Wedge development due to exposed oceanic conditions, infrastructure will still be installed.

6.2.6.1.5 *Net washing*

Unless removed for cleaning on-shore, nets are cleaned in-situ to remove biofouling and maintain the water flow through the cages for fish health. In-situ net washing is generally a quiet operation, typically producing a L_{eq} of approximately 78 dB(A) at 2 m. This noise generating activity is only undertaken during the day.

6.2.6.1.6 *Harvesting*

Tassal's harvesting vessel operates fish harvest stunning equipment and generators that have the potential to produce significant noise. The intensity of noise produced from harvesting operations has been significantly reduced, with mufflers on the stunners. As such harvesting is now a much quieter operation.

6.2.6.1.7 *Shore facility*

There is no new shore facility associated with this proposed development. However, the marine traffic associated with this development will work from Tassal's shore facility at Badger Cove, Nubeena, and related marine traffic noise will increase to and from this facility.

Shore facility noise sources include vessel movements, forklifts, haulage, and light vehicle movements.

6.2.6.2 Foreseeable variations in noise generated during the start-up phase should be identified and any temporary mitigation requirements specified.

All noise producing equipment introduced to the proposed West of Wedge development will undergo a thorough noise evaluation, with mitigation measures taken if the equipment exceeds WH&S and environmental requirements.

6.2.6.3 Potential for noise emissions (during both the construction and operational phases) to cause nuisance for nearby sensitive receptors.

The Marine Farming Branch of DPIPWE has worked in consultation with the EPA to determine appropriate noise permit conditions for marine farming leases. From the point of view of regulating noise emissions, there is little difference between a marine farming lease and any other industry in Tasmania. The nearest residences to the proposed West of Wedge development are in fairly exposed coastal areas, so the local background noise levels are expected to be of ordinary rural areas.

The EPA specifies that the standard noise level limits for a new industry in rural area (i.e a new marine farming lease in Storm Bay) are;

- Day (0700 to 1800 hrs) 45 dBA
- Evening (1800 to 2200 hrs) 40 dBA
- Night (2200 to 0700 hrs) 35 dBA

Slightly more stringent noise limits may be specified for new facilities in rural areas that have occasionally very low background noise levels, but the Storm Bay area is not such an area.

To ensure that potential noise impacts are thoroughly identified for the proposed West of Wedge development, Environmental Dynamics were engaged to evaluate potential noise impacts and provided recommendations to avoid nuisance noise. The subsequent report titled *Tassal Operations Pty Ltd: Proposed West of Wedge Island Marine Farming Zone: Noise Impact Study, August 2016* as Appendix 4.

Work conducted previously for Tassal's Sheppards Point lease has shown that any intrusive qualities of the noise emissions from fish farming activities are limited to weak tonalities that are not particularly attention-grabbing. The Environmental Dynamics (2016) survey found that there is no apparent modulation in the noise emissions from farming operations; low frequency noise is reduced by spreading over large distances (>1500 m), and the only impulsive characteristics of noise emissions associated with salmon aquaculture is from the acoustic stunners used in the harvesting of salmon, which are not audible at distances greater than 1500 m.

All sources of noise were identified in the Environmental Dynamics report, and were based on detailed measurements taken by the 2012 noise level survey of the Sheppards Point marine farm lease (see Table 34).

Table 34 Expected noise levels from noise sources on the proposed leases

	L_W	---------L_{eq} noise levels (dBA re 20 µPa)-------		
Operation	**dB re 1 pW**	**30 m**	**4 km**	**6 km**
Feed Barge gen sets	97	59.0	14.2	9.6
Single fish feeder	98	60.2	- 2.5	- 8.6
Fish Bathing	108	70.1	23.3	18.6
Net Washing	97	66.5	18.9	14.3

Harvesting	108	70.2	16.5	10.6
Heavy lift	101	63.0	14.3	8.5
Single vessel	105	67.0	18.8	14.0

Worst-case noise emission scenarios for the proposed development were also conducted in the study (Environmental Dynamics 2016) (see Table 35).

Table 35 Worst-case noise emission scenarios

Operation	**4 km (dBA)**	**6 km (dBA)**
Four feed barge gen sets	2 x 14.2	2 x 9.6
Six fish feeders on each barge	6 x -2.5	6 x -8.6
Fish bathing	23.3	18.6
Net washing	18.9	14.3
Harvesting	16.5	10.6
Heavy lift	14.3	8.5
Eight vessels on each lease	8 x 18.8	8 x 14.0
TOTAL	**30.1**	**24.2**

For all four leases operating at the same time, each carrying out all the marine operations listed in Table 35, the total day time noise level at the nearest residences is predicted to be:

$$2 \times 30.1 + 2 \times 24.2 = 34 \text{ dBA}$$

This prediction is under the day time noise level limit of 45 dBA that is usually set by the EPA for new industry in a rural area.

A target noise level of 50 dBA is usually considered to be acceptable when assessing noise impact on people engaged in recreational activities near an industrial facility [see Table 1 of the *Environment Protection Policy (Noise) 2009]*. In the above worst-cased scenario, noise levels are predicted to be above 50 dBA at distances closer than about 480 m from where the combined farming operations are happening. People on the shore (e.g. Wedge Island), and people on vessels or kayaking along the coast are approximately 2 km from the leases. Only people in vessels passing close to the leases on a busy day may experience noise levels above 50 dBA, and at a speed of 10 kts will move through the high-noise area in less than two minutes.

Construction issues

There will not be major construction undertaken within the proposed West of Wedge development area as pens and moorings will be constructed on land and brought to the site.

Installation of farm infrastructure such as feedpipe, moorings, pens and navigation markers will take place during daytime hours. This work is much the same as regular farm work and is not expected to be unduly noisy. Deployment of moorings would require the use of a large company workboat with a crane to lift and deploy mooring blocks.

6.2.6.4 Mitigation Measures

Noise levels for the proposed West of Wedge development is not expected to cause nuisance noise given:

- The deployment of K-Grid nets will minimise net cleaning requirements resulting in reduced noise levels from net cleaning equipment and activity, and also reduce the need for seal mitigation and associated noise.

- Due to advances in the selective breeding program, the necessity to bathe fish and operate fish bathing equipment is decreasing.

- As pen lighting is not expected to be used at the West of Wedge development, there will be no noise associated with this activity as at other sites around the state. If any operation procedures were to change, Tassal will liaise with Marine Farming to ensure that noise impact from any such activity is assessed.

- The harvest vessel, Tassal 1, has much quieter operations due to the Kan-a-Vac fish-pumping system now being electric as well as mufflers being fitted to the fish stunners.

Tassal proactively works with community members should any noise issues arise; Tassal has successfully resolved such issues in the past and will continue to employ an acoustic specialist to assist with noise mitigation across all sites as required.

Tassal is also required to comply with guidelines on noise emission made under the *Environmental Management and Pollution Control Act 1994* for marine farming operations.

6.2.6.5 Overall effect following implementation of mitigation measures

It is anticipated that with due diligence and care, in conjunction with open community liaison, that noise will not have a nuisance impact and adversely affect amenity for residents in the White Beach and Lory Point area. This will also ensure that there is no significant impact on the recreational users of Wedge Island and surrounding area. Tassal's experience of noise control will enable any unexpected noise issues to be addressed in a thorough and timely manner.

Noise emissions from the proposed West of Wedge development are confidently predicted to result in a worst case level of 34 dBA at the nearest residences. This level is approximately 11 dBA lower than the expected day time noise level limit of 45 dBA. Tassal generally commences noise producing tasks at its marine operation sites from 0700 hrs onwards, however, if work was to commence prior to this, the worst-case predicted noise level is still below the expected night time noise level limit of 35 dBA.

The appropriate design and engineering of the feed barge, coupled with the remote location of the proposed West of Wedge development, will limit noise impacts resulting from this development.

6.2.7 Odour

6.2.7.1 Potential sources of odour emissions

Salmon farming activities have the potential to be a concentrated source of odour due to the large volume of organic matter associated with these activities. Potential sources of odour from salmon farming operations within the proposed West of Wedge development include:

- storage of dead stock
- spilled or incorrectly stored feed
- organic fouling on equipment
- chemicals including petroleum products
- engine exhausts from vessels and other machinery

6.2.7.2 Potential for emissions to cause environmental and health effects should be evaluated

Potential odour impacts from salmon farms can vary in nature depending on the type and intensity of individual farming operations. There is not expected to be any environmental or health effects associated with odour at the proposed West of Wedge development.

6.2.7.2.1 *Land-based*

The land based facility at Badger Cove has a refrigerated shipping container for the storage of deceased stock. This cold chain storage is an essential link for the successful rendering and quality control at Tassal's Triabunna Rendering Plant (see section 3.6.1).

The land base is also a sufficient distance from the nearest residence to further mitigate any potential odour issues should they arise.

6.2.7.2.2 *Marine-based*

There are generally no odour issues associated with marine-based operations. Loss of amenity due to odour would have to be very close to the source (i.e. feed storage), and this proximity would be unlikely to occur from outside of the lease boundaries.

6.2.7.3 Mitigation Measures

Tassal currently operates in accordance with specific strategies on a company-wide basis to mitigate potential odour impacts. The specific strategies include:

- timely removal of deceased stock from farm cages – dive teams currently collect dead stock from cages twice per week and they are placed in sealed plastic bins for transport to shore
- on-shore storage of decreased stock within refrigerated containers awaiting transport to Triabunna plant
- appropriate transport of stock mortalities in accordance with transport environmental requirements
- feed is delivered directly to the on-site feed barge or land base where it is stored in a completely sealed hopper from which feed is directly dispersed to the fish pens
- appropriate containment and disposal of harvesting wastes produced at marine sites – bloodwater is collected and held within harvest vessels and treated at Dover WWTP
- management of equipment to ensure it is kept clean and in good working order
- secure and appropriate storage of chemicals including petroleum products

6.2.7.3.1 *Regulatory Controls*

The following regulatory control is contained in the Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005.

- **Management Control Section 3.11.1** Lessees are to ensure that odour generated from marine farming operations does not create an odour nuisance as defined by the Secretary.

6.2.7.4 Overall effect following implementation of mitigation measures

Given the mitigation measures and distance of the proposed West of Wedge development to potential sensitive receptors, odour impacts resulting from the proposed new site are considered negligible.

6.2.8 Commercial Fishing

As outlined in section 5.5.3, the main commercial fisheries in the proposed West of Wedge development include abalone, rock lobster and scalefish fisheries.

Tassal corresponded with representatives of the Tasmanian Seafood Industry Council (TSIC), Tasmanian Abalone Council (TAC), Tasmanian Rock Lobster Fisherman's Association (TRLFA) as well as the two Danish Seine fishermen in the Storm Bay area during the preparation of this EIS. TSIC, TAC and TRLFA are all generally supportive on the understanding that the proposed development is conducted in a sustainable manner and does not negatively impact on the other fishing industry sectors.

The two Danish Seine fishermen raised concerns, specifically around the displacement of trawling grounds in the location of the proposed development.

6.2.8.1 Effects on commercial fishing activities

The proposed West of Wedge development may affect commercial fishing in a number of ways, including:

- displacement from fishing grounds
- altered navigation in transit to/from fishing grounds
- entanglement of fishing lines and anchors in farm mooring lines
- impacts/alterations on commercial fish stocks

Displacement from fishing grounds

Within the 45 hectare areas where surface located marine farming equipment is deployed , no public access is allowed unless prior permission is granted by the leaseholder. Subject to any marking requirements determined by MaST and DPIPWE necessary to ensure safety of navigation and of marine farming operations, public access will be granted to the balance of the lease area where sub surface marine farming equipment is to be deployed, therefore access to the part proposed West of Wedge lease areas for fishing grounds will be prohibited. The physical displacement of fishers from fishing grounds is not thought to be an issue for rock lobster or abalone fishers, as the proposed West of Wedge development will be located over unconsolidated/unvegetated sediments (not rocky reef), therefore not impeding access to these fishers' targeted habitat. The eastern lease boundary is approximately 2 km away from the western shore of Wedge Island. There may be incidences where a limited number of commercial fishers that hold non-transferrable personal endorsements to fish within sheltered coastal waters, i.e. Danish seine fishers, may be moderately impacted.

Altered navigation in transit to/from fishing grounds

The proposed West of Wedge development is located within an area of Storm Bay that is accessible to navigation by commercial fishers. Transit though sections of the marine farming lease areas designated for surface located marine farming equipment is prohibited, therefore any commercial operators that have previously transited through the proposed West of Wedge development area will be disrupted and forced to alter course. Incidental above-water equipment, shallow-submerged equipment and aquaculture support vessels operating in the area may also cause disruption to commercial vessels transiting to and from fishing grounds.

Entanglement of fishing lines and anchors in farm mooring lines

Mooring lines can extend outside the lease boundaries, but are contained within the marine farm zones. Within zones, all equipment must be submerged at a minimum depth of 5 m. The potential for entangling gear or anchors will be increased by the commencement of finfish aquaculture at the proposed West of Wedge development.

Impacted commercial fish stocks

Key impacts on commercial fish stocks may include the following:

- impacts on water quality
- the effect of salmon farming on algal blooms
- the effect of salmon farming on macroalgal assemblages

6.2.8.2 Mitigation Measures

Displacement from fishing grounds

The proposed West of Wedge development location is not considered to affect majority of commercial fishing operations. It is estimated that the proposed development will occupy only ~1.73% of the total area of Storm Bay. Some commercial fishers, i.e. Danish seine fishers, may lose access to an area of fishing grounds that they are currently licenced to access. The displacement from this area is considered small relative to their known extent of fishing in south-east Tasmania. However, in an effort to further mitigate impact on the fishing grounds for the Danish seine fishers, Tassal has moved the proposed location of the West of Wedge development 400 m northwards.

The likelihood of abalone or rock lobster fishing grounds being adversely affected is considered to be low. The nearest distance between the proposed development (lease boundary) and nearby rocky reef systems on the western side of Wedge Island is approximately 2 km.

Altered navigation in transit to/from fishing grounds

Marine farming lease areas are marked with International Association of Lighthouse Authorities (IALA) markers (as determined by MaST). The safe and effective marking of lease areas and areas within leases will continue to be managed by Tassal and regulated by the DPIPWE Marine Farming Branch. Compliant boundary markers will clearly identify the proposed West of Wedge development area and facilitate the safe navigation of mariners at both night and day. On-going consultation with MaST will continue to remove potential impediments to safe navigation.

Entanglement of fishing lines and anchors in farm mooring lines

Mooring lines can extend outside the lease boundaries, but are contained within the marine farm zones. Within zones, all equipment must be submerged at a minimum depth of 5 m. The potential for entangling gear or anchors is a risk within any marine farming zone. Boundary markers will be deployed to mitigate risk of entanglement and assist with safe navigation around the lease boundary.

Impacted commercial fish stocks

Tassal is engaging collaboratively with the commercial fishing industry to provide synergistic options for the management of shared marine resources. For example, Tassal conducts daily algal trawls on all its sites as part of their water quality monitoring program; this algal monitoring program could be beneficial to the abalone and rock lobster industries as the data obtained may be used as an indicator/early warning system for PST producer blooms. This collaboration could be of benefit in managing adjacent fishing blocks.

Impacts on water quality

The effects of salmon farming on the marine environment have been shown to result in changes to water quality, the severity of which depends on the type and intensity of the farming activity and the capacity of the receiving environment to assimilate any impact (Black, 2001). There have been a range of advancements over the last 20 years which have been observed through improvements in feeding practices, feed formulation, understanding fish behaviour (Price and Morris, 2013) and the correct siting of marine farms in higher energy environments.

Algal bloom events

In most studies there is usually insufficient data to link nutrient availability to algal growth. Despite this uncertainty, the incidence of algal bloom events in Tasmanian waters, particularly those comprising harmful species, have become a major concern for both wild fishing and aquaculture sectors.

Harmful algal blooms (HABs) are known to cause widespread mortality in natural populations of invertebrates and fishes, as well as aquaculture species. In addition, some HABs can present significant public health and human impact issues.

In 2006, the Scottish Executive and Environmental Group (SEEG) reviewed harmful algal bloom communities as they relate to fish farming in the coastal waters of Scotland. The review found that, in general, there was little indication that harmful algal blooms were developed, or sustained, by the nutrient inputs associated with salmon aquaculture facilities. It also found that waste composition, water quality and oceanographic conditions required to initiate and sustain a harmful algal bloom are very complex and very much species specific (SEEG 2006, Buschmann et al. 2007). There is little evidence to suggest that finfish farming in Tasmanian waters increases the risk of HABs.

Impacts on macroalgae

The release of nutrients from marine farming activities has the potential to impact on rocky reef community structure. A recent study by Valentine, et al. (2016) showed that there was no consistent pattern of change in the community composition of macroalgae on subtidal rocky reefs in the Tinderbox and Nine Pin Point marine park areas between 1992 to 2015. This study found that variations in community composition tended to be fluctuations rather than directional change. The results of these findings suggest that impacts to macroalgal communities at the broadscale level are considered to be low.

Tassal has already established two subtidal monitoring sites off the north eastern corner of Wedge Island and at the Duckholes (south of Wedge Island) and will continue to monitor the composition of macroalgal assemblages at these sites in line with the Eastern Farming Zone monitoring program.

6.2.8.3 Overall effect following implementation of mitigation measures

There is limited commercial fishing activity in the waters of the proposed West of Wedge development location. Whilst the key Tasmanian wild fishery sectors (i.e. abalone, rock lobster and scalefish) continue to record catches from fishing blocks adjacent to the proposed lease area, these catches represent a minor component of overall fishery production for each of these sectors as the proposed development is over unconsolidated/unvegetated sandy sediments.

A key management and compliance control from the Tasman Peninsula and Norfolk Bay MFDP area requires that significant adverse environmental impacts do not extend beyond 35 m from the lease boundary. These managed impacts are unlikely to influence recognised commercial fishing activities, as the spatial separation of the two activities is considered sufficient to mitigate any impacts.

Implementation of the proposed mitigation measures will assist in minimising the potential overall impact on commercial fishing.

6.2.9 Recreational Fishing

The Tasmanian Association for Recreational Fishing (TARfish) is the fully independent peak body representing the interests of recreational marine fishers in Tasmania. The main concerns for

recreational fishers in south east Tasmania is loss of public amenity (TARfish, pers. comm., 31 May). Fishing locations around Tasmania are limited due to access and weather, particularly on the west and south coasts, therefore the east coast is a significant and popular area for recreational fishers. Additionally, aquaculture already exists on the south east coast, therefore also limiting access for recreational fishers. This and the long term strategies of aquaculture growth remain the main concerns for recreational fishers on the south east coast of Tasmania.

In the Storm Bay region on the Tasman Peninsula, there are 4 game fishing clubs in which are likely to be affected by the proposed West of Wedge development, including the Tuna Club of Tasmania. The proposed development will likely interfere with recreational fishers in the area, particularly for flathead, shark and other targeted pelagic fish species such as tuna, Australian salmon and couta. Additionally, Dart Bank (near Wedge Island) is an important and popular spot for tuna.

6.2.9.1 Effects on recreational fishing activities

A report by IMAS (2013) concluded that the biggest issue facing offshore recreational fisheries in Tasmania is commercial fishing followed by sustainable management (Figure 6.18). The categories were generated by the responses to an open ended question.

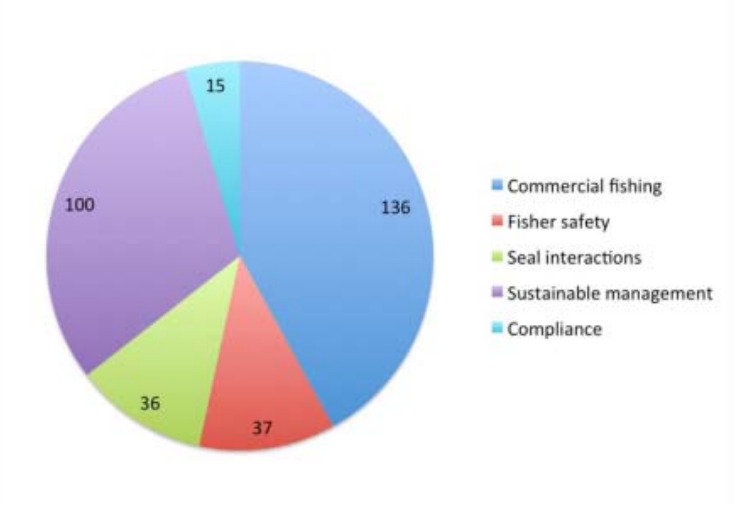


Figure 6.18 Distribution of the 'biggest' issues facing offshore recreational fisheries in Tasmania as received by respondents. The categories were generated by the responses to an open ended question (IMAS Report 2013)

Liaison with stakeholders within this area for recreational fishing included the Tasmanian Association for Recreational Fishing (TARfish), and the Tasman Council and Tasmanian Seafood Industry Council (TSIC). The main concern from the perspective of the recreational fishers in the Tasman Peninsula region include loss of public amenity and the possibility of future expansions, therefore reducing space for recreational purposes.

The proposed West of Wedge development may affect recreational fishing in a number of ways, including:

- displacement from fishing grounds
- entanglement of fishing lines and anchors in farm mooring lines

- altered navigation in transit to/from fishing grounds
- impacts/alterations on recreationally targeted fish stocks
- potential for finfish escapees
- increased interactions between seals (attracted to area by salmon pens) and fishers

Displacement from fishing grounds

Within lease boundaries the area designated for marine farming surface equipment is not available for public access, therefore, any recreational fishers/divers that have previously accessed the proposed West of Wedge development area will be displaced. However, this displacement will only occupy ~0.36%, (area occupied by the proposed surface equipment) of the total area in Storm Bay, making the impact from displacement relatively minor.

Entanglement of fishing lines and anchors in farm mooring lines

Subject to any marking requirements determined by MaST and DPIPWE necessary to ensure safety of navigation and of marine farming operations, within zone boundaries (surrounding leases) and subsurface parts of leases there are no formal access restrictions, but fishers have an increased risk of fouling lines or anchors on submerged marine farming equipment (mooring lines, anchor blocks, etc.).

Altered navigation in transit to/from fishing grounds

Transit through the area designated for marine farming surface equipment is prohibited, therefore any recreational fishers that have previously transited through the proposed West of Wedge development area will be required to adjust their navigation through these waters.

Impacts on recreationally targeted stocks

The main concerns raised by TARFish and the Tasman Council during stakeholder engagement include:

- displacement from fishing grounds
- communication of industry plan for Storm Bay development
- effect on macroalgal assemblages and other marine communities

Salmon escapees

Marine farming practices, farm designs and equipment specifications are designed to avoid the release of fish. However, despite the best of intentions and practices, the occasional escape of fish is an unavoidable impact of finfish marine farming operations. These escapees are targeted mostly by recreational fishers.

Increased seal – fisher interactions

The expansion of marine farming could potentially result in a higher incidence of interactions between seals and fishers, as seals may be attracted to marine fish farms.

6.2.9.2 Mitigation Measures

Displacement from fishing grounds

Displacement from fishing hotspots in the proposed West of Wedge development was a concern raised during consultation with major stakeholders.

Tassal is mindful that fishing grounds and waterways are a public resources for recreational users and access will be unavoidably reduced due to the proposed West of Wedge development. Tassal will continue to work with recreational fishing groups to explore options for improving the quality of recreational fishing experiences.

Entanglement of fishing lines and anchors in farm mooring lines

Mooring lines can extend outside the lease boundaries, but are contained within the marine farm zones. Within zones, and outside the area containing surface-located marine farming equipment, all equipment must be submerged at a minimum depth of 5 m. The potential for entangling gear or anchors is a risk within any marine farming zone.

Altered navigation in transit to/from fishing grounds

Marine farming areas are marked with International Association of Lighthouse Authorities (IALA) markers. The safe and effective marking of areas containing surface-located marine farming equipment will continue to be managed and regulated by the DPIPWE Marine Farming Branch. It is expected that compliant boundary markers will clearly identify the proposed development areas and facilitate the safe navigation of boaters during night and day.

Impacts on recreationally targeted stocks

Tassal is constantly looking to improve methods of feed delivery to minimise feed loss to the environment. All farms employ underwater cameras to monitor and minimise feed loss. There have recently been significant improvements in this technology which Tassal are in the process of implementing across the business.

Salmon escapees

Tassal is always working to minimise the risk of salmon escapes. Improved mooring systems, stronger sea-cages, stronger nets, reduced seal interactions and better staff training programs all combine to reduce the risk of breach that can allow salmon to escape.

Tassal has developed and implemented an Escape Prevention and Response Protocol at each of its marine farming sites. This plan incorporates escape prevention, net inventory, weighting systems, smolt input and harvest operations as well as inventory management and incidental losses.

This process also included the development of Tassal's Escape Response Kits. These kits contain equipment for containment or attempted recapture and include a documented procedure for their use. They have been successfully used in the marine farming environment, with positive feedback from operational staff.

K-Grid technology will be utilised at the proposed West of Wedge development. At the time of writing, there have been no predator breaches of this net technology.

Increased seal – fisher interactions

Tassal continues to work on improving technology to seal-proof its marine farm sea-cages. K-Grid net technology will be installed on its pens at the proposed West of Wedge development which will further reduce the potential for seals to enter cages, and this may assist in mitigating against habituate behaviour and the attraction of seals to marine farms. Traditionally, nets have been strengthened, stiffened and tensioned below the water line and 'seal barriers' have been installed above the water. If seals cannot gain access to the salmon within the sea-cages, they are less likely to frequent the area.

6.2.9.3 Overall effect following implementation of mitigation measures

The proposed West of Wedge development will displace recreational fishing opportunities to the extent of the lease areas and some fishing quality between the lease areas and zone boundary. This is an unavoidable impact of a proposed development, but one that does not remove the potential for accessing both fishing areas and recreational fishing species within the broader Storm Bay region – the proposed development (zone area) will only occupy ~1.73% of the total Storm Bay area and the proposed areas authorised for surface located marine farming equipment will only occupy ~0.36%.

The impact on recreational divers is considered low due to the distance of the proposed West of Wedge development from the reef extending off Wedge Island and the depth at the proposed location being more than 30 m, unfavourable for the majority of recreational divers.

Implementation of the proposed mitigation measures will assist in minimising the potential overall impact on recreational fishing.

6.2.10 Recreational Activities

Recreational activities that are undertaken in the vicinity of the proposed West of Wedge development and surrounds include on-water activities (boating/sailing, kayaking and fishing), in-water activities (diving, snorkelling and surfing) and on-land activities (fishing, camping, walking, wildlife watching and general sight-seeing).

An information day was held at Nubeena on 15 May 2016 that was open to all members of the public. Approximately 100 people were present, of which around 70 were from the local community. Verbal and written feedback raised concerns around recreational fishing and navigation for boats and yachts in the area of development.

Numerous information/consultation sessions have been conducted between Tassal and various boating and yachting clubs. Previously raised concerns regarding navigation and fishing grounds were discussed and appropriate steps have been taken to alleviate concerns (including shifting the location of the proposed West of Wedge development 400 m northwards).

6.2.10.1 Effects on recreational activities

The proposed West of Wedge development has the potential to affect recreational activities in a number of ways including:

- reduction in available on-water area for recreation
- increased visual impact of marine farming activities
- increased noise impact of marine farming activities

- increase of on-water activity/traffic associated with marine farming activities
- potential increase of rubbish/debris from marine farming activities

Potential impacts on recreational fishing are discussed in section 6.2.9.1. There is no impact predicted for diving activities as the proposed West of Wedge development occurs over sand at a depth of greater than 30 m, and is considered unfavourable for diving.

Reduced available on-water area for recreation

Within the area of the lease authorised for surface located marine farming equipment, no public access is allowed unless prior permission is granted by the leaseholder; therefore access to these parts of the lease areas for recreational activities will be restricted. This is a proposal for new lease developments, therefore there would be reduced on-water area for recreational activities within Storm Bay. However this would only be a small percentage (~1.73% - proposed zone area) of the Storm Bay area.

Increased visual impact

The proposed commencement of finfish aquaculture will result in the addition of fish pens, barges and other associated infrastructure on the sea surface. This will affect the aesthetics of the surrounding coastal scenery and seascapes, which may affect the regional ambience for recreational users. Findings from the visual impact assessment (Appendix 14) defines recreational users (including people visiting Wedge Island, mariners passing the proposed leases and bushwalkers) as minor observers groups whose sensitivity to the proposed development may vary from low to high. However, on a scale of impact, the classification level is considered medium to negligible as the proposed leases are not a strong visual feature at a distance and for mariners passing the leases, the visual impact will only occur when they are close the lease areas.

Increased noise impact

In addition to the current noise impact from marine farming operations within Wedge Bay, the proposed commencement of finfish aquaculture will result in increased noise including more frequent vessel movement, net washing, fish feeding and fish harvesting. This may affect the regional ambience for recreational users. According to the noise impact assessment (Appendix 4) the target noise level of 50 dBA is usually considered to be the acceptable limit on people engaged in recreational activities near an industrial operation. The total noise level for operations at all four proposed leases is predicted to be less than 40 dBA on the west side of Wedge Island. Therefore, given the location of the lease relative to any potential noise receptors, the impact of increased noise is considered very low.

Tassal operations comply with guidelines on noise emission under the *Environmental Management and Pollution Control Act 1994* for marine farming operations. Noise associated with construction works will be limited to daylight hours.

Increased on-water activity/traffic associated with marine farming activities

The proposed West of Wedge development will result in an increase in on-water activity and traffic associated with marine farming activities. This may affect the regional ambience and on-water movements for recreational users. The increased activity and traffic associated with marine farming activities is unlikely to cause any conflicts with recreational users; therefore impacts of increased activity and traffic are considered very low. The maximum number of vessels servicing the development will be eight on any given working day.

In addition, Tassal have the ability to respond to marine distress situations. This has occurred historically in Tassal farming regions.

Increased litter/debris from marine farming activities

There is an increased potential for more marine farming-associated rubbish and debris to enter the environment as a result of the proposed West of Wedge development.

6.2.10.2 Mitigation Measures

Reduced available on-water area for recreation

The location of the proposed West of Wedge development is not considered to affect any known hotspots for recreational activities. Given that no specific concerns regarding displacement were identified, no mitigation measures are proposed. However, it should be noted that after consultation with specific stakeholders, Tassal moved the location of the proposed West of Wedge development 400 m northwards in order to minimise any impact to boating navigation and associated safety concerns.

There remain numerous adjacent areas suitable for all types of marine pursuits, and sheltered waters close by in a range of weather conditions.

Increased visual impact

For a detailed discussion of visual impact effects and mitigations, refer to section 6.2.1.

Increased noise impact

Tassal operations comply with guidelines on noise emission under the Environmental Management and Pollution Control Act 1994 for marine farming operations. Noise-producing construction work will be limited to daylight hours. For more detail on mitigations relating to noise impact, refer to section 6.2.6.

Increased on-water activity/traffic associated with marine farming activities

No specific mitigation measures are proposed to address the potential increase in on-water activity associated with marine farming activities. However, all Tassal vessels are in commercial survey and will continue to comply with navigation regulations including safe speed and vessel lighting requirements. Tassal has the capacity to limit vessel traffic to specific operational times as required.

Increased litter/debris from marine farming activities

Under the Litter Act 2007, a person must not deposit litter in any public place except in a receptacle that the owner or controller of the public place has provided for litter. Therefore, no mitigation measures are proposed to address the potential increase in litter/debris from marine farming activities, other than ensuring farm workers abide by the legislation controlling litter in the environment.

For more detail refer to section 6.1.4.4.4.

6.2.10.2.1 *Regulatory Controls*

The Tasman Peninsula and Norfolk Bay Marine Farm Development Plan (November 2005) places the following regulatory controls on lease holders (controls listed are those relevant to salmonid farms):

Management Control 3.10 Access Controls

3.10.1 Lessees must mark the external boundaries of the lease area in whatever manner is required by the Secretary and by the relevant authority under the provisions of the *Marine and Safety Authority Act 1997.*

3.10.4 Lessees must identify the lease area in a manner specified by the Secretary.

3.10.5 Anchors and mooring lines that extend outside the lease area must be at least 5 metres below the surface at the boundary of the lease area and must not extend outside a marine farming zone.

The draft amendment proposes the following special management controls;

Zone 16 – (west of Wedge Island)

3.14.14 Within Zone 16, an area or areas that, in total, do not exceed 180 ha area is to be known as the farmed area.

The farmed area may be defined by coordinates, physical markers visible on the water surface or as otherwise specified in the relevant marine farming licence.

3.14.15 Within Zone 16, the lessee is to ensure that all marine farming equipment is contained within the farmed area, 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

3.14.16 The lessee must mark any area or marine farming equipment within Zone 16 in whatever manner is required by the Secretary and by the Marine and Safety Authority.

3.14.17 The leaseholder of any marine farming lease allocated within Zone 16 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.

6.2.10.3 Overall effect following implementation of mitigation measures

Since the proposed West of Wedge development is a new proposed marine farming area, additional restrictions to recreational activities from existing conditions will occur.

For a detailed explanation of effects on recreational activities resulting from this proposed development, see sections 6.2.1, 6.2.2, 6.2.6.

6.2.11 Tourism

Section 5.7.2.1 highlights both marine and land based tourism operations in the area of the proposed West of Wedge development. Marine-based tourism in the immediate area of the proposed development is limited with operators utilising the area intermittently. To the best of our knowledge there are no regular tours operating in the vicinity at the time of writing.

6.2.11.1 Results of stakeholder consultation undertaken

Consultations via email were conducted with tour operators that are known to utilise the Tasman Peninsula area: Pennicott Wilderness Journeys, Par-Avion and Roaring 40°S Kayaking.

As stated in section 4.1.4, all consulted tourism providers advised Tassal that they have no objections to the proposed West of Wedge development.

6.2.11.2 Effects on tourism activities

No negative effects on current tourism activities in the area are anticipated as a result of the proposed West of Wedge development.

6.2.11.3 Mitigation Measures

As a result of feedback received, no mitigation measures are proposed.

6.2.11.4 Overall effect following implementation of mitigation measures

It is considered that the proposed West of Wedge development would not impact on current tourism operations within the Storm Bay or Tasman Peninsula area.

As addressed in section 6.2.1 there will be some loss of visual amenity as a result of the proposed West of Wedge development.

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 West of Wedge development is at least 8 km from the nearest recognised walking track (start of the Three Capes Track at Noyes Road, White Beach) in the Tasman National Park and it is unlikely that there would be any significant visual impact at that distance.

6.2.12.2 Effects on residential activities

As nearest residences are at least 4 km from the proposed West of Wedge development area it is considered that significant impacts from noise would be unlikely to occur. There will be impacts to visual amenity for some residents as discussed in section 6.2.1. There are no other sources of effects on residential activities in relation to the proposed development area and proposed farming activities.

6.2.12.3 Effects on industrial activities

There are no industrial activities relevant to this proposed development.

6.2.12.4 Effects on other commercial activities

There are no identifiable commercial activities relevant to this proposed development.

6.2.12.5 Mitigation Measures

Mitigation measures for noise are provided in section 6.2.6. It is considered very unlikely that significant impacts from noise in residences would occur.

6.2.12.6 Overall effect following implementation of mitigation measures

Given the mitigation measures given in section 6.2.6 and the distance from the proposed West of Wedge development, it is considered that impacts on land use and developments is negligible.

6.2.13 Socio-economic Aspects

Tassal contracted a third party to produce a report on the socio-economic impacts of the proposed West of Wedge development. The third party used their own Regional Input-Output model (RIOM) with six key measures: the output of Tasmanian industries, the Gross State Product, employment numbers, wages income, taxes generated and imports. Additional information about the local, regional and state characteristics and impacts were derived from publicly available data and from information provided by Tassal. For the full report see Appendix 15.

In Tasmania today, most of Tasmania's seafood production comes from the aquaculture sector. Farmed salmon is considered to be the most important contributor to this sector, accounting for 91% of production volume and 95% of the total volume generated by the industry.

The significance of Tasmania's farmed salmon industry to Australia's national seafood production is also reflected in the salmon industry's contribution to strengthening the social and economic structure in regional communities throughout Tasmania. Continued growth of the industry is also an important aspect to renewed optimism in the State's economy, and this process of amendment through regulation ensures that this growth is progressed in a measured and sustainable manner.

6.2.13.1 Estimate of total capital investment for the proposal

The proposed West of Wedge development will require an initial capital investment of $30.8 million. With the exception of $150,000 for the initial baseline survey and EIS contractors, all of this will represent investment in the proposed leases and associated machinery and equipment. This includes:

- upgrade to the existing land base
- mooring and grid systems
- circular sea pens
- feed barges, feeding systems and other surface infrastructure
- dedicated harvest and feed vessels

Installation of the mooring grids is expected to take four months, weather permitting. Constructed cages would then be towed into position and stock for grow out added over time.

6.2.13.2 Effects on local and state labour markets

The proposed West of Wedge development would directly employ 73 people on a full-time basis in the South East coast region, thus boosting the region's share of total aquaculture employment. Almost half of these jobs (44%) would either require (14 jobs, 19%) or prefer (18 jobs, 25%) a degree in Aquaculture or a related discipline. In comparison to the Tasmanian workforce as a whole, this is a considerably higher proportion. In Tasmania, 15% of those employed in aquaculture hold a bachelor degree or higher qualification, compared to only 12% of employees across all industries.

In addition to training staff to function effectively and safely in their roles and to meet legal obligations where specific licences, tickets or skills are required, Tassal offers all employees the opportunity to formally request training or further education. Specific training targets are set for each position, which vary depending on the requirements, level and skills of the position (Tassal 2015). Thus, staff can clearly identify the training they need to advance in their careers.

The effects on employment during construction and operational phases of the proposed development is further discussed in section 6.2.13.3.

6.2.13.3 Effects on upstream/downstream industries, both locally and for the state

The proposed West of Wedge development would ensure upstream/downstream industries continued to be supported in the area, and there would be positive employment impact during the construction and operational phases.

6.2.13.3.1 *Construction phase*

Impacts from the construction phase of the proposed West of Wedge development are temporary in nature. Around half of the aggregate impact of $30.73 million in output and $9.9 million in Gross State Product (GSP) is seen in the demand industries, as shown in Table 36.

Table 36 Demand industry impacts – construction

Industry	Output Impact ($MM)	GSP Impact ($MM)	Total Employment Impact	FT Employment Impact	Wages Impact ($MM)
Polymer product and rubber product manufacturing	$3.98	$1.49	12.27	9.20	$0.92
Transport equipment manufacturing	$4.53	$1.36	13.90	11.54	$1.02
Machinery and equipment manufacturing	$0.66	$0.28	2.79	2.68	$0.17
Other construction	$6.53	$1.62	5.22	2.71	$0.78
Scientific, research and technical services	$1.38	$0.22	11.56	8.79	$0.11
All demand industries	**$17.08**	**$4.97**	**45.74**	**34.92**	**$3.00**
% of total impact	**56%**	**50%**	**45%**	**48%**	**56%**

Figure 6.19 and Figure 6.20 show the distribution of impacts on other industries in the economy with the largest impact on output seen in the Construction trade services industry, with an increase of $2.6 million ($0.56 million GVA). This predominantly represents demand generated as a second round (indirect) effect of the land base upgrade and the other construction (e.g. waste pipeline) undertaken as part of the establishment of the proposed development. The boost in the Wholesale trade is a combination of indirect and induced demand. There are strong forward linkages from all manufacturing sectors (including net, cage, machinery, boat and mooring manufacturers) to the Wholesale industry. In addition, the Wholesale industry benefits from induced demand through forward linkages across the whole economy and strong backward linkages from retail.

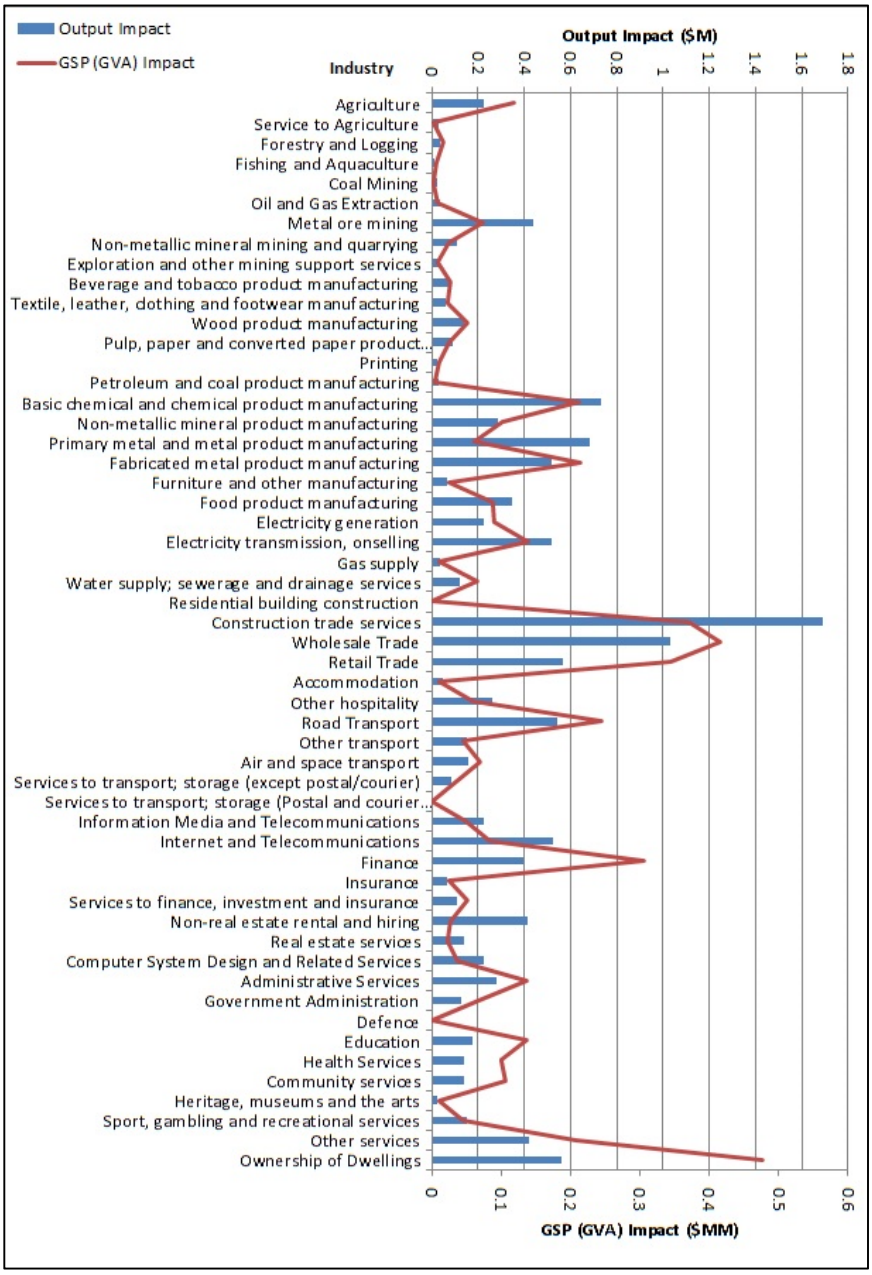


Figure 6.19 Construction impacts on Output and GSP (GVA) – industry level

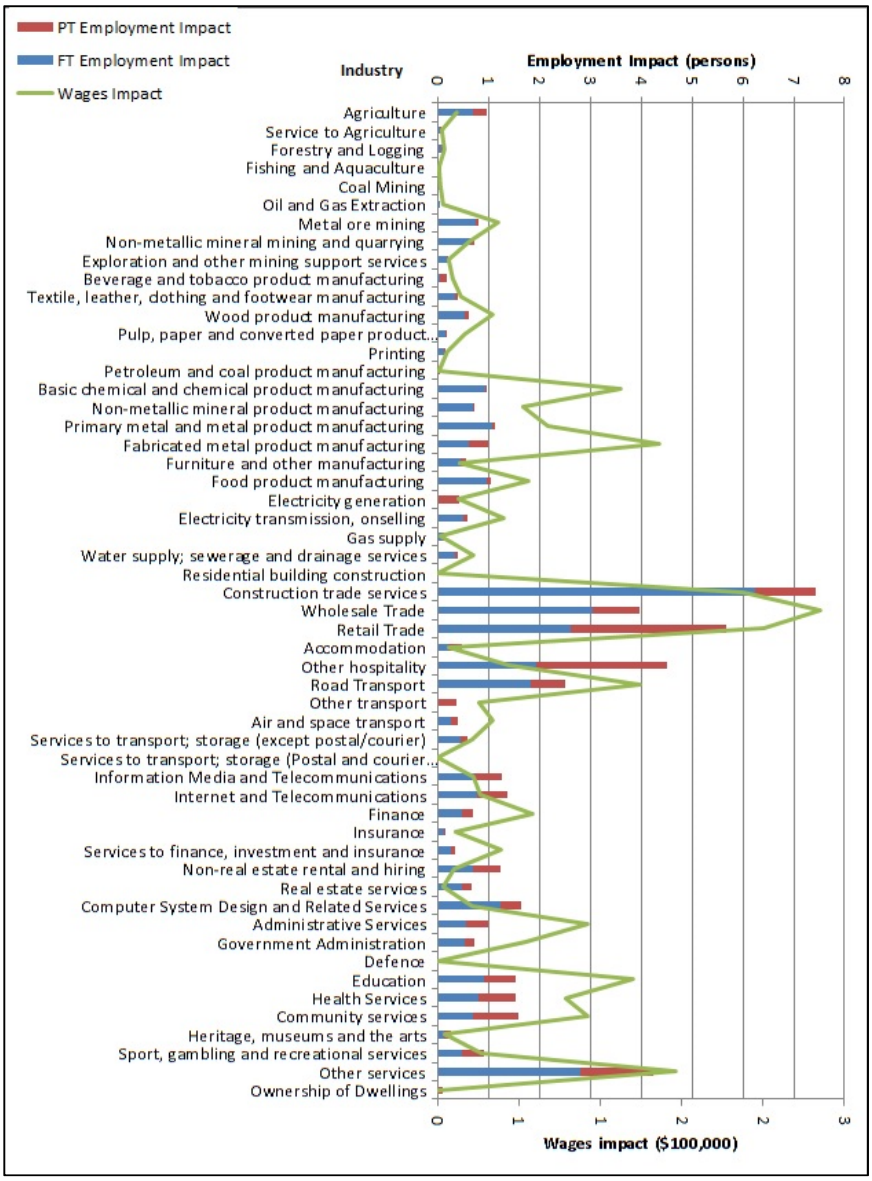


Figure 6.20. Construction impacts on employment and wages - industry level

6.2.13.3.2 *Operational Phase*

Over half of the overall impact in the operational phase of the proposed West of Wedge development would be seen in Tassal's own industries of aquaculture, food product manufacturing and retail. The flow of the remaining impacts across other industries is shown in Figure 6.21 and Figure 6.22.

The highest impact on output and GVA (Figure 6.21) is seen in the Agriculture industry. The industry's output increases by $86 million and GVA increases by $47 million. These increases are largely

mediated by large backward and forward linkages from the Food Product Manufacturing industry and a smaller backward linkage from Aquaculture. In simple terms, Tassal's products use agricultural products (e.g. in production of their frozen meals, and in feeding their fish) and also provide inputs to the industry (for value adding outside Tassal's vertically integrated structure). The smaller peak that is apparent for the services to the Aquaculture industry is an example of a predominantly indirect linkage. The increase in demand for agriculture has boosted this industry as a second round effect.

The Wholesale industry also shows a large impact ($9 million in output and $3.6 million GVA), through backward linkage to the aquaculture sector, linkages in both directions to the food product manufacturing sector and a forward linkage to the retail sector. Although the increase in direct demand for retail is small (representing the small proportion of Tassal's product sold through its Salamanca retail outlet), the effect on the Wholesale and Retail industries are boosted by induced demand. The large employment and wages impact seen overall provides a boost to retail as workers spend their new wages.

The next notable peak in Output and GVA is for the road transport industry. Particularly in Tasmania, where road transport lacks the competition from rail seen elsewhere, road transport is a significant beneficiary of forward linkages from many industries; the products they produce must be transported to the customer.

Peaks in employment and wages (Figure 6.22) are seen in the industries discussed above. 88 jobs (63 full-time) are created in Agriculture and 17 jobs (12 full-time) in services to Agriculture to keep up with the large boost in output. Similarly, retail and wholesale industries see increases related to direct, indirect and induced effects. The increase in scientific, professional and technical services employment is more complex. 27 full-time and nine part-time jobs in this industry are created. The industry has strong backward and forward linkages across the economy. Tassal's specific direct purchase of services from this industry include scientific monitoring of water quality and EPBC listed threatened species, veterinary services and economic impact assessments. The industry also includes accounting, legal, advertising and marketing services, utilised across all industries in response to the indirect and induced demand generated. The other hospitality industry (in this case representing food service businesses) also sees an increase. 12 full-time and 16 part-time jobs are generated in this industry, mediated through induced demand as well as by forward linkages from food product manufacturing and aquaculture.

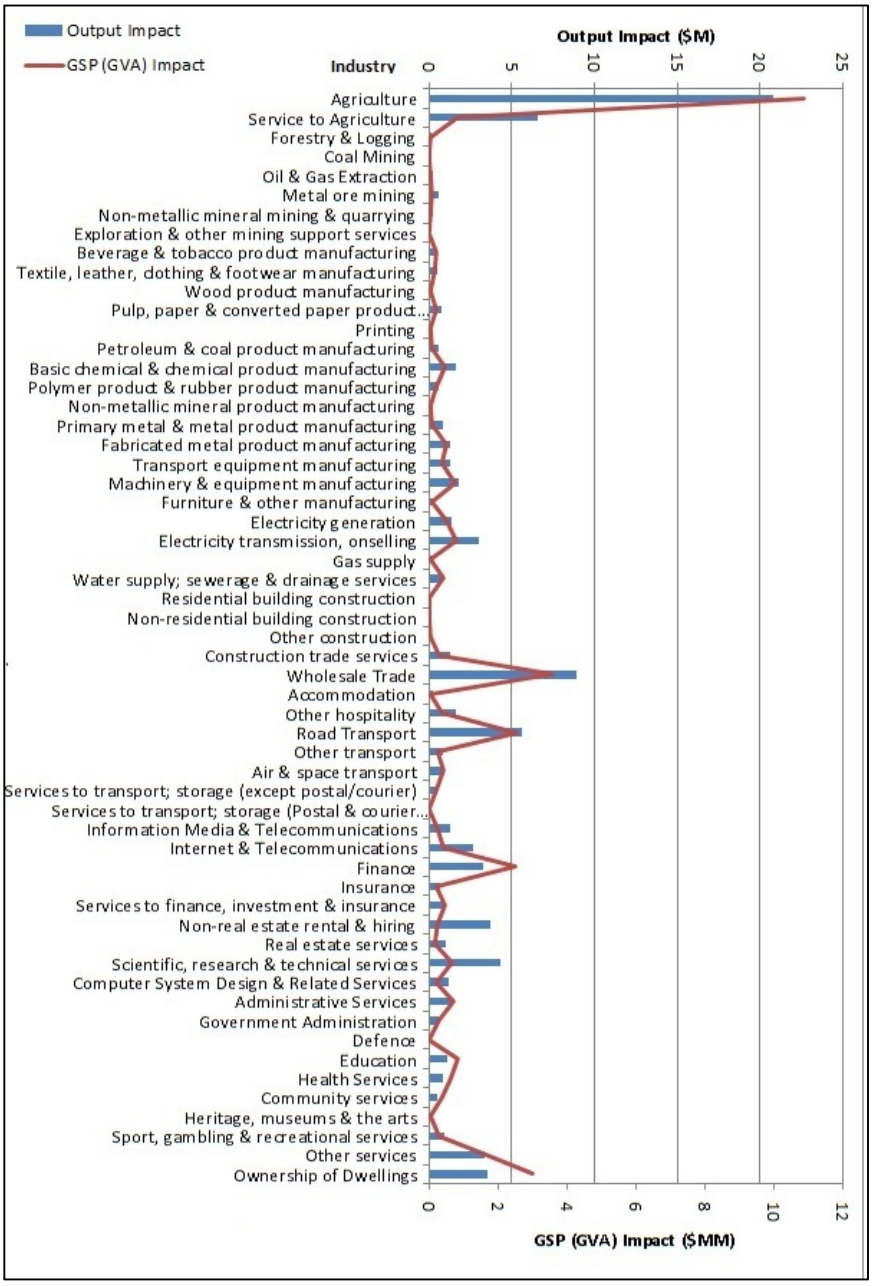


Figure 6.21. Operational impacts on Output and GSP (GVA) – industry level

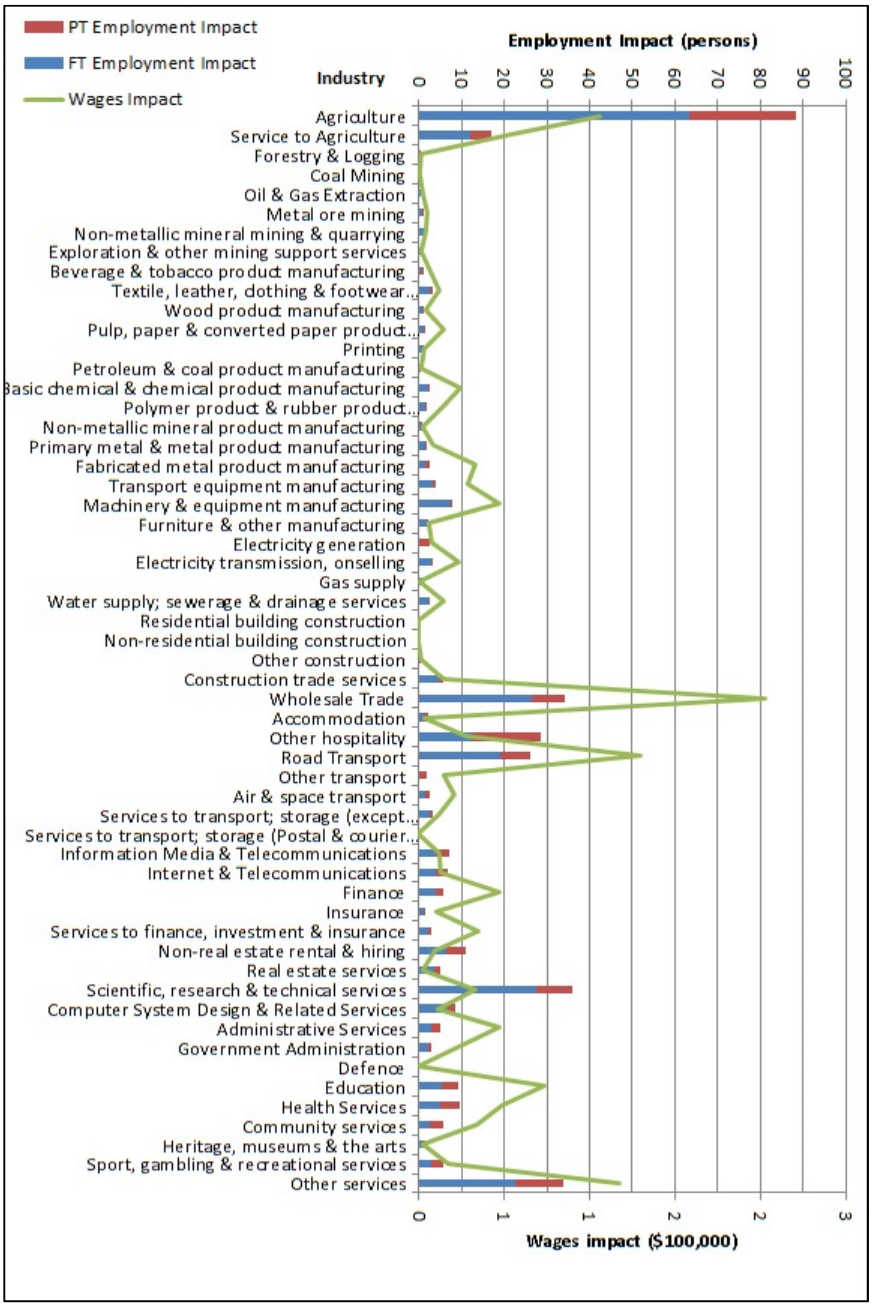


Figure 6.22. Operational impacts on Employment and Wages– industry level

6.2.13.4 Extent to which raw materials and services will be sourced locally

Infrastructure for the proposed West of Wedge development is specialised equipment and not directly available within the Tasman Peninsula. However, all raw materials and services would be purchased and sourced from Tasmanian suppliers wherever possible.

6.2.13.5 Effects on land values and demand for land and housing

Table 37 shows the percentage of employees who live and work in the same local council for Tassal's regional sites.

Table 37 Percentage of employees living locally

Region	% of employees living locally
Bruny / Kingborough	74%
Dover / Huon Valley	79%
Macquarie Harbour	21%
Margate	64%
North West Bay	58%
Russell Falls / Derwent	54%
Tasman	65%

If these proportions were to be maintained for employees of the proposed West of Wedge development, around 50 employees could be expected to live (and shop) in the Tasman Council area. Tassal would recruit locally where possible, with some proportion of those employed likely to have to move from elsewhere (within Tasmania or from interstate). These people (and their families) would represent new customers for businesses in the area.

Realestate.com currently lists 95 houses for sale in and around Nubeena, as shown in Figure 6.23. In addition there are 46 building blocks listed. In comparison to properties for sale, rental properties are scarcer, with only four listed.

The proposed development would be expected to increase the number of people living in the Tasman Peninsula area however, due to the number of properties currently available in the area this increase is not expected to effect demand on housing or land values.

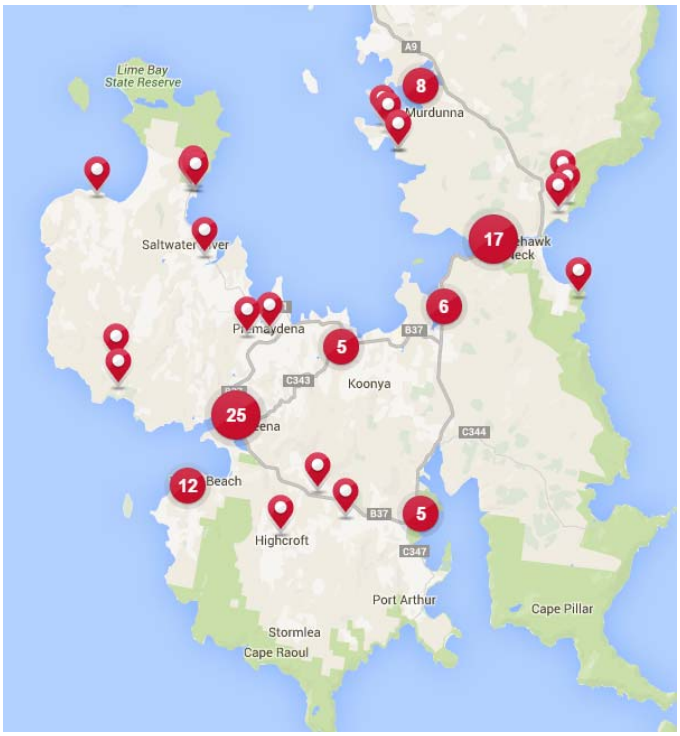


Figure 6.23 Properties for sale in and around Nubeena

6.2.13.6 Effects on local, regional and national economies

6.2.13.6.1 *Local/regional impacts*

Construction Phase

The initial $30.8 million investment in the proposed West of Wedge development would flow through to Tasmanian companies and contractors (99% of all expenditure). While this would be a short-term injection of funds in the local economy, it would still have significant indirect impacts across all Tasmanian industries.

Overall, the initial capitalisation investment results in an output increase of $30.24 million. Gross State Product (the measure of "value adding" in the economy) increases by $9.73 million. Over 100 additional jobs are created, 71 of them on a full-time basis, representing $5.3 million of wage income for Tasmanian workers.

The spread of the impacts across different industry groups is shown in Figure 6.24 and Figure 6.25. The largest impacts are seen in the Manufacturing and Construction sectors. The Manufacturing output shows an increase of $12.24 million with a contribution to Gross State Product of $3.98 million. The construction sector shows an increase of just over $8 million in output and just under $2 million in GVA.

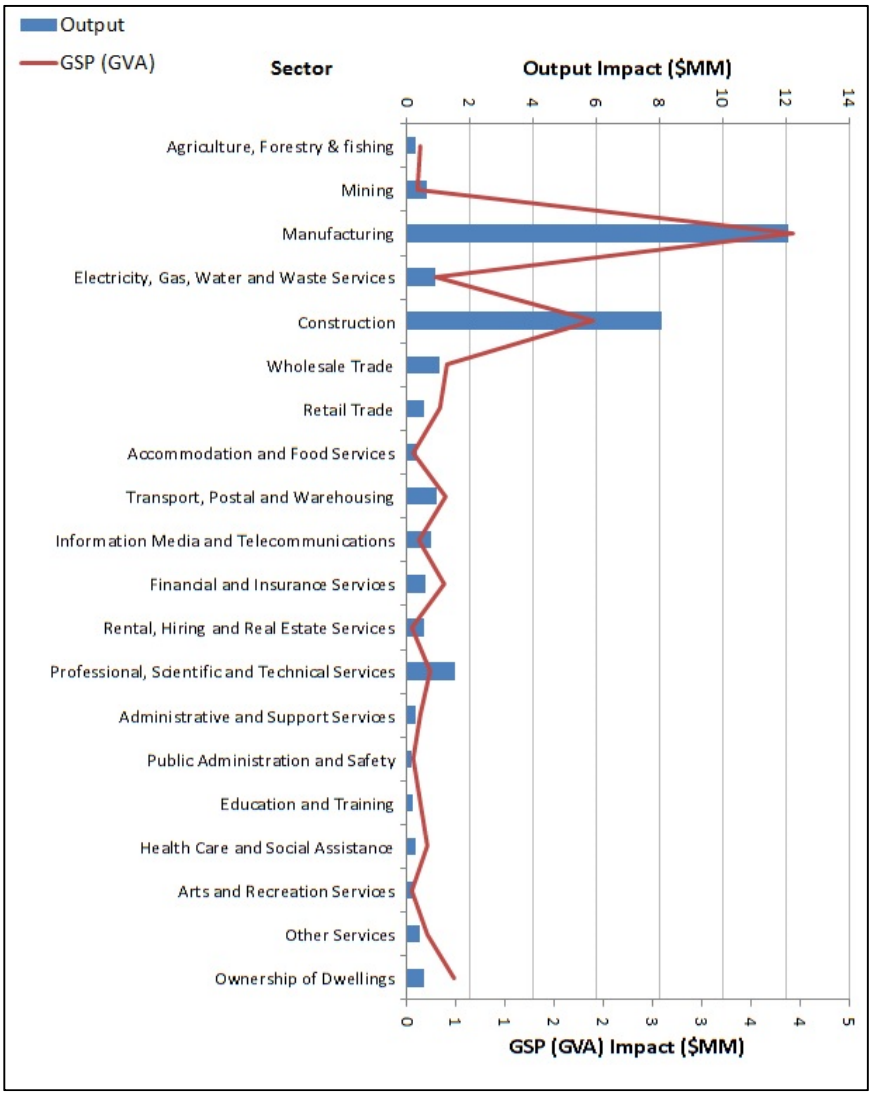


Figure 6.24 Construction impacts on output and GSP by industry sector

Employment effects are also seen in Manufacturing, with the creation of 36 new jobs, 29 of them are on a full-time basis. Construction sees an increase of eight full-time and four part-time jobs. Despite the low proportion of total project expenditure on scientific, research and technical services, a relatively large short term effect on employment in this sector is seen, with the creation of 13 jobs, 10 of them on a full-time basis.

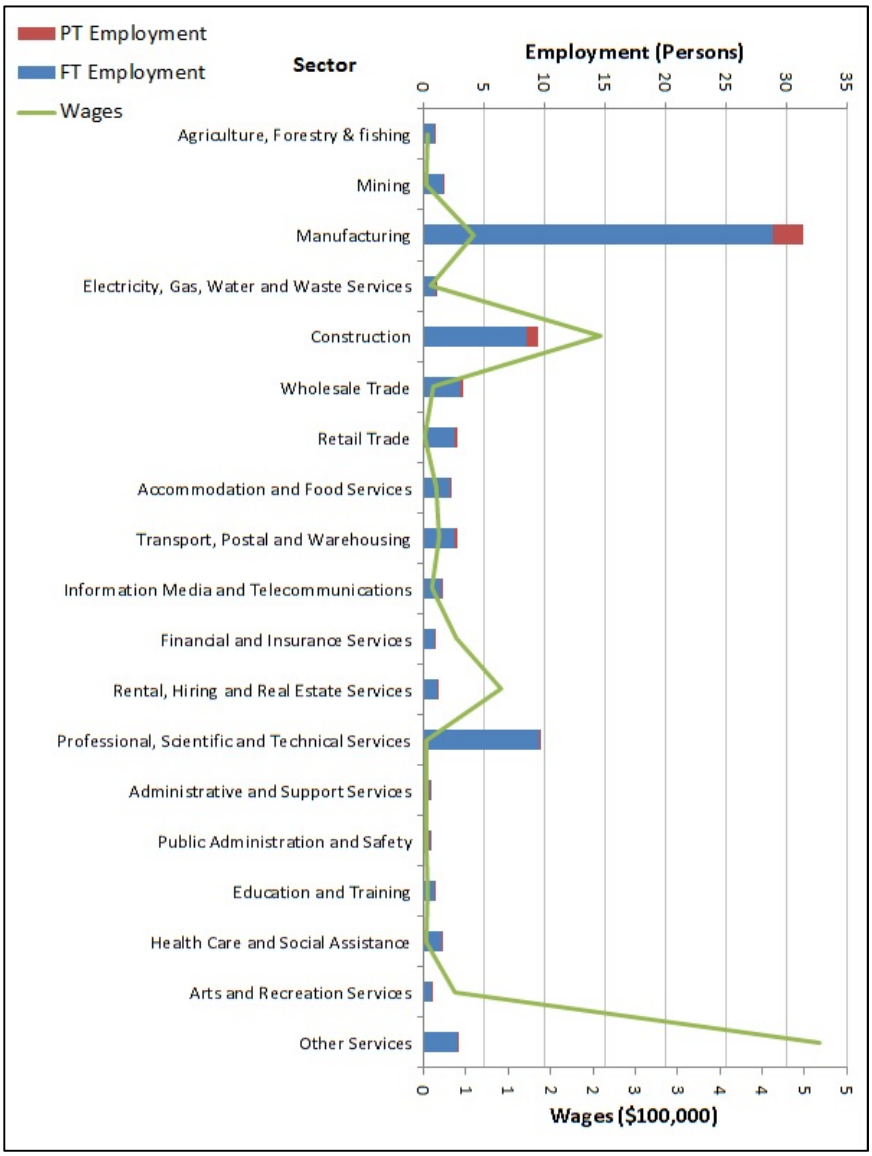


Figure 6.25 Construction impacts on employment and wages impact by industry sector

Operational Phase

Table 38 illustrates the additional revenue created from the proposed West of Wedge development. 92.1% of Tassal's production represents exports for the state (predominantly to other states). Of the remainder, 0.5% of the total (5.8% of Tasmanian sales) represents final sales to households through the Tassal Salmon Shops. The remaining 7.4% of total sales represents intermediate sales to other Tasmanian businesses.

Table 38 Additional revenue from the proposed West of Wedge development

	Revenue	% of Revenue
Projected additional West of Wedge revenue (total)	$156,000,000	50% of 14-15 Tassal revenue
Export & Interstate Sales	**$143,676,000**	92.1% of revenue increase
Tasmanian Sales (Total)	$12,324,000	7.9% of revenue increase
Tasmanian Sales (Final)	**$714,792**	5.8% of Tasmanian increase
Tasmanian Sales (Intermediate)	$11,609,208	94.2% of Tasmanian increase
Total increase in Final Demand	**$144,390,792**	**92.5% of revenue increase**

As for the construction phase, the direct increase represents only a part of the overall impact. In addition to hatcheries and sea pens, Tassal operates three processing sites and two direct retail outlets (The Salmon Shop) in Salamanca, Hobart and Kew, Melbourne. Salmon from the proposed West of Wedge development would be initially gutted at the Dover processing plant, before being graded according to quality and size and packed for transport either directly to retailers and wholesalers or to Tassal's value added processing facilities in Margate and Huonville. These facilities produce filleted, smoked or frozen salmon products. Thus, Tassal's Tasmanian revenues can be seen to be generated in three separate industries: Aquaculture (Dover HOG product), Food Product Manufacturing (Margate and Dover) and Retail (The Salmon Shop in Salamanca).

The on-shore value adding by the company is important as the employment and Gross State Product contributions these activities generate would otherwise accrue to other states. 61.5% of Tassal's fish is sold with further processing beyond simply gutting, thus representing demand for the food processing or retail industries rather than aquaculture.

92% of Tassal's production is exported from the state. All such sales represent the final demand in the Tasmanian economy. Within Tasmania, $11.6 million of sales are to other industries (food wholesalers, external retailers, food service companies, etc.). Only direct sales to the public through Tassal Salmon Shops constitute Tasmanian final demand.

The total (direct, indirect and induced) impacts of these changes in final demand are shown in the Table 39. These impacts represent an ongoing gain for the Tasmanian economy. The output of all industries increases by $246.02 million and GSP by $103.08 million. 907.78 additional jobs are created, 661.87 of them on a full-time basis, representing $33.27 million of wage income for Tasmanian workers.

Table 39 Composition of final demand from West of Wedge production

Industry	Demand ($million)
Retail Trade	$0.71
Food product manufacturing	$55.32
Fishing and Aquaculture	$88.36

The spread of the impacts across different industry groups is shown in Table 40. As to be expected, results illustrate that the largest impacts are seen within the demand industries themselves.

Table 40 Demand industry impacts – operational

Industry	Output Impact ($MM)	GSP Impact ($MM)	Total Employment Impact	FT Employment Impact	Wages Impact ($MM)
Fishing and Aquaculture	$86.05	$46.90	271.87	195.75	$8.13
Food product manufacturing	$59.47	$15.36	179.41	165.06	$9.62
Retail Trade	$4.52	$2.74	44.92	20.67	$1.59
All demand industries	**$150.04**	**$65.00**	**$496.20**	**$381.47**	**$19.33**
% of total impacts	**61%**	**63%**	**55%**	**58%**	**58%**

Impacts are also seen within other industries across the whole Tasmanian economy. Impacts by industry sector are shown in Figure 6.26 and Figure 6.27.

Major increases on output and Gross Value Added (GVA) are seen in the Agriculture, Forestry and Fishing and Manufacturing sectors. The Agriculture, Forestry and Fishing sector sees an output increase of $113.53 million and GVA increases by $58.68 million. In addition to the $88 million plus direct demand generated by the proposed West of Wedge development, this is fuelled in part by the anticipated $50.5 million feed expenditure, which will be sourced from local suppliers. The Manufacturing sector sees an increase of just under $70 million in output and $18.8 million in GVA with most of the increase in the Food Product Manufacturing industry.

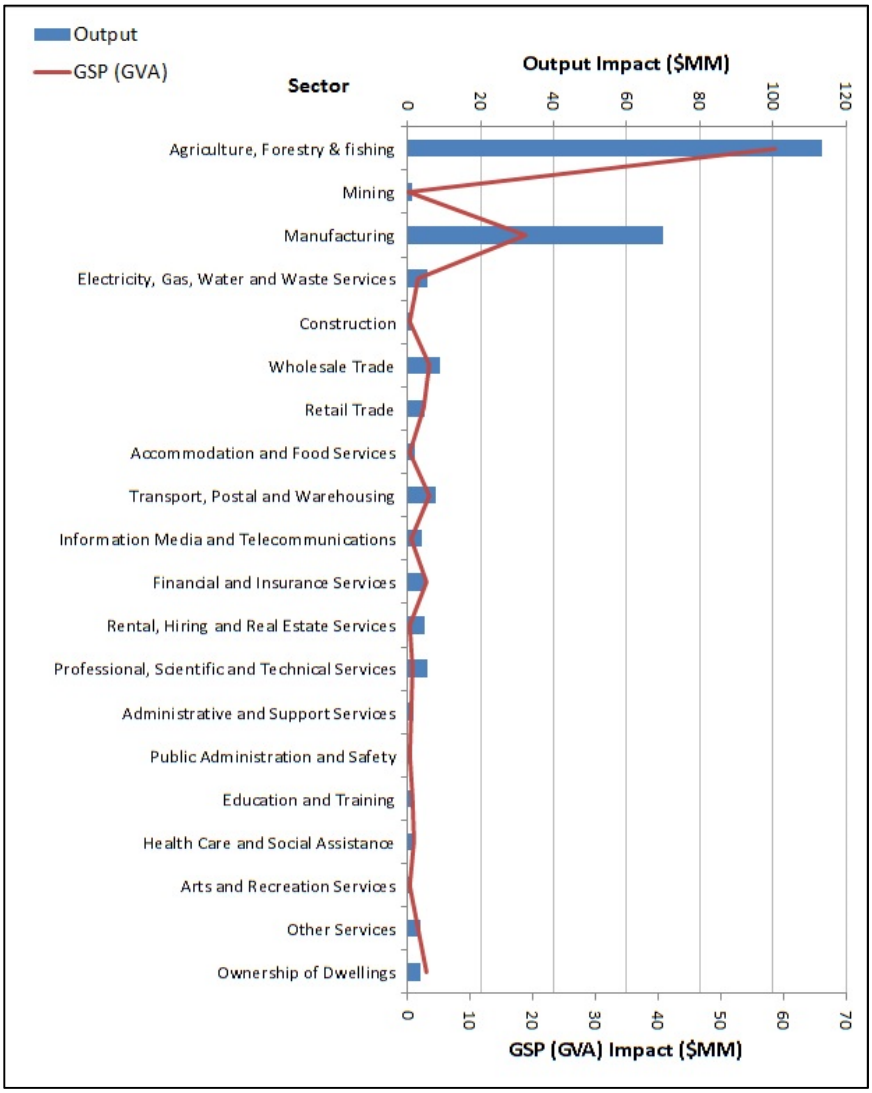


Figure 6.26 Operational impacts on output and GSP by industry sector

The Agriculture, Forestry, Fishing and Manufacturing sectors also see the largest increases in employment and wages. 377 jobs are created in the Agriculture, Forestry and Fishing sector, 272 of them on a full-time basis. In the Manufacturing sector, 190 full-time and 12 part-time jobs are created.

Smaller increases are seen in the professional, scientific and technical services (13 jobs, 10 full-time) and retail/trade sectors (six jobs, three full-time).

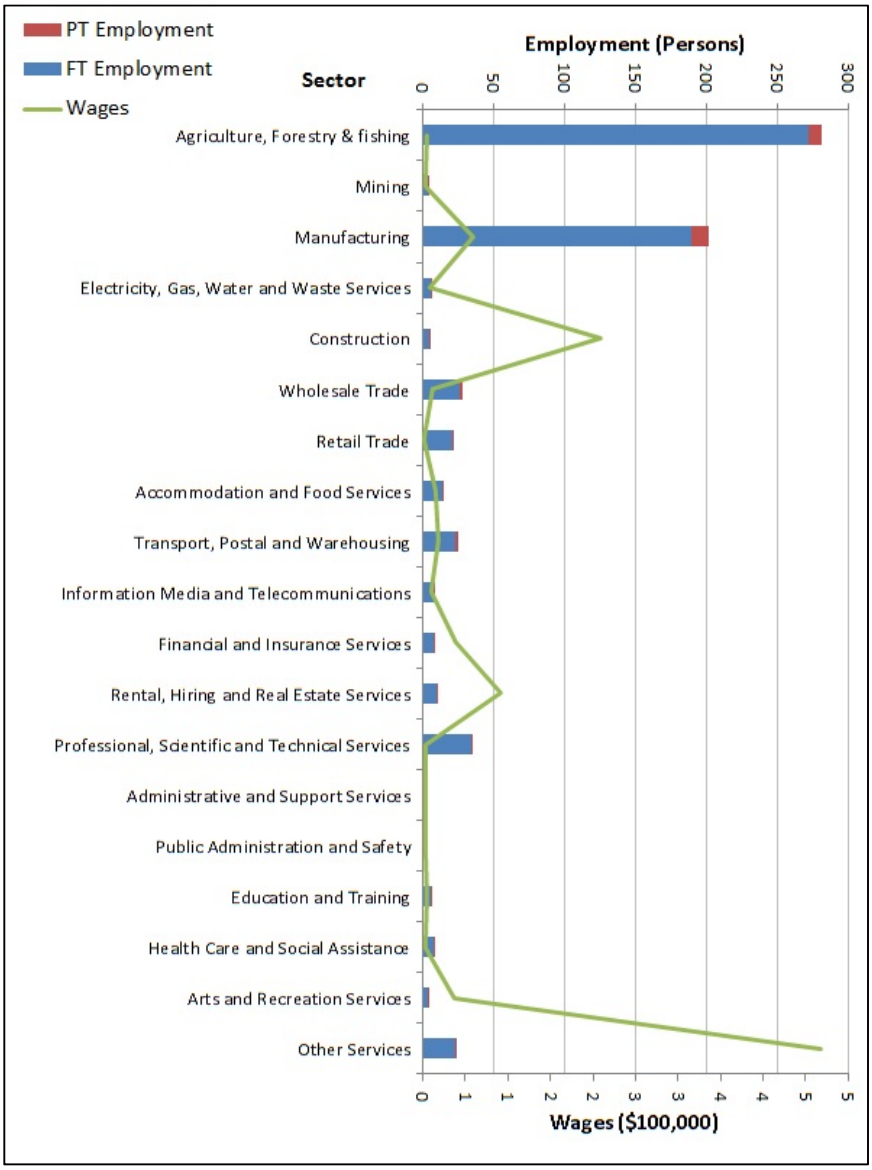


Figure 6.27 Operational impacts on employment and wages impact by industry sector

6.2.13.6.2 *National impacts*

More than 90% of Tassal's production is sold outside Tasmania, predominately to interstate markets. Salmonids were the largest contributor to Australian aquaculture production in 2013–14, representing 56% of the total aquaculture production volume and 55% of the value. 97% of domestic salmonid production occurs in Tasmania and demand is growing both nationally and globally (DSG 2014). Forward linkages to mainland industries from Tassal products are likely to reflect some of the impacts discussed in the previous sections, as mainland wholesalers, retailers, food processors and food service businesses use Tassal products.

6.2.13.7 Mitigation Measures

No mitigation measures are required as the proposed West of Wedge development's potential effects are deemed as positive. Currently, Tassal supports a number of community based organisations on the Tasman Peninsula and in Nubeena (Tasman Men's Shed, Tasman Historical Society, Tasman District School, Dunalley Tasman Neighbourhood House and local sporting clubs) and will continue to support these and other local community based organisations through their community engagement strategy. In addition, Tassal supports local and Tasmanian businesses through purchasing strategies which prioritise local expertise and products where available. This includes, and is not limited to, fuel, vessels, sea cages and outboard motors.

6.2.13.8 Overall effect following implementation of mitigation measures

No mitigation measures are required as the proposed West of Wedge development effects are deemed positive.

It is anticipated that the proposed West of Wedge development will incur $30.8 million in set up costs and, once fully operational, will generate additional revenue of $156 million.

Initial construction is expected to take only four months. Temporary impacts generated by this investment include:

- $30.24 million increase in output across all industries
- $9.7 million boost to Gross State Product
- 101 jobs (71 of them full time) representing $5.3 million in wages income

In the operational phase, the proposed development would provide substantial ongoing gains for the Tasmanian economy, including:

- $246 million increase in output across all industries
- $103 million boost to Gross State Product
- 907 jobs (661 of them full time – across all industries) representing $33 million in wages income

7 Summary of Effects and Management

Table 41 Summary of potential effects and their management

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
6.1.1	**Water Quality**		
	• Increased nutrient release into surrounding waters, localised within Storm Bay. • Deterioration in water quality from nutrient emissions - eutrophication of the water column and impacts on the ecology of native flora and fauna.	• A staged entry approach to production set initially at conservative levels, until the results of environmental monitoring and modelling studies suggest a more appropriate level of production • A dedicated water quality monitoring program with associated site specific water quality limit levels and an expanded monitoring zone. • Continuation of macroalgal monitoring surveys to examine potential broadscale impacts to rocky reef communities. • Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions. • On-site daily monitoring of DO, temperature, salinity, plankton and turbidity. Periodic monitoring of ammonium, dissolved nutrients and dissolved organic matter. • Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols.	• Adaptive management response to production maintained at environmentally sustainable levels • Due to the addition of pens and associated stock, there is expected to be a minor localised impact from increased nutrient emissions – however, these impacts are not expected to translate into adverse broadscale effects to water quality and other ecological assemblages. • Increased focus on the use of key environmental indicators to monitor for changes to the marine ecosystem. • Consolidation of environmental data and implementation of WQ limit levels including management response mechanisms (in line with international best practice). • Increased environmental data capture and characterisation of the entire farming region.

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		• Feeding procedures and company policies to minimise feed wastage. • Continued ASC certification and associated third party audit (to be incorporated as an extension to current ASC certificated farming sites). • Decreased cleaning frequency due to the implementation of K-Grid design mesh nets to proposed leases. • Environmental WQ loggers and additional 'Smart Farm' technology to be installed across the Eastern Farming Zone.	
6.1.2	**Substrates and Fauna**		
	• Organic enrichment of sediments directly beneath cages from feed, faeces and net wash effluent • Reduction in oxygen component of sediments directly beneath cages • Bacterial matting build up directly beneath cages • Changes in species number, diversity, abundance and biomass of benthic faunal and meiofaunal assemblages directly beneath cages	• A staged entry approach to production set initially at conservative levels, until the results of environmental monitoring and modelling studies suggest a more appropriate level of production • The adoption of a broadscale environmental monitoring program to detect changes within sediments • Internal ROV surveys and management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions	• Adaptive management response to production maintained at environmentally sustainable levels • Tassal does not anticipate any adverse effects beyond 35m from the lease boundaries • The use of DEPOMOD to model solid particulate emissions deposited on the underlying substrate will: ▪ Understand the nature of the emissions footprint ▪ Understand ways in which feed practices can be altered to minimise the emissions footprint (i.e. reduce feeding during particular conditions to limit enlarging this footprint) ▪ Determination of site specific stocking and fallowing regimes

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• Hypoxia in the water overlying the sediment • Increased sulphate reduction • Build up and release of methane and hydrogen sulphide gas from sediments	• Appropriate management responses will continue to be adopted if unacceptable changes are observed from annual ROV monitoring surveys • Feeding procedures and company policies to minimise feed wastage • Continued ASC standard certification and associated third party audit • Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols – use of high frequency/low volume practices to prevent colonisation of biofouling organisms and reduce overall outputs • Decreased cleaning frequency due to the implementation of K-Grid design mesh nets to the proposed leases • Ongoing compliance with Schedule 3V of License Conditions • Specific regulatory management controls	• Reduced net wash effluent released to marine environment as K-Grid design mesh nets are utilised and implementation of Environmental Best Practice for In-situ Net Cleaning • Routine monitoring will reduce the likelihood of unacceptable impacts occurring to the substrate from the fish farm organics and nutrients • Continual improvement focus through ASC certification requirements and adoption of best practice farm management protocols to reduce impacts
6.1.3	**Marine Vegetation**		
	• Deposition of feed and emissions could potentially reduce growth of canopy forming macroalgal species	• A dedicated monitoring program to assess potential impacts on macroalgal assemblages within Storm Bay • Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols • Decreased cleaning frequency due to the implementation of K-Grid design mesh nets to the proposed leases	• The nearest macroalgal assemblages are approximately 1.6 km away, therefore the potential for adverse environmental effects from the proposed development is considered to be low

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		• Marine farming licence conditions – marine farming activities only allowed over unconsolidated, unvegetated substrates • Closest fringing reef approximately 1.6 km away • The adoption of a broadscale monitoring program to detect changes in macroalgal community assemblages • Ongoing monitoring of Giant Kelp abundance and canopy cover in the Eastern Farming Zone • Establishment of monitoring locations that border upon known extent of soluble emissions • Feeding procedures and company policies to minimise feed wastage • Historic reef monitoring in region by Tassal and TRF project.	
6.1.4	**Birds**		
	• Habitat loss – may impact upon normal feeding, breeding, foraging or roosting behaviour and activities • Behavioural changes – birds may be attracted by fish and feed resulting in changes to home ranges or increased potential for interactions (e.g. entanglement) with marine farming operations	• Bird exclusion control through sea cage aerial netting • On-site (enclosed) feed storage and management • Company-wide adherence to Tassal's internal Wildlife Interaction Plan, including SOPs to minimise bird interactions • Shoreline clean-up of marine debris (undertaken outside of breeding season to prevent nest disturbance). K-Grid nets reduce rope used to configure pens, therefore reducing the potential onshore impacts of farm debris • Limit night lights deployed onsite	• Following the implementation of the mitigation measures, it is considered that the proposed West of Wedge development will not have a significant or adverse impact on birds in the Storm Bay area west of Wedge Island

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT

	• Changes to foraging behaviour from increased olfactory perception of feed storage within zone
	• Entanglements – birds may be injured or killed in bird netting
	• Marine debris impacting on nesting and roosting sites on adjacent shorelines
	• Predation of stocked fish
		• All feed to be stored in sealed hoppers on-site
		• Provide information to staff on how to treat and release birds found on farming infrastructure and vessels
		• Ongoing risk planning/risk assessments with Birdlife Tasmania
		• Staff training / operational practices to decrease marine debris
		• Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions
		• Continued ASC standard certification and associated third party audit
		  • **ASC Criteria 2.5.3** Number of mortalities of endangered or red-listed marine mammals or birds on the farm = 0.
		  • **ASC Criteria 2.5.5** Evidence that information about any lethal incidents on the farm has been made easily publically available.
		  • **ASC Criteria 2.5.6** Maximum number of lethal incidents on the farm over the prior two years = < 9 lethal incidents with no more than two of the incidents being marine mammals.
		  • **ASC Criteria 2.5.7** In the event of a lethal incident, evidence that an assessment of the risk of lethal incident(s) has been undertaken and	

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		demonstration of concrete steps taken by the farm to reduce the risk of future incidences.	
6.1.5	**Marine Mammals**		
	• Entanglement of marine mammals in netting, ropes or mooring lines resulting in injury or death • Marine debris causing entanglement or ingestion by marine mammals • Modification of behaviour – the presence of marine farms may affect the foraging behaviour of marine mammals, particularly in the open waters of the Storm Bay • Modification of seal behaviour through habituation to marine farms • Predation of farmed fish • Negative impacts on fish performance • Risk of fish escapes from damaged nets • WHS risk to farm staff	• Tassal's strategy for seal interactions is to implement technology for total exclusion • Seal exclusion – sea cage netting/net tensioning • Seal proof bird nets • Implementation of K-Grid net technology (and associated decrease in potential for nets to be damaged or accessed by seals) • Company-wide implementation and adherence to procedures contained in the Tassal Wildlife Interaction Plan • DPIPWE seal management protocols • Staff training and compliance with wildlife management procedures • Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions • Continued ASC and WHS standard certification and associated third party audit • WWF partnership protocols	• The proposed West of Wedge development is expected to attract seals, however Tassal's seal management strategy is total exclusion and non-lethal deterrents will mitigate negative interactions • The likelihood of negative interactions occurring with whales and dolphins is considered low

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• Negative welfare issues for seals	• Site records of marine mammals sightings and company policy to potentially reduce/halt work when within 500 m of operations (e.g. towing cages)	
6.1.6	**Threatened Species**		
	• Entanglement - marine farming equipment, ropes, marine debris, netting, mooring lines have the potential to entangle birds and marine mammals resulting in injury or death • Habitat loss – Marine farming equipment at the proposed West of Wedge development may impact on habitat requirements and habitat quality for a range of listed threatened and migratory species. Additional impacts affecting habitat include effects from sedimentation below cages from farming emissions and deployment of mooring blocks affecting infaunal and demersal marine species • Bird collisions with marine farming infrastructure • Behavioural change – the additional fish to the Eastern	• The adoption of a broadscale monitoring program with associated site specific water quality trigger values • Ongoing monitoring of Giant Kelp abundance and canopy cover in the Eastern Farming Zone • Use of feeding management protocols to minimise feed wastage and emissions • Use of fallowing and rotational stocking practices to promote sediment recovery • Regular monitoring of seabed characteristics (annual ROV surveys) and water quality monitoring • Discourage positive association with marine farms (e.g. seals) • Fish escape prevention and formal protocols, particularly during handling procedures, as a result of predator attacks, or equipment failure, through the establishment of emergency procedures • Regular net inspections and routine maintenance by divers, MIC, ROV and marine operations personnel	• No significant effect from the proposed development on the following Listed Threatened or Migratory Species (identified as potentially being impacted by the proposed West of Wedge development): ▪ Wedge-Tailed Eagle ▪ White-bellied Sea-Eagle ▪ Spotted handfish ▪ Red Handfish ▪ Long-nosed Fur Seal ▪ Southern Right Whale ▪ Humpback Whale ▪ Giant Kelp Communities of South East Australia ▪ Gunn's Screw Shell ▪ Shy Albatross ▪ Wandering Albatross ▪ Sub-Antarctic Fur Seal ▪ Blue Whale

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	Farming Zone may cause some listed threatened species to alter their behaviour, particularly foraging behaviour of seals • Predation – potential predation of threatened species and/or threatened species preyed on by escaped salmonids • Alternation of breeding behaviour – marine farming operations may interrupt breeding or diminish breeding success (e.g. nest disturbance) • Reduction in the ecological integrity of an ecological community (e.g. Giant Kelp Marine Forests of South East Australia and Handfish habitat) – degradation of water quality	• Prevent the introduction of diseases and marine pests through best practice farm hygiene and biosecurity protocols • Minimise discharge of waste and emissions into the marine environment • No disposal of dead fish to the marine environment, only land-based disposal and reuse • Continual improvement in the design and installation of mooring systems and full use of K-Grid and other emerging net technology • Tassal employs a dedicated Wildlife Management Team to continue to reduce negative interactions with wildlife, and train other staff with best practice wildlife management skills. • Shoreline clean-up of marine debris in accordance with BirdLife Tasmania to protect nesting shorebirds (always undertaken outside of breeding season) • Marine farming licence conditions – marine farming activities only allowed over unconsolidated, unvegetated substrates • Research conducted into the survivability of escaped salmonids	
6.1.7	**Chemicals**		

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• Chemicals such as fuel, disinfectants and therapeutants can potentially harm local flora and fauna if mishandled or spilled	• Any chemicals that are classified under the *Environmental Management and Pollution Control Act 1994* as controlled wastes require disposal by an appropriate licensed contractor - approved waste service providers dispose of chemicals in accordance with the appropriate regulations • All chemicals used on marine farming sites are stored in bunded areas with the capacity to hold 110% of the volume of the largest container • Spill kits and training – Tassal's policy is to have a spill kit on every company vessel and barge and at all fuel-fill stations • Regular servicing of all boats and equipment; daily inspection and appropriate start up and shut down procedures ensuring early identification of issues and appropriate remedial action • WHS and Environmental policies and procedures in place for correct storage and handling • Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions • Continued ASC and WHS standard certification and associated third party audit	• The proposed West of Wedge development is not expected to result in significant chemical use on-site. Most chemical use will be undertaken at existing land base in designated areas • It is expected that the implementation of the mitigation measures would restrict the likelihood of impacts occurring from chemical use
6.1.8	**Species Escapes**		

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• Establishment of wild populations • Impact on native fish populations through predation or competition for resources • Disease/parasite transfer from farmed fish to native fish populations	• Comprehensive diving regime to routinely monitor net integrity ▪ Minimum weekly sub-surface inspections of nets, mooring lines and cage infrastructure integrity, and daily inspection of aerial bird netting • K-Grid net technology stronger than traditional net types • Regular net tension testing conducted • Newly deployed nets are dived prior to fish stocking • All stock transactions conducted in weather conditions that do not present an unacceptable risk of fish escape • All cages, nets and mooring systems appropriate for the prevailing weather conditions, currents, water depths and seabed characteristics at the site • Mooring system engineering and design in accordance with NS 9415:2003 to account for site positioning in exposed locations • Integrity of all farm systems checked and repaired after severe weather events • Appropriate procedures, staff training and education are implemented regarding key processes that pose a higher risk of an escape event if not performed correctly • Continued third party certification audit process verifies Tassal escape mitigation procedures	• Tassal implemented protocols manage the associated risks and significantly reduce the likelihood of escapes and remain committed to continually improving these practices • Due to all female stock used and the inability to successfully forage for feed in the wild - the risk of wild populations becoming established is very low

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		• Company Wide Escape Prevention and Response Protocols in place • Escape Response Kits on all work and feed barges • MIC Net Cleaner conducts regular net inspections while cleaning • Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions • Continued ASC standard certification and associated third party audit • Routine mooring inspection and maintenance work	
6.1.9	**Disease**		
	• Antibiotic use • Mass mortality event • Transmission of an existing salmonid disease to wild fish	• Strategies to mitigate against the threat of disease in farmed fish are employed at all stages of fish production from the hatchery through to the full marine production cycle including harvesting (see Fish Health Management Plan – South East) • Measures aimed at minimising the spread of pathogens include disinfection procedures, effective control of mortalities and bloodwater, optimal nutrition and husbandry procedures • Adherence to Tasmania's strict biosecurity and quarantine regulations • Participation in Tasmanian Biosecurity and Surveillance Program	• There is a low risk that presence of disease-causing agents to farmed salmon in the Eastern Farming Zone would have any effect on the natural environment • Disease management protocols adopted to reduce any potential impact on native fish populations • Major effort to prevent introduction of new diseases at Tasmanian border and other Tasmanian farming areas significantly reducing the risk of new diseases introduced into the Eastern Farming Zone

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		• Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions	
6.1.10	**Waste Streams Disposed on Land**		
	• Farmed fish mortalities – impacts on natural and human environment: spread of disease to wild fish; organic enrichment of water column and seabed from putrefying fish; odour issues (public amenity and aesthetics); water quality changes • Farmed fish mortalities – impacts on other farmed fish: spread of disease and parasites; lowering of DO (and impact on other water quality physio-chemical parameters) due to microbial degradation of putrefying fish; stress on existing populations and potential health impacts • Marine debris – entanglement of fauna; public amenity and aesthetics; hazards to navigation • Inappropriate discharge of black and grey water – physio-chemical	• Fish mortalities – avoidance through best practice husbandry, biosecurity measures, utilisation of only best available stock identified through the industry's Selective Breeding Program (SBP), seal exclusion, vaccination, increased company focus on fish health, appropriate disposal of mortalities • Marine debris - clean-up of existing marine debris through Shoreline Clean-up program; staff training and operational practices to decrease marine debris • Black and grey water discharge - is collected by service vessel and discharged to sewer • Organic material from in situ net cleaning – Caring for our Country research has quantified MIC removal and modelled dispersal of fouling • Marine operations Waste Management Plan and Waste Management Policy • Continued ASC standard certification and associated third party audit	• Implementation of mitigation measures would restrict likelihood of impacts occurring from grey and black water and bloodwater from harvesting operations and other waste streams • The proposed West of Wedge development may result in an increase in the quantity of marine farming derived marine debris – shoreline clean-up program to assess through monitoring, data collection and follow-up where required • Commitment to expand shoreline-clean-up areas within Eastern Farming Zone

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	effects on water quality; increased faecal coliforms; fish health impacts • Dispersion of organic material from in situ net cleaning into the receiving environment • Bloodwater from harvesting - potential to organically enrich surrounding waters; potential to spread disease amongst fish stocks	• Net Washing Best Practice Guidelines and anticipated decreased cleaning frequency due to implementation of K-grid nets • Strict storage and disposal procedures to ensure bloodwater is not released to the environment • Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions • Draft Industry Mass Kill Contingency Plan	
6.1.11	**Introduced Marine Species**		
	• Potential for marine farming activities to translocate marine pest species or extend their known range • Potential for translocation of introduced marine pests from marine farming operations to alter ecological structure and function of native marine communities	• Use of on-site harvest vessel – eliminates movement of pens between farming sites and processing facilities • Use of antifouling paint on vessel hulls – inhibits fouling growth on marine hulls (potential source of marine pests) • Company-wide adherence to biosecurity protocols and disinfection procedures at all farming and processing sites • Collection of marine debris and appropriate disposal on land • Continued ASC standard certification and associated third party audit • Monitoring for marine pest species through annual underwater ROV video surveys - regulatory annual	• The potential for the spread or translocation of IMSs as a result of the proposed West of Wedge development is considered low

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		ROV compliance species database records the presence of any IMS in and around lease area • Farming infrastructure will not move between biosecure zones. The proposed West of Wedge development will have zone specific equipment in relation to company biosecurity protocols	
6.1.12	**Marine and Coastal**		
	• Sediment dynamics regarding channels and sand bars	• No mitigation measures are required	• No overall effect expected
6.1.13	**Climate Change**		
	• Sea level rise • Changes in weather patterns • Decreased summer rainfall/ increased winds throughout winter • Increased water temperature and associated changes to water chemistry	• Selective breeding for increased tolerance to elevated water temperatures • Venturation of pens through high temperature periods and low dissolved oxygen events • Sea surface temperature project commissioned between Tassal and CSIRO to track currents and mass water movements around the state. • Water quality monitoring • Purpose built mooring systems designed to withstand severe weather events • Industry supplied with temperature trends and long range forecasts through CSIRO	• Climate change mitigation and adoption of decision support systems will support future farm planning and management – no net effects anticipated for proposed West of Wedge development • Offshore oceanic site subject to less temperature fluctuation than existing farming zones

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
6.2.1	**Visual**		
	• Reduction in visual amenity	• Management controls from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005 and marine farming licence conditions • Barge design will consider height above water to limit its visual impact • Visual assessment conducted by expert	• Residents and users of the Storm Bay and Nubeena area are deemed to have minor adverse impact resulting from the proposed West of Wedge development
6.2.2	**Navigation**		
	• Some impact on mariners as navigation around proposed development area will be required	• Navigational lighting/ boundary markers compliant with MaST and DPIPWE requirements • Tassal vessels and staff are always available to assist in safety at sea incidents • Industry and Tassal navigation risk assessments completed • Consultation with marine, regulatory and recreational boating organisations • Management controls from Tasman Peninsula Marine Farming Development Plan 2005	• Expected to be minimal impact to safe navigation • Implementation of MaST and DPIPWE requirements and use of navigational aids reducing the overall effect, considered low
6.2.3	**European and Other Heritage**		
	• There are no recorded sites of heritage significance or value	• No mitigation measures are proposed	• There will be no overall effect from the proposed West of Wedge development
6.2.4	**Aboriginal Heritage**		

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• Aboriginal Heritage Tasmania have advised that there are no recorded sites of Aboriginal heritage value	• No mitigation measures are proposed	• There will be no effect from the proposed West of Wedge development
6.2.5	**Reservations**		
	• Loss of visual and noise amenity and farm debris on-shore	• No specific mitigation measures proposed (but refer to sections 6.1.11, 6.2.1 and 6.2.6)	• There will be no overall effect to the reserves
6.2.6	**Noise**		
	• Loss of amenity for sensitive receptors • Residents and users of White Beach were deemed to be potential noise sensitive receptors relevant to the proposed West of Wedge development • Barge generator power source for: ▪ Venturation ▪ Fish feeding	• Tassal staff comply with guidelines on noise emissions made pursuant to the *Environmental Management and Pollution Control Act 1994* for marine farming operations • Prior to deployment compliance monitoring and noise modelling will be undertaken to ensure that noise emissions do not exceed prescribed limits • Tassal staff adhere to noise protocols • Implementation of K-Grid net technology will reduce noise associated with net washing • Noise producing construction work will be limited to day time hours • The offshore location of the proposed West of Wedge development is expected to dissipate noise of marine farming operations • Community consultation to assess noise and any noise issues	• The location of the proposed West of Wedge development 4 km from the nearest potential sensitive receptor coupled with appropriate design, engineering, and management is expected to minimise noise impacts on all potentially sensitive receptors • Noise levels are confidently predicted to be a maximum of 14.2 dBA at isolated residences south of White Beach (4km away from nearest lease). This level is well within the stringent night time noise limits imposed by the EPA on new rural industry

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
		• Assessment and report provided by acoustic specialist to assess noise impacts and assist in noise mitigation as required	
6.2.7	**Odour**		
	• Loss of amenity to sensitive receptors due to: ▪ Dead and decaying stock ▪ Spilled or incorrectly stored feed ▪ Organic fouling on equipment ▪ Harvesting wastes ▪ Chemicals including petroleum products ▪ Engine exhausts	• Timely removal of mortalities from farm cages – removal of mortalities from cages at least twice per week and placed in sealed plastic bins for transport to rendering plant • Appropriate removal and disposal of stock mortalities • Feed stored in sealed hoppers on feed barges • Appropriate containment and disposal of harvesting wastes produced at marine sites – bloodwater is collected and disposed of at Dover WWTP • Management of equipment to ensure it is kept clean and in good working order • Secure and appropriate storage of chemicals including petroleum products • Management control from Tasman Peninsula and Norfolk Bay Marine Farming Development Plan November 2005	• There is not expected to be any odour related impacts for the proposed West of Wedge development
6.2.8	**Commercial Fishing**		

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• The proposed West of Wedge development has the potential to affect commercial fishing in a number of ways, including: • Displacement from fishing grounds • Disrupted transit to/from fishing grounds • Impact on commercial fish stocks	• Compliant boundary markers will clearly identify the proposed West of Wedge development areas and facilitate the safe navigation of boaters during both the day and night • Liaison and engagement of fishing sectors (i.e. Danish seine, shark, abalone and rock lobster) • Movement of the location of the proposed development 400 m northwards to minimise impact on fishing grounds	• Implementation of the proposed mitigation measures will assist in minimising the potential overall impact on commercial fishing • An unavoidable impact of the proposed West of Wedge development is the spatial displacement of commercial fishing from the West of Wedge areas containing surface located marine farming equipment; potential effects on fisheries are not considered to be significant within Storm Bay area • Proposed development zone will only occupy approximately 1.73% of the Storm Bay area
6.2.9	**Recreational Fishing**		
	• The proposed West of Wedge development has the potential to affect commercial fishing in a number of ways, including: • Displacement from fishing grounds • Entanglement of fishing lines and anchors in farm mooring lines • Disrupted transit to/from fishing grounds • Impacts/alterations on recreationally targeted fish stocks	• Compliant boundary markers will clearly identify proposed areas containing surface located marine farming equipment and facilitate the safe navigation of boaters during both the day and night • Use of K-grid nets at the proposed West of Wedge development	• Reduction of access to some currently accessible recreational fishing grounds • An unavoidable impact of the proposed West of Wedge development is the spatial displacement of recreational fishing from the West of Wedge areas containing surface located marine farming equipment; potential effects on fisheries are not considered to be significant • Reduction of salmon escapee events

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	• Increased interactions between seals and recreational fishers		
6.2.10	**Recreational Activities**		
	• Visual and auditory impact of marine farming activities • Increased marine debris from marine farming activities • Reduced available on-water area for recreation • Increased on-water activity associated with marine farming	• Tassal staff comply with guidelines on noise emissions made pursuant to the *Environmental Management and Pollution Control Act 1994* for marine farming operations • Management and monitoring of noise making equipment with proposed West of Wedge development (see section 6.2.6.4) • Marine debris – clean-up of existing marine debris through Shoreline Clean-up program; staff training and operational practices to decrease marine debris • Movement of the location of the proposed development 400 m northwards to minimise impact on fishing grounds • Tassal vessels will continue to comply with navigation regulations regarding vessel speed and lighting; all Tassal vessels are in commercial survey	• The proposed West of Wedge development is expected to have some impact on recreational activities • Increased on-water activity associated with marine farming should not significantly impact on recreational on-water activities
6.2.11	**Tourism**		
	• No negative effects on tourism activities in the area are anticipated as a result of the proposed West of Wedge development. In adjacent waterways there are tourism	• Community consultation to advise local operators in the region of the proposed development	• There are no negative effects anticipated as a result of the proposed West of Wedge development

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
	businesses which have incorporated salmon farm tours as part of their on-water tour experience		
6.2.12	**Land Use and Development**		
	• As this is a marine based development there are no potential effects or threats to land use and development as residences are at least 4-6 km from the nearest proposed lease, and there are no relevant commercial or industrial activities identified	• No mitigation measures are proposed	• Not applicable as there will be no land based activities for the proposed West of Wedge development
6.2.13	**Socio-Economic Aspects**		
	• There are socio-economic benefits directly resulting from the proposed development • The salmon farming Industry is a growth industry in Tasmania and one the most important seafood producers in Australia	• No mitigation measures are proposed as impacts are considered positive in nature	• Optimisation of fish performance ensures the future viability of Tassal • The overall socio-economic impact from the proposed West of Wedge development will be seen in both construction and operational phases • In construction phase impacts (across all industries) include: ▪ $30.24 million increase in output across all industries ▪ $9.7 million boost to Gross State Product ▪ 101 jobs (71 of them full time) representing $5.3 million in wages income.

SECTION	POTENTIAL EFFECT	AVOIDANCE AND MITIGATION	OVERALL EFFECT
			• In operational phase impacts (across all industries) include: ▪ $246 million increase in output ▪ $103 million boost to Gross State Product ▪ 907 jobs (661 full-time) representing $33 million in wages

8 Conclusion

Commencing in 2013, Tassal embarked on a South East Optimisation Project, aiming at delivering sustainable growth, enhanced fish health and performance and improved environmental management. As a company, Tassal is focussed on supplying better returns economically and socially, whilst also minimising impacts to the environment. The proposed West of Wedge development and the amendment to the Tasman Peninsula and Norfolk Bay MFDP is driven by a growing demand for Tasmanian salmon and the need to mitigate biosecurity risks through increased geographical separation.

Potential impacts from the proposed West of Wedge development have been assessed and discussed within this document. Throughout decades of farming in south-east Tasmania, Tassal has successfully demonstrated an ability to manage logistical issues and environmental impacts. An adaptive management framework will be adopted for the proposed development, which will encompass all current monitoring requirements and management practices in conjunction with continued environmental monitoring and any new regulations. Tassal will also continue to actively engage in research and seek constant improvement in the management of their marine operations.

Tassal is supportive of productions levels within the Storm Bay region being regulated through a TPDNO as determined by the EPA. The company will actively engage and work with the regulatory authority in relation to on-going monitoring and site evaluations to meet designated environmental performance criteria as well as ensure fish health and performance.

Salmon farming is fast becoming the most economically important fisheries sector in Australia and more importantly a leading sector in the Tasmanian economy. The proposed West of Wedge development will result in an initial investment of $30.8 million which will create more than 100 jobs across all industry sectors. Once operational, there will be a $246 million increase in output across all Tasmanian industries with the generation of potentially 600 full-time jobs across all industry sectors. The proposed development itself will generate 73 full-time employment opportunities.

Tassal's goal is to remain a long term, sustainable and reputable company in Tasmania. The company has a recognised ability to work with stakeholders and has invested heavily in its people, environmental management and compliance as well as third party certification processes in order to gain the confidence of the State and the Tasmanian public. The proposed West of Wedge development is an important component in Tassal's growth strategy as well as its on-going commitment to sustainable farming operations.

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10 Appendices

Appendix 1. Tassal Sustainability Report 2015-16

Appendix 2. Map of proposed West of Wedge development with Tasman Peninsula and Norfolk Bay MFDP amendment

Appendix 3 Image of K-Grid netting

Appendix 4 Noise Impact Assessment

Appendix 5 Net Cleaning Best Practice Guidelines

Appendix 6 Rocky Reef Report

Appendix 7 Tassal South East Regions Optimisation Plan

Appendix 8 Proposal Summary for Stakeholders

Appendix 9 West of Wedge Community Survey

Appendix 10 Community Survey Report

Appendix 11 West of Wedge Zone Assessment

Appendix 12 West of Wedge mooring grid layout

Appendix 13 Schedule 3V

Appendix 14 Visual Impact Assessment

Appendix 15 Socio-economic Impact Report

Appendix 16 DEPOMOD Report with full production cycle

Appendix 17 BRUV Survey 2015

Appendix 18 Guidelines for Observing Cetaceans

Appendix 19 TSGA Biosecurity Program

Appendix 20 Indicative Storm Bay Environmental Monitoring Program