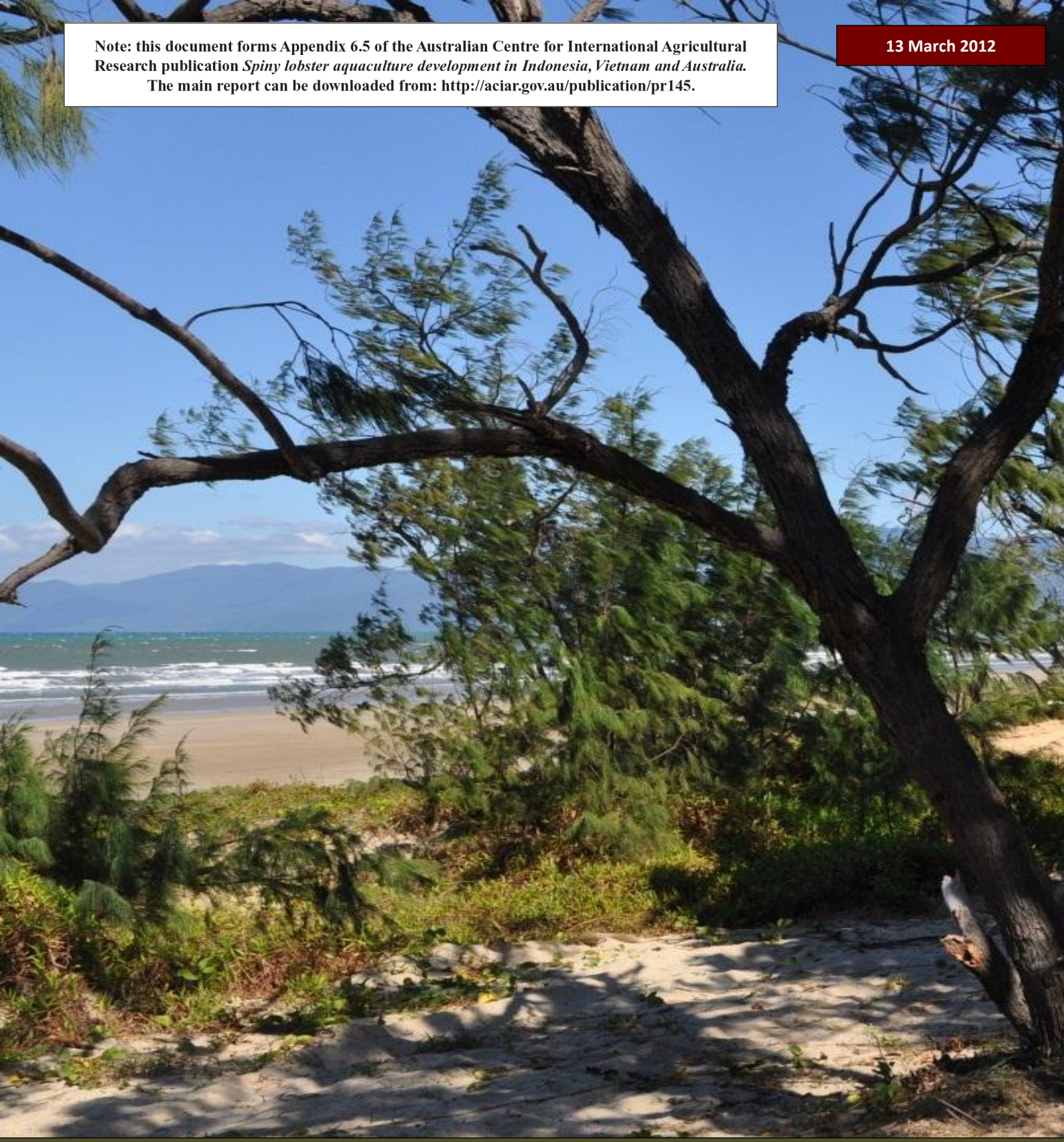
Note: this document forms Appendix 6.5 of the Australian Centre for International Agricultural Research publication *Spiny lobster aquaculture development in Indonesia, Vietnam and Australia.* The main report can be downloaded from: http://aciar.gov.au/publication/pr145.

13 March 2012



Jaragun Pty Ltd

Quality is Our Business

Lobster Grow-out Pilot Project

Yarrabah Business Case

Contents

1. EXECUTIVE SUMMARY

1.1 Introduction

This Business Case has been prepared for the establishment of an aquaculture facility to grow out spiny lobster at Yarrabah, Qld. The project is being conducted in two stages. A Pilot Project will demonstrate proof of concept and allow further R&D on the biometrics of spiny lobster farming, which is a new industry in Australia. A commercial facility will be established post pilot to provide training, employment and economic development opportunities for the Aboriginal community.

The Qld Department of Employment, Economic Development and Innovation (DEEDI) commissioned the Business Case after more than a decade of R&D on spiny lobster at its research facility, located in the Northern Fisheries Centre, Cairns. DEEDI has successfully grown out a premium quality product in a tank-based system over several years. This has been accompanied by significant scientific breakthrough into closing the species cycle, which means that it is now possible to supply juvenile lobsters for grow-out from hatchery-produced seed stock rather than take from the wild. DEEDI's R&D program has brought spiny lobster husbandry to a stage where it is ready for development in a farm setting. Establishment of the industry will allow Australia to take advantage of the huge and growing Chinese market for spiny lobster worth $190 million USD in 2011.

1.2 Project proponent

The Gunggandji PBC Aboriginal Corporation (Gunggandji PBC) is the proponent for the Pilot Project. The organisation represents Traditional Owners and descendants of people who were forcibly removed off traditional homelands to Yarrabah. On conclusion of the Native Title process, the Gunggandji PBC will be trustee of Lot 207, the site selected for the aquaculture facility.

The Gunggandji PBC will partner with DEEDI to implement the Pilot Project. DEEDI's technical support and extension services are critical to the successful establishment and operation of the grow-out facility. DEEDI will have a key role in developing the community's animal husbandry skills that are needed to operate the facility post pilot.

1.3 Preferred site

The preferred site to conduct the Pilot Project is adjacent to the foreshore of Mission Bay at Yarrabah. The site was selected by Traditional Owners and DEEDI, with support from the Qld Department of Environment and Resource Management (DERM). This was preceded by a Scoping Study that reviewed all possible locations available to the project on the Yarrabah peninsula at the time.

The Pilot Project will need to address several environmental management challenges to obtain the development permits and approvals needed from Australian and State Government agencies to conduct aquaculture farming at the site. The location is:

- Adjacent to the Great Barrier Reef World Heritage Area, the Great Barrier Reef Marine Park (GBR Marine Park) and State Marine Park

- Potentially inhabited by threatened species, ecological communities and migratory species listed as Matters of National Environmental Significance (MNES)
- Contains two regional ecosystems for protected areas, wildlife and critical habitats associated with remnant vegetation
- Potentially within a declared erosion prone area, and
- Contains wetlands of High Ecological Significance.

1.4 Business Case

The Business Case provides the information necessary to progress the Pilot Project. The information covers socio-economic factors, marketing opportunities and competition, production systems and processes, biometric data and financial data. The Business Case had two underpinning objectives.

Firstly, the Business Case sought to identify all the requirements needed to meet permit and approval conditions for establishment of the aquaculture facility at Mission Bay, including associated application processes and costs. The review indicates that environmental management agencies have a varying level of confidence associated with approvals. DERM and the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) consider that environmental aspects are likely to be met, albeit with permit conditions. The application to SEWPaC will need to present a strong case of the socio-economic benefits of the development to the Yarrabah community. The Great Barrier Reef Marine Park Authority (GBRMPA) has a more cautionary approach, requiring the aquaculture facility to have a negative impact on the GBR Marine Park.

The application process is complex, involving five permits and approvals for construction of the aquaculture facility. These require collection of a significant amount of scientific and technical information and data. The estimated upfront cost is between $0.85 million and $1.11 million, which is largely associated with:

- Possible need for an Environmental Impact Statement (EIS), which would require 12 months of data collection, and
- Need for an engineer-endorsed design of the production facility and intake/outfall pipelines, which would include developing applications and management plans to specifications agreed with environmental management agencies.

GBRMPA will decide the need for an EIS, in conjunction with SEWPaC, based on the level of nutrient discharge relative to existing water quality in Mission Bay. A key determinant will be the sufficiency of existing water quality data held by the Yarrabah Aboriginal Shire Council, against the need for further data collection through a baseline study.

Preliminary estimates from engineers indicate that between $6 million and $8 million is required to establish the Pilot Project. The main costs are associated with project management and construction of the intake/outfall infrastructure.

Secondly, the Business Case aimed to demonstrate long-term commercial viability of the aquaculture facility. GBRMPA stipulated this as a requirement for assessment of a Marine Parks Permit application to operate the Pilot Project adjacent to the GBR Marine Park.

The analysis shows that a commercial facility is not viable at this point in time, due to operational costs outweighing sales over the long-term. A great deal of caution is needed in basing a decision on whether or not to pursue the Pilot Project on the financial analysis alone.

Analysis of financial data for a commercial-scale facility is premature at this time. A key role of the Pilot Project is to continue R&D into identifying the optimal biometric conditions for farming spiny lobster in Australia, particularly to determine stocking densities, grow-out rates and number of production cycles. Current experience with the establishment of other aquaculture species in Australia, such as prawns and barramundi, has involved significant advances in culture methods and farming viability as a result of ongoing R&D programs.

Further, the financial analysis is underpinned by an 18 month grow-out period to meet GBRMPA's requirement for a business case that supports a commercial facility. This does not reflect the operation of the Pilot Project, which was expected to involve only a six-month grow-out period based on the purchase of spiny lobster at minimum legal size, rather than an 18 month grow-out period based on supply from hatchery-produced seed.

Because of these constraints and inappropriate use of the data, DEEDI requested that the financial analysis in this report be prepared for the Pilot Project, rather than for a commercial-scale facility. This was to avoid prejudice associated with consideration of any future business case prepared for a commercial facility. As such, the Business Case in this Report is not suitable for GBRMPA's needs.

1.5 Recommendations

The Business Case shows significant challenges to proceeding with the Pilot Project at Yarrabah at this point in time. The preferred site is an environmentally sensitive area that, as a result, presents additional cost to the project. The biometric data needed to develop the business case required by GBRMPA to assess an application for a Marine Park Permit is not currently available. The cost associated with construction of marine infrastructure is potentially unaffordable.

The Business Case points to the need to review how to take the Pilot Project forward in a location with less prohibitive financial and permit and approval constraints. Other locations along the Qld coast will face similar constraints due to the environmental sensitivities. The most cost-effective solution is a site that has an existing aquaculture permit and land-based infrastructure, such as Fitzroy Island. It is recommended that:

(i) Consideration of Yarrabah as the site for the Pilot Project is discontinued at this point in time

(ii) A suitable site is identified to conduct the Pilot Project, including the process and timeframe for taking the project forward, and

(iii) Yarrabah be considered for a commercial facility, once R&D on biometric data becomes available as an outcome from the Pilot Project.

2. PROJECT OVERVIEW

This Part provides the rationale for conducting the Pilot Project at this point in time. This includes the link between the Pilot Project and the associated international R&D program, the target market for spiny lobster and the development status of the industry in Australia.

2.1 Objective

The project objective is to establish a spiny lobster (Panulirus ornatus) grow-out enterprise in the Aboriginal community of Yarrabah. The project involves establishment of a pilot facility to demonstrate proof of concept for the grow-out of spiny lobster in an Aboriginal community. The longer-term aim is to provide employment and training opportunities through commercialisation of the pilot facility and establishment of similar enterprises in other Aboriginal and Torres Strait Islander (ATSI) communities across northern Australia. The Business Case is limited to the pilot facility at Yarrabah (Pilot Project).

2.2 Reasons for proposing the activity now

The timing of the Pilot Project coincides with the status of R&D, with the grow-out of spiny lobster ready for development in a non-scientific setting. DEEDI has successfully grown out a premium quality product in a tank-based system at the Northern Fisheries Centre over several years. The survival rate is currently 51 per cent, with the animal grown from seed stock to a commercial size within an 18 month period.

The ability to grow-out lobster in a tank-based system is the result of improved animal husbandry techniques and development of artificial feeds. These have underpinned increased grow-out rates and stocking densities. This compares with overseas practices where poor water quality and disease outbreaks are connected to the use of 'trash' fish for feed.

It is also anticipated that hatchery produced seed stock will be available to supply the commercial facility. DEEDI's R&D has involved significant scientific breakthrough into closing the species cycle, which means that it is now possible to supply juvenile lobsters for grow-out from hatchery produced seed stock. The ability to source juveniles from an artificial setting, rather than rely on the unsustainable practice of wild-caught seed, will enhance the ability to obtain an aquaculture permit approval.

DEEDI is pursuing establishment of a commercial hatchery at the same time as the Pilot Project. The hatchery project is recognised by the Qld Government as one of eight priority projects for 2012. The official opening of the Tropical Spiny Rock Lobster Pilot Commercial Hatchery, which is located at the Northern Fisheries Centre in Cairns, will enable prospective investors to see first-hand the technology involved. It was launched by the Honourable Tim Mulherin MP, Minister for Agriculture, Food and Regional Economies on 16 December 2011.

2.3 Market demand for spiny lobster

The demand for farmed spiny lobster has grown exponentially over the last two decades to an industry worth $190 million USD in 2011. The main market is China, where the animal is highly valued for banquet-based entertainment activities.

Vietnam is the main supplier of product to the Chinese market. The industry involves small-scale, family-based, sea cage enterprises, with seed stock for grow-out taken from the wild. The industry is not regulated, having developed rapidly from a few hundred sea cages in 1992 into a large export-oriented, village-based industry involving some 49,000 sea cages. Production levels reached approximately 1,900 tonnes in 2011. Growth of the industry has been accompanied by increased market price (farm gate) for the animal, which rose from approximately US$50 per kg live into Hong Kong in 2007 to US$100 plus per kg in 2011.

The development of the Vietnamese industry has been accompanied by significant signs of stress due to reliance on wild take for the supply of seed stock and trash fish for feed. The industry depends on an abundance of naturally settling late larval stage juvenile lobsters (puerulus), which are collected along the coastline of central Vietnam. Collection rates rose from 500,000 in 1999 to 2,500,000 in 2003. Disease devastated the industry in 2007, with production cut to 1,400 tonnes. The disease outbreak was attributed to the environmental degradation associated with unmanaged industry development and from inappropriate feeding practices.

2.4 Industry establishment in Australia

DEEDI's R&D program has centred on the Vietnamese industry, with the current research period 2010-12 involving $1.30 million for the international "Spiny Lobster Aquaculture Development in Indonesia, Vietnam and Australia" project (International Project), managed by Dr Clive Jones of the Northern Fisheries Centre.

The International Project is funded by the Australian Centre for International Agricultural Research (ACIAR). The funding forms part of the Australian Government's international development cooperation program that encourages Australia's agricultural scientists to use their skills for the benefit of developing countries and Australia. R&D is aimed at technology transfer and capacity building of local communities. Aquaculture in recognised internationally as having a vital role in promoting better use of fishery resources and alleviating poverty in rural communities.

The International Project has three broad objectives to promote sustainable aquaculture in rural communities of the three participating countries, involving:

1. Enhancing sustainable lobster production in Vietnam
2. Transferring lobster farming technology from Vietnam to establish a new industry in Indonesia, and
3. Facilitating commercial establishment of tropical spiny lobster grow-out aquaculture in Australia (i.e. northern Queensland).

The key activities include:

- Commercialisation of the hatchery technology in Australia
- Supply of hatchery-reared lobster seed stock for grow-out in the enterprises of each participating country
- Introduction of artificial formulated feeds
- Enhancement of existing small-scale, family-based sea cage enterprises in Vietnam and using similar animal husbandry techniques to establish enterprises in Indonesia and Australia, and
- Establishment and subsequent commercialisation of a grow-out Pilot Project in an Aboriginal community in Australia.

2.5 Conclusion

The spiny lobster industry has grown exponentially to meet the soaring demand for the product, particularly the Chinese banquet market. Demand for product is expected to continue to grow well into the foreseeable future, in terms of both the volume and wholesale price of the live product.

The R&D associated with the International Project is needed to grow the Australian industry. The high regulatory regime of wild commercial fisheries inhibits growth of the industry without the establishment of aquaculture. The International Project has facilitated the R&D needed for an environmentally sustainable industry in Australia, independent of wild caught seed stock and feed. DEEDI's R&D program has taken the spiny lobster husbandry to a stage where it is ready for development in a farm setting.

ATSI communities are the target group for development of the aquaculture industry in Australia. The Australian Government's international development cooperation program is premised on R&D programs for the benefit of impoverished communities, based around technology transfer and capacity building. This makes the project suitable for participation by coastal ATSI communities in areas where spiny lobster occur naturally in the wild.

3. PROJECT DETAILS

This Part contains details of the Pilot Project, including its purpose, the site selection process, features of the system technology and training needs of the community.

3.1 Proof of concept

Role of Pilot in establishing production capacity and economics of a commercial facility

The intention of the Pilot Project is to furnish the information and data needed to design a commercial aquaculture facility that is suitable for establishing spiny lobster farming as a new industry in ATSI communities across northern Australia. The Pilot Project will be conducted over a three-year period.

A different technology is required to the sea cages used to establish the industry in Vietnam. Regulatory requirements prohibit the use of sea cages along the Qld coast, due to the environmental management requirements of GBRMPA. The alternative land-based technologies include ponds, raceway or tank-based systems.

The Pilot Project will determine the biometric conditions required for optimal grow-out rates of spiny lobster, according to the type of land-based technology used. Key influencing factors are the size/design of the tank, maintenance of water quality and feeding regimes. These will determine grow-out rates, survival rates and stocking densities. The outcomes will inform production capacity, in terms of the length of production cycle, number of crops per annum and farm gate sale prices (i.e. based on the quality of product).

The Pilot Project will determine the biometrics for farming spiny lobsters in Australia on a commercial scale. Cost factors include: aquaculture system and facility design and construction, infrastructure (e.g. roads, electricity supply and fencing), ongoing repairs and maintenance, training and labour, lobster feeds, and financing. The outcomes will inform the break-even point, in terms of the minimum scale and timeframe for the commercial facility to be financially viable.

Engagement of ATSI community

The involvement of the ATSI community is required during the conceptual design and implementation of the project.

The project proponents will be a registered Indigenous organisation to own and take the project forward from the pilot stage through to commercialisation. The organisation will have a key role in developing the support needed for successful operation of an aquaculture facility in the community.

Training and extension services will be critical to capacity building and achievement of the ATSI employment objectives. The training focus will be on spiny lobster husbandry techniques, gained by working alongside DEEDI scientists and completion of Certificate III qualification in aquaculture (minimum requirement).

The individuals selected for training will need to be available during the construction phase. This will promote understanding of the workings of the technology/equipment and overall operation of the facility.

The timing of the qualification will commence shortly after the facility becomes operational. This will provide for hands-on learning, where theory can be applied in practice.

The qualification training is expected to be supported by Language, Literacy and Numeracy (LLN) skills development.

3.2 Site selection process

Selection of Yarrabah

Grow-out of spiny lobsters in Australia is best suited to tropical northern Australia[1], where climate and seawater access are most amenable to good growth and production. The facility must be located on the coastline, providing access to high quality sea water.

In Qld, several ATSI communities between Bowen and the Torres Strait were considered as possible locations for the Pilot Project.[2] Yarrabah was given priority for the following reasons:

- It has access to high-quality, deep sea water all year, which is needed for optimal grow-out conditions
- It is close to the DEEDI Northern Fisheries Centre, which will facilitate project management and technical support from the Centre's lobster grow-out and hatchery research facility
- There is Traditional Owner support for the Pilot Project, and
- Jaragun P/L has established business relationships with Traditional Owners, which will ensure community protocols are followed in relation to site selection and community consultation.

A key consideration in the selection of a site at Yarrabah was involvement of Traditional Owners. Traditional Owners have previously expressed interest in economic development, have a body corporate needed to carry out a business activity[3], are best positioned to garner broader community support and have access to property that can be developed through native title tenure over sizeable areas of Deed of Grant in Trust (DoGIT) land.

Traditional Owners and DEEDI identified nine possible locations on private and DoGIT land. These were at:

- Fitzroy Island
- Turtle Bay (and Little Turtle Bay)
- False Cape

[1] Longitude north of Bowen.
[2] Communities that were considered suitable for the Pilot Project included Bowen, Palm Island, Cooktown, Mornington Island, Lockhart River and Badu (Torres Strait).
[3] At the time of the Scoping Study, the Yarrabah Aboriginal Shire Council managed DoGIT land. The Gunggandji PBC is expected to assume management following the native title determination in December 2011.

- Buddabadoo
- King Beach
- Back Beach (Wungu and Jilji), and
- Mission Bay, Yarrabah.

Figure 1: Map of locations

Mission Bay was selected after completion of a Scoping Study and need to identify an additional site due to either permit issues or unsuitability of the other locations.

Scoping Study

Preliminary investigations eliminated four locations from further consideration due to land tenure issues, poor access and general unsuitability for an aquaculture development. These included Fitzroy Island, Turtle Bay, False Cape and Buddabadoo.

Fitzroy Island had been the preferred location. It was favoured by Traditional Owners, with access to deep sea water, an existing aquaculture facility and a current aquaculture permit/licence. The location was excluded after it was found that the lessee had already entered into an agreement with another party, making the facility unavailable to the Pilot Project. No other sites are available on Fitzroy Island because of restrictions on land tenure/zoning. Following completion of site assessments at Yarrabah, the leaseholder of the facility at Fitzroy Island indicated a willingness to negotiate with DEEDI.

Turtle Bay was excluded due to its isolation and access only by sea. It was considered that inclement weather would impede all-year-round access, affecting successful implementation of the Pilot Project. Further, construction of an 'all weather' road to overcome the logistics of boat access would add significant cost and delay start-up of the Pilot Project.

False Cape was the preferred location accessible by road. This involved a freehold property that already had cleared land suitable for development. The property was on the market at the time of

the assessment. However, while seeking permission to conduct the site inspection, it was established that the property was under contract. This effectively eliminated False Cape as a potential location to conduct the Pilot Project.

Buddabadoo was found unsuitable due to its rough terrain, need for significant land clearance and high potential for flooding on lower ground during the wet season.

Site assessments at King Beach and Back Beach

Three sites were assessed at the two remaining locations of King Beach and Back Beach. These included King Beach, Wungu at the northern end of Back Beach and Jilji at the southern end of Back Beach. The sites are within the jurisdiction of both the Qld State Parks (intertidal area between low and high water mark) and GBRMPA.

The assessments were based on a set of criteria[4] developed by DEEDI appropriate to an above-ground raceway or tank-based aquaculture system.

None of the sites met all criteria.

King Beach

King Beach was the preferred site, being located on DoGIT land, having good acreage available for later expansion to a full-scale commercial facility, having access to high quality sea water, and being protected from the prevailing south easterly winds.

King Beach is located east, south east of Yarrabah. The beach is approximately two kilometres in length and is surrounded by mountains on the southern, western and northern boundaries. A tidal mangrove creek runs along the valley and empties into the sea mid-way along the beach.

The location is not currently accessible by road, although a disused road previously provided access from Yarrabah to the southern headland.

A site at the southern end of the beach was assessed and scored for suitability to conduct the Pilot Project. The site is approximately 100 metres from the low water mark, and abuts the southern mountain face, giving it protection from the prevailing south easterly winds.

[4] The criteria were: suitability of location for sea cages, ponds and tanks; potential site within 250m of sea; more than one potential site at the location; area available for construction of a land-based system; presence of a creek or river mouth within 1 km of site; depth of water off the beach; distance to deep water (>5m depth); soil composition, in terms of clay, soil or sand; availability of mains power and road access; coverage of the site by an existing aquaculture permit; permit issues of Marine Parks/GBRMPA; and, native title issues.

Figure 2: King Beach

King Beach, however, has significant licensing/permit challenges. Being located in a Marine National Park Zone, no aquaculture permits are currently permissible. While the proposed technology is a land-based system, water would indirectly discharge into the Marine National Park Zone. This would most likely be via a tidal mangrove-lined creek that provides a natural filtering system. Further site inspection is required to determine the proximity of the creek to the proposed site, i.e. its feasibility for water discharge. Commonwealth and State authorities would need confidence that the level of residue nutrient drop-out would not negatively impact on either the local ecology or the Marine Park.

In addition, King Beach requires significant infrastructure development to overcome lack of mains power supply and all year round road access.

Wungu

Wungu is located at the northern end of Back Beach, directly south of Fitzroy Island and separated from King Beach to the north by a rocky headland. The headland drops off steeply into a deep water channel formed between the mainland and Fitzroy Island. A permanent, mangrove-lined tidal creek runs behind the sand dune and empties into the sea at the base of the headland. The creek, which is fed by an inland spring, flows most of the year.

The location is a recreation area for locals during the dry season, with road access and a car park at the beach proper. Two basic beach shelters and a camping area have been constructed on either side of the car park. Three residences have been built in the bush between the road access and the headland, two of which are inhabited.

The assessment was conducted for suitability of a site close to the beach. The site is approximately 150 metres from the low water mark, and is situated between a recreation shelter and a seasonal drain that feeds into the tidal creek.

Figure 3: Wungu

Wungu was found unsuitable, on the basis that it was only appropriate for conducting the Pilot Project due to unavailability of sufficient land suitable for commercialisation.

Other significant issues included poor or no road access during the wet season and lack of mains power supply. The location may also lack community support, as it has high usage as a recreation area.

Jilji

Jilji is located towards the southern end of Back Beach. The location is situated between a permanent, fresh water creek (north) and a small rocky outcrop (south). The creek, which runs from north to south, drains a large swampy area behind the beach. The creek empties large volumes of water onto the beach, causing the mouth to change course amid shifting sands throughout the year.

The location includes residential zoning on the southern side, and is a high use recreation area by locals. The location is accessible by road and car park behind the beach. The car park includes two shelters.

The site assessment was conducted at the northern car park shelter. The site is approximately 150 metres from the low water mark, on an elevated area that sits between the swamp and mouth of the creek.

Figure 4: Jilji

Jilji was found unsuitable, primarily due to the threat of poor water quality during the wet season. It was considered that the fresh water influence would not be able to be countered in a cost-effective manner.

The site lacked access to mains power supply.

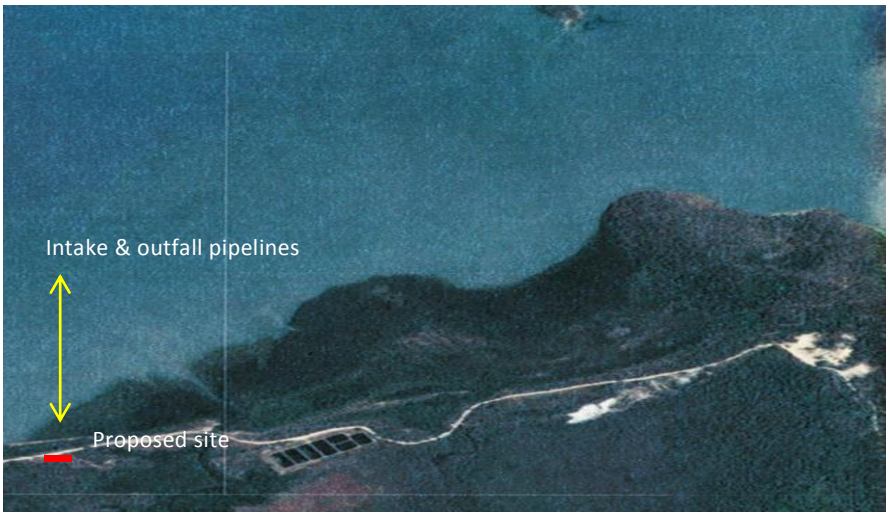
Mission Bay

Traditional Owners responded to the lack of a suitable site at the preferred locations by identifying a site on Mission Bay, within the town boundaries.

Lot 207 has an approximate area of 15,600h on the False Cape peninsula. The area extends from the eastern perimeter of Yarrabah township to the Coral Sea. The area includes both urban and Environmental Conservation and Management zones. The development footprint for the Pilot Project is expected to be within the urban zone, while the commercial facility is expected to extend into the Environmental Conservation and Management zone.

The tenure of Lot 207 is DOGIT. The Lot was transferred to the Gunggandji PBC, following native title determination in December 2011.

Figure 5: Mission Bay



The site was found suitable, following assessment by DEEDI. The site is accessible to key infrastructure, having all-year-round road access and proximity to mains power supply to support operations of the facility. Being DoGIT land, there are no tenure issues, with sufficient area for expansion to a commercial size facility, subject to development application conditions associated with the Environmental Conservation and Management zone. A creek runs close to the site, providing the option of a natural filtration system for nutrient discharge.

Limitations of the site include the poor quality water in Mission Bay. The Bay itself is shallow, while there is effluent discharge from the nearby sewage treatment works and seepage from the town dump. Initial assessment anticipates the need for intake pipes to be extended some 300-400 metres in length to access deeper, high quality sea water.

3.3 Facility and technology

The Pilot Project has several infrastructure components. These include the production facility, intake/discharge pipes and overall facility requirements.

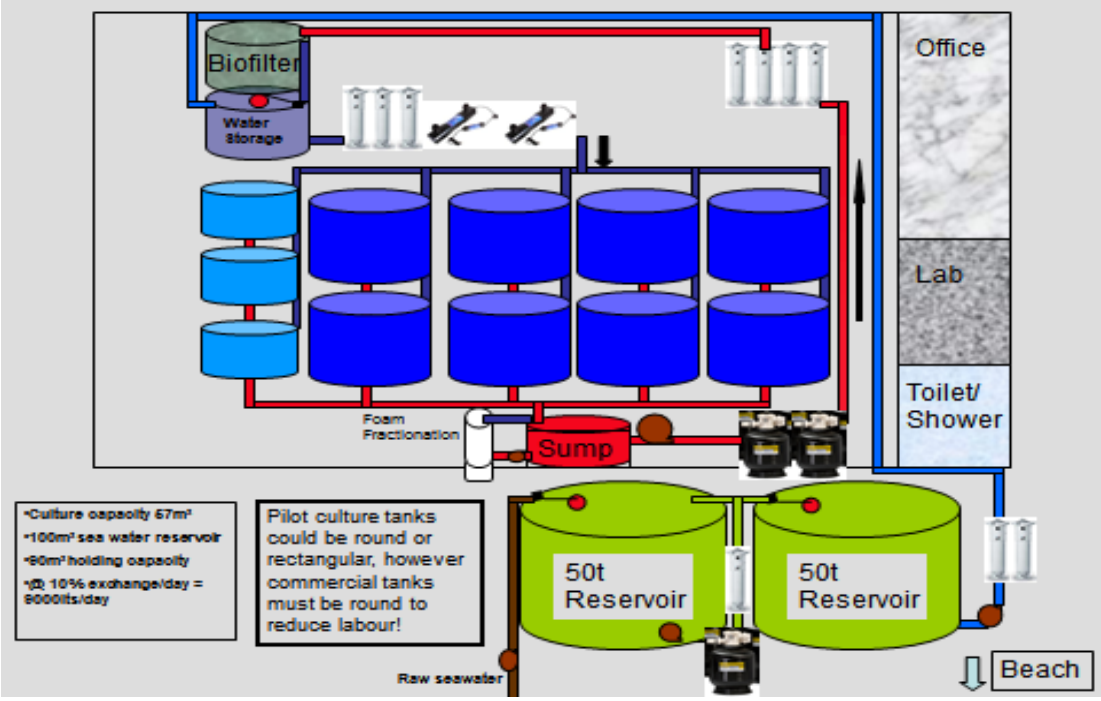
Production facility

The spiny lobster will be grown out in the production facility. A tank-based recirculation system has been selected to conduct the Pilot Project.

The design features of the recirculation system include the following components:

- Filtration systems
- Water storage tanks
- Water inlet
- Water outlet (discharge), and
- Solid waste concentration (sump).

Figure 6: Tank based recirculation system



The technology has several significant advantages over other systems. This best practice technology will maximise outcomes from the Pilot by:

- Giving almost total control of the grow-out environment (providing for optimal grow-out rates of the spiny lobster)
- Reducing impact on the GBR Marine Park, and
- Minimising costs associated with a land-based grow-out system.

Spiny lobsters need a constant supply of high quality sea water, with salinity levels maintained at approximately 35 parts per thousand. Recirculation systems are able to maintain the required salinity levels by providing for ongoing replenishment of sea water through ocean intake and outlet pipes. DEEDI scientists used a recirculation system at its Northern Fisheries Centre to conduct the R&D for both the hatchery and the grow-out aspects of the Spiny Lobster Project, with DEEDI having designed the Pilot Project facility for Yarrabah based on a technical configuration best suited to the location and purpose. The technology is also proven for the culture of other marine and freshwater species in commercial settings.

GBRMPA requires the aquaculture facility to use recirculation technology to manage any possible negative environmental effects on the GBR Marine Park. The main potential for impact is associated with nutrient discharge, or the waste (uneaten food and faeces) associated with the stocking and feeding regimes of aquaculture production systems. The facility will reduce the level of nutrient discharge by: filtering water prior to discharge; and, recirculating 90 per cent of water to reduce the overall volume of discharge.

Recirculation systems have several potential economic advantages. They reduce costs associated with power consumption through the ability to:

- Minimise the draw on sea water, that is, they pump water to top up the facility on a needs basis.[5] The Pilot Project will reduce the volume of sea water the facility needs by as much as 90 per cent, and
- Pump water intake at high tide, with use of gravity feed for returning water to the tanks.

In addition, the size of the facility can be limited to a small area of land, while the filtration systems provide the high water quality needed to maintain higher stocking densities.

Intake and outfall pipelines

The design specifications of water intake and outfall pipelines associated with the production facility have significant bearing on the overall ability to manage water quality and to reduce any potential environmental impact on the GBR Marine Park.

A registered engineer is required to design and document suitable pipeline infrastructure. The general specifications for the scope of work will relate to the characteristics of the Mission Bay site and integration of the pipeline infrastructure with the production facility. The specifications include:

- Analysis of site conditions (e.g. through a site survey and geotechnical investigation) to determine geotechnical and bathymetric conditions at the Mission Bay site and along the proposed pipeline alignments[6]
- Analysis of the proposed operation of pipelines (e.g. flow rate characteristics through the intake/outfall) to determine the size of the pipelines and pumping infrastructure, and
- Review of the design of the aquaculture tank system to determine how the intakes and outfalls will connect to this infrastructure.

The exact location of the production facility is required to perform this work.

Conditions set by GBRMPA and DERM will determine other design specifications associated with minimising any environmental impacts from either the level/quality of nutrient discharge or construction activities associated with the intake and outfall pipelines. The types of conditions are likely to include water intake and outfall pipeline alignments, diffusion points, water intake and nutrient discharge intervals (i.e. to take advantage of high tides and ocean currents), materials, design type (e.g. floating or submerged pipelines) and distance to the point of discharge from the shoreline or any sensitive receptors. This preliminary information will be required to accurately cost these aspects of design work.

Other factors will include required operational characteristics, such as use of pumping and gravity feed water system.

[5] By contrast, flow-through systems require continuous pumping of water to maintain water quality.
[6] Geotechnical information associated with construction on the site is required, especially the engineering properties of subsurface conditions and materials to determine how they will interact with the proposed construction.

Other facilities

Other facilities needed to support the production facility will include:

- Office, for management purposes
- Research laboratory, for on-going R&D
- Refrigerated unit, for storage (e.g. feeds)
- Workshop, for minor repairs and maintenance, and
- Rest area and amenities, for management and staff.

3.4 Conclusion

The Pilot Project is expected to provide proof of concept that farming of spiny lobster is financially viable in ATSI communities in northern Australia. The need to the refine technology and demonstrate financial viability in a real farm setting underpins the staged approach to establishment of the industry in Australia, involving a Pilot Project prior to establishment of a commercial facility. In particular, the Pilot will provide the information/data needed for realistic economic modelling, with the R&D expected to achieve improvements in viability at levels consistent with what has occurred with other aquaculture species in Australia, e.g. prawns and barramundi. For the ATSI community where there is little or no previous experience in aquaculture, the Pilot Project will establish the foundation needed to advance the project onto a commercial footing.

The selection of Mission Bay at Yarrabah to conduct the Pilot Project is underpinned by the ease of access afforded to scientists of DEEDI's Northern Fisheries Centre. The Pilot Project requires a high level of technical support over several years to succeed. Mission Bay is the most suitable site on Yarrabah peninsula, taking into account access to high quality marine water, access to infrastructure, land tenure and area available for expansion to a commercial facility. Traditional Owners support the establishment of an aquaculture enterprise that will result in training and employment opportunities for community people.

GBRMPA's requirement for the use of a recirculation system resulted in the choice of tank-based technology for the facility. The best practice technology has greatest ability to reduce impact on the GBR Marine Park and is a proven technology for the culture of other marine and freshwater species in commercial settings.

4. PROJECT IMPLEMENTATION

This Part provides an overview of the stakeholders consulted about the Pilot Project. It identifies the roles and responsibilities of the partner organisations, and areas for further consultation with permit and approval agencies.

4.1 Consultation process

Consultations have been held with a range of organisations and individuals, including from the Yarrabah community, government regulators and the private sector (expertise/engineering advice). These have resulted in identification of the project proponent, individuals who will be affected by the project and organisations that will need to contribute expertise and resources.

Yarrabah Aboriginal community

The Yarrabah community needs to support the establishment of an aquaculture enterprise for the Pilot Project to be successful. Traditional Owners have expressed their support on the basis of economic, employment and training opportunities afforded to local Aboriginal people.

Traditional Owners are represented by the Gunggandji PBC. Prior to incorporation, the Native Title Working Group (NTWG) provided written support for the Pilot Project. The NTWG established a Working Group to progress the Pilot Project.

The Gunggandji PBC has been involved in all stages, involving initial selection of locations for consideration on the Yarrabah peninsula, site assessments and eventual identification of Mission Bay as the preferred site.

Separately, individual Traditional Owner family groups expressed strong support for the project. Information sessions were held for the broader community.

A Community Consultation Plan will be needed to advance the project. It is important to:

- Inform locals about visitors expected in the community and the purpose for their presence, in accordance with community protocols, and
- Build ownership and responsibility for the project, as a strategy for involvement in security of the site.

The Plan should include reengagement with the broader Yarrabah community through information sessions, prior to commencement of project implementation. The Plan should outline the project areas, roles and responsibilities of all stakeholders, and implementation timeframes.

Government planning and management agencies

Various Australian, State and Local Government agencies have been consulted about the application processes (including fees) and requirements for development approvals. A summary of the purpose of these consultations and nature of ongoing consultation required for approval of an aquaculture development at the Mission Bay site is provided in the following table.

Table 1: Agency consultations

Type of approval	Agency consultation	Project requirement
Resource entitlement		
DERM (SLAM)	Entitlement to use Lot 207 for aquaculture purposes	Verification of: (i) Owner's consent to the resource/use of the land (ii) Development is consistent with an 'allocation of use'
YASC	Permission from property manager to use Lot 207 for aquaculture purposes	Provision of lease agreement, as evidence of resource entitlement. This only applies if management of the DoGIT has not transferred to the Gunggandji PBC at the time of application
DERM (SLAM)	Entitlement to draw sea water from the State Marine Park, i.e. taking or interfering with a State resource	Confirmation from DERM (QPWS): (i) Giving consent to use the marine water resource (ii) The development is consistent with an 'allocation of use'
Adjoining property owner	Proposed aquaculture development will not prejudice the property owner's access rights	Provision of letter of support
Marine Parks Permit		
GBRMPA DERM (QPWS)	Protection of the GBR Marine Park	Need for: (i) Joint application (ii) Application that demonstrates commercial viability (GBRMPA requirement) (iii) Assessment against mandatory and discretionary criteria, which may include requirement for either: a. Public Environment Report b. Environmental Impact Statement and associated: - Deed of Agreement - Environmental Management Plan and Advisory Committee
Development approval		
DEEDI	Confirmation of Assessment Manager for the application	Submission of the development application to DEEDI
	Protection of marine and terrestrial ecologies from aquaculture activities and measures to minimise attracting wildlife	Need for: (i) Geomorphology/ecological assessment to determine attributes at risk (ii) Technical specifications of facility in place to control risk factors (iii) Aquaculture Site Management Plan to rehabilitate site following construction, operate facility safely, prevent fish escape and manage disease
DERM	Protection of erosion prone areas	Need to meet requirements for Declared Coastal Management Districts, outlined in

		Queensland Coastal Hazards Guidelines
	Protection of wetlands of High Ecological Significance within the Great Barrier Reef Wetlands Protection Area	Assessment is against an Applicable Code that identifies acceptable outcomes during construction and operation that prevent degradation. To avoid duplication, assessment is not required if already performed for erosion prone areas
	Management of Acid Sulfate Soils	An applicable code contains management strategies where acid sulfates are exposed through disturbance of soil during construction
EPBC Approval		
SEWPaC	No threat to Matters of National Environmental Significance, including listed threatened species, ecological communities and migratory species, within either: (i) GBR Marine Park World Heritage Area (ii) Lot 207	Assessment of application, involving either: (i) Formal approval under the EPBC as a 'controlled action', or (ii) A conditional approval as a 'not controlled action particular manner'
Nature Conservation Approval		
DERM	Protection of native vegetation from land clearance	(i) Consult YASC as to urban boundary once Town Plan is finalised (ii) Map the boundary of the development to establish whether it is subject to a Nature Conservation Approval, noting that developments inside the urban zone are excluded from the requirement (iii) Where approval is required, a vegetation survey to establish whether any listed species of ecological significance are at the site (iv) Where listed species are in a clearance area, determine an 'off-set' area for relocation of the species (v) Relocate listed species
Infrastructure		
YASC Telstra	Supply of mains power	Following a decision to proceed with the Pilot Project at Mission Bay, YASC and Telstra will need to be consulted about power supply to the site.
Maritime Safety Qld	Need for warning sign	A seaward facing warning sign will need to be erected on land, if the opening for the intake and outlet pipelines are above the seabed

Key: DERM, Qld Department of Environment and Resource Management
SLAM, State Land Asset Management
YASC, Yarrabah Aboriginal Shire Council
GBRMPA, Great Barrier Reef Marine Park Authority

QPWS, Qld Parks and Wildlife Service
DEEDI, Department of of Employment, Economic Development & Innovation
SEWPaC, Department of Sustainability, Environment, Water, Population and Communities
EPBC, *Environmental Protection and Biodiversity Conservation Act 2000*

Part 5 – Permits and Approvals contains detailed requirements of the various permits and approvals.

Other organisations

Two engineering organisations were consulted about the scope of work required to design the facility according to site and environmental permit conditions. This included indicative project management and construction costs, which included collection and preparation of data and information needed for the permit and approval process.

4.2 Management arrangements

The Pilot Project will require a partner arrangement between Gunggandji Traditional Owners and DEEDI, underpinned by a MoU. Community ownership will meet economic objectives of both the broader project and Yarrabah community. Gunggandji are able to provide the land for construction of the facility. DEEDI's technical support and extension services are needed for successful establishment of the grow-out facility, transfer of the skills needed by the community to operate the facility independently and ongoing R&D.

Project proponent

The Gunggandji PBC is expected to be the project proponent. The Gunggandji PBC was established through Native Title to look after the interests of Yarrabah Traditional Owners and the broader community.

The Pilot Project is consistent with the PBC's economic development objective. Its tenure of DoGIT land is pivotal to performing this role in respect of the Pilot Project.

Recent change of Directors underpins the need to confirm previous interest in pursuing the project. A resolution from the Board is required that commits to their role in the Pilot Project and to a partner agreement with DEEDI.

The mission will be to establish a pilot aquaculture project that will:

- Lead to a commercially viable aquaculture business
- Set the standard for the grow-out of spiny lobsters in Australia, and
- Encourage other A&TSI communities to become involved in the industry.

Specific responsibilities will include:

- Permit and approval processes
- Community engagement
- Selection, training and management of staff
- Sourcing funding
- Project management

- Grow-out of spiny lobster
- Facilities management in conjunction with DEEDI, and
- Security arrangements.

The PBC will need resources to perform this role. This will include small business support to build the organisation's capacity (including governance) to manage the facility. This needs to occur in the lead-up to and during commercialisation of the Pilot Project.

Project partner

DEEDI will be involved across the duration of the Pilot Project. This includes for the development application process, where DEEDI's expertise is needed for the design specifications of the aquaculture facility.

Specific responsibilities will include:

- Technical design of the facility
- Skills transfer (animal husbandry and operation of the facility)
- Technical support and extension services (installation, operation and maintenance of plant/equipment)
- R&D aimed at increasing production rates
- Sourcing seed stock for grow-out, and
- Facilitating initial sales of live product through existing market supply chains.

DEEDI will separately pursue commercialisation of the hatchery technology during implementation of the Pilot Project.

4.3 Intellectual Property

The Pilot Project could involve further Intellectual Property, beyond that which DEEDI has already developed on grow-out of spiny lobster. Gunggandji PBC and DEEDI will require agreement on the ownership and management of Intellectual Property.

4.4 Timeframe

A timeline for implementing the Pilot Project will be developed after a decision is taken to pursue the Pilot Project at Yarrabah and the Gunggandji PBC confirms its commitment to the Pilot Project.

The Pilot Project is expected to run for a three-year period. The timeframe comprises:

- Construction of the facility, of six months
- Sourcing seed stock and establishing animal husbandry regimes, of six months
- Grow-out of spiny lobster to point of sale (minimum legal size), of 2 years.

The timeframe does not include the permit and approval process, which will take a minimum of 12 months if an EIS were required to collect water quality data at Mission Bay.

4.5 Conclusion

A partner arrangement between Gunggandji Traditional Owners and DEEDI is necessary to implement the Pilot Project. Traditional Owner support is integral to obtaining the community support and DEEDI support is necessary to provide the technical skills and extension services. The partner arrangement should be underpinned by a MoU that clearly identifies roles, responsibilities and timeframes for implementation.

5. PERMITS AND APPROVALS

This Part contains details of the permits and approvals required to construct an aquaculture facility at Yarrabah. This includes the criteria that will be used by environmental management agencies to assess applications, including the extent to which challenges can be addressed. Some indicative costs are provided for the work involved.

5.1 Introduction

The characteristics of the proposed location underpin the need to obtain five permits/approvals with Australian, State and Local Government authorities for the development to proceed. These include:

1) Resource entitlement
2) Development Permit
3) Clearing Permit (Nature Conservation Permit)
4) Marine Parks Permit (for aquaculture)
5) *Environmental Protection and Biodiversity Conservation Act 2000* (EPBC Act) Approval.

The permit/approval process has several significant challenges to meet environmental protection requirements of both Australian and State Governments. This is due to the proposed location of the aquaculture facility adjacent to the GBR Marine Park and requirements for development proposals within the coastal zone, as follows:

- Under State legislation, Lot 207 is potentially within a declared erosion prone area, contains wetlands of High Ecological Significance, and contains two regional ecosystems for protected areas, wildlife and critical habitats associated with remnant vegetation, and
- Under Australian Government legislation, the GBR Marine Park has several listings under the EPBC Act as Matters of National Environmental Significance (MNES), including:
    - The GBR Marine Park as a World and National Heritage Area, and
    - Potential for the GBR Marine Park and Lot 207 to contain threatened species, ecological communities and migratory species.

The GBR Marine Park also overlaps with the State Marine Park.

DERM has recommended that the Gunggandji PBC apply for permits for the commercial facility, rather than just the Pilot Project. This on the basis that the PBC would otherwise be required to reapply for permits for the commercial facility at a later date, which would unnecessary duplication of resources and application fees. Further, much of the material required for assessments by GBRMPA and SEWPaC for the Pilot Project will meet DERM's requirements for a Development Permit for the commercial facility.

Details of requirements for each permit/approval, together with the assessment agency and associated project costs[7], are detailed below.

[7] The costs are estimates only, and would need to be subject to tendering processes.

5.2 Resource entitlement

The Pilot Project will be constructed on an undeveloped urban block[8] and draw sea water from the State Marine Park. The Gunggandji PBC will need to verify its entitlement to use the two resources for aquaculture purposes, through application with supporting documentation to DERM (SLAM).

Development proposals on State land

Evidence of resource entitlement for Lot 207 is required as a result of a Material Change in Use of Premises, involving the construction of the facility on vacant State land for commercial purposes.[9] DERM will need to be satisfied that:

- Gunggandji PBC has the owner's consent to the resource/use of the land, and
- Development is consistent with an 'allocation of use', i.e. the intended purpose of entitlement.

Gunggandji PBC will require either:

(i) A copy of the certificate of title for the land, or
(ii) A lease agreement with the YASC.

The need for a lease versus evidence of land tenure depends upon which organisation is trustee of Lot 207 at the time of application, given its designation as DoGIT. As previously indicated, management will transfer from YASC to the Gunggandji PBC as a result of the native title determination of December 2011. A lease agreement will need to specify commercial aquaculture as the purpose of land use.

Gunggandji PBC will also require evidence that the proposed work will not prejudice the access rights of adjoining property owners. The one property owner potentially affected by the development will be required to provide a letter of support.

Should the Gunggandji PBC change Lot 207 to Aboriginal freehold land following its transfer from YASC, the land would no longer be state land (i.e. a State resource), and evidence of resource entitlement would not apply.

[8] Lot 207, Map no. NR7310.

[9] The proposed development meets several criteria for a Material Change of Use of Premises, including the start of a new use of the premises, a material increase in the intensity/scale of the use of the premises and the start of an Environmentally Relevant Activity on the premises. See *Sustainable Planning Act 2009*, Section 10(1).

Use of marine water

Evidence of resource entitlement from the State is required as a result of the need to draw marine water from the State Marine Park to support operations of the aquaculture facility, i.e. taking or interfering with a State resource.

The chief executive of the department administering the resource, in this case DERM (QPWS), will need to confirm that the development is consistent with an allocation or entitlement to the resource.[10]

There are no fees associated with the assessment process.

5.3 Development Permit

Development Permits are required for applications that are deemed 'assessable' under the *Sustainable Planning Act 2009* (SPA). The purpose of the Permit is to ensure the development meets environmental protection requirements of State legislation.

The aquaculture facility potentially triggers the need for assessment in relation to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, *Environmental Protection Act 1994*, *Vegetation Management Act 1999*, and *Nature Conservation Act 1992*.

Applications for Development Permits are assessed through the Integrated Development Application System (IDAS). IDAS provides for appointment of an Assessment Manager, in this case DEEDI, to coordinate assessment and approval processes by those State and local government agencies with relevant legislative responsibilities.

The referral agencies associated with the above legislation include:

- DEEDI, in respect of aquaculture
- DERM, in respect of:
    - Erosion prone areas
    - Wetlands of High Ecological Significance
    - Native vegetation
- Marine Safety Qld, in respect of vessel safety at sea, and
- YASC, in respect of development in an urban zone, road access and power supply.

The agencies are required to take account of Qld coastal planning policy. The policy is in a state of transition. The *Queensland Coastal Plan*[11] is expected to replace the *State Coastal Management Plan* and the associated *Wet Tropical Coast Regional Coastal Management Plan*.

The *Queensland Coastal Plan* provides for updated information on those coastal areas projected to be at risk from extreme weather conditions that can cause coastal erosion, permanent inundation

[10] The agency to sign on behalf of the State of Qld is determined according to the status of the land and/or the purpose of the work, in this case, the works are to be used for commercial purposes.
[11] DERM advised to plan the Development Application on the *Queensland Coastal Plan*, in anticipation of its imminent introduction.

and storm tide inundation up to the year 2100[12], including from the impact of climate change.[13] The Plan has been publicly available since March 2011 but is yet to come into effect.

The *Queensland Coastal Plan* provides for the preservation of the natural qualities of the coast, by providing an integrated approach to management and planning of urban development in the coastal zone (including coastal waters). It does this by incorporating State Planning Policies on coastal management and protection. In particular, the *State Planning Policy for Coastal Protection* specifies several new policy outcomes and associated criteria for assessing development proposals. The policy outcomes cover land-use planning, coastal hazards, nature conservation, scenic amenity, public access, coastal-dependent development and canals and artificial waterways.

The requirements of the Development Permit process have been prepared in accordance with the *Queensland Coastal Plan*. This is on the advice of DERM—the key agency with responsibility for State coastal planning. If the Development Application were made prior to the *Queensland Coastal Plan* coming into effect, DERM would assess the Development Application against the *State Coastal Management Plan*.

The cost of a Development Permit is approximately $0.30 million in professional fees. The professional fees would be reduced to approximately $0.14 million, if an EIS were also required for the Marine Parks Permit (for aquaculture) and *Environmental Protection and Biodiversity Conservation Act 2000* (EPBC Act) Approval, as detailed separately below.

These fees are separate to environmental management agency fees, which are estimated at $0.50 million, if an EIS assessment were not required.

Each of the approval requirements for the above legislation and the *Queensland Coastal Plan* follow.

Aquaculture

Aquaculture development is assessable under IDAS due to the discharge of waste into Qld waters.[14] Approval is dependent upon the ability of the aquaculture facility to meet environmental guidelines for the preservation of ecological values. Key criteria for assessment are set out in the *Environmental Protection (Water) Policy 2009*,[15] which includes requirements for protection of marine and terrestrial ecologies from aquaculture activities.[16] There is also a requirement that the development is designated, constructed and operated to minimise attracting wildlife.

[12] Coastal erosion, permanent inundation and storm tide inundation that are a result of extreme weather conditions are collectively known as coastal hazards. Climate change is expected to increase coastal hazards through rising sea levels and more severe extreme weather events.

[13] The expected impacts include a sea-level rise of 80 centimetres and a 10 per cent increase in the maximum potential intensity of cyclones.

[14] Aquaculture development is classed as either 'self-assessable development' or 'assessable development, with criteria set out in the *Code for Self-Assessable Development* (AQUA01).

[15] The application for aquaculture development is expected to be assessed against three sets of criteria. It will be assessed as an Environmentally Relevant Activity under the *Environmental Protection Act 1994*, the Fisheries Act 1994 and, potentially, against the *Queensland Coastal Plan*.

[16] This includes the management of ponds to minimise leakage to groundwater systems during normal operating conditions, as well as risk of overflow during storm and flood events.

Assessment criteria

The information required for the application covers three areas: characteristics of the site's geomorphology and ecology, the facility's design features, and the facility's management arrangements, as follows.

Information on the ecology of the location is required to assess the potential environmental impacts at the development location. The information needs to include the geomorphological/ecological attributes of the site, including:

- Physical characteristics, such as extent and nature of marine plants and water courses
- Contour lines, including Q100 flood event level and topographic features like gullies and waterways, and
- Depth of expected excavation in relation to the 5 metre Australian Height Datum (AHD) contour level.[17]

Information on the technical specifications of the aquaculture facility is required to assess the controls in place to reduce ecological degradation and to control disease outbreaks. This includes water intake and discharge structures, water storage ponds and water distribution channels, nursery and grow-out ponds, water treatment ponds and aquaculture furniture.

The technical specifications need to be accompanied by an 'Aquaculture Site Management Plan' on arrangements to monitor and manage risks, including throughout the construction phase. The operating procedures need to include details of:

- Operational considerations, in relation to production tanks, water supply system, water storage, water distribution system, water treatment, drainage, discharge system and storage of feed
- Details of measures to prevent fish escape, in relation to fencing of facility, screening of intake and outlet pipelines, treatment of water before discharge, maintenance of tank walls, predator exclusion systems, daily monitoring of equipment and surface water runoff management, and
- Details of disease prevention and management practices, in relation to monitoring for disease, source of broodstock, quarantine practices for new stock introduced to the facility, veterinary monitoring of stock, and daily/natural disaster control measures.

A further consideration for the application is the *Queensland Coastal Plan*. The Plan indicates that new aquaculture areas are to be identified and designated using the aquaculture development area methodology. It requires aquaculture development to occur within designated areas, unless the project proponent can demonstrate that an alternative development site is suitable using the methodology. It is currently unclear whether the location of the aquaculture project at Mission Bay is within a designated aquaculture area, as neither the areas nor the methodology are public information.

[17] Any works at or below the 5 metre AHD level may trigger referral for acid sulphate soils assessment and treatment.

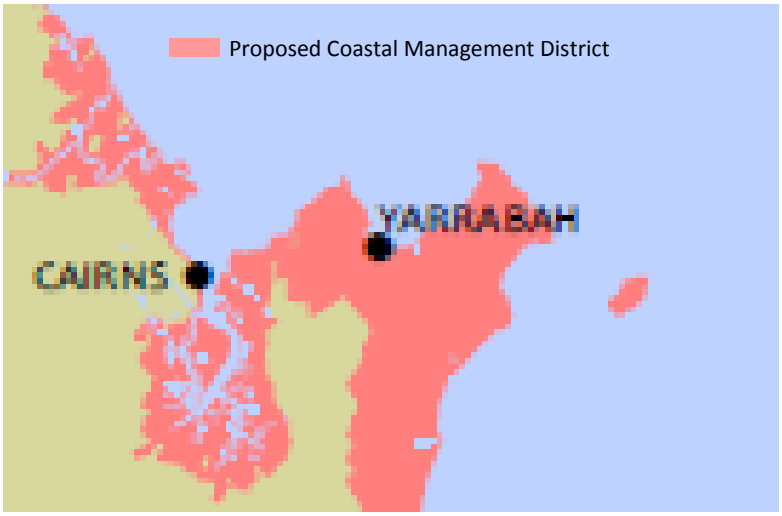
Coastal hazards—erosion prone areas

Development applications are assessable for operational work carried out in tidal zones. Approval is dependent upon meeting requirements for areas declared as Coastal Management Districts.[18] These require special development controls and management practices for coastal hazards, i.e. areas subject to coastal erosion, storm tide inundation and permanent inundation due to sea level rise.[19]

The proposed Coastal Management District for Mission Bay is yet to be published under the *Queensland Coastal Plan*. In its absence, the Wet Tropical Coast Coastal Management District[20] (under the current *State Coastal Management Plan*) designates the Erosion Prone Area as 80 metres landward from mean high water springs (MHWS) along Mission Bay.[21]

The aquaculture facility is likely to be deemed assessable development, given the proximity of the site to the foreshore of Mission Bay. The Gunggandji PBC will be in a position to receive confirmation from DERM on completion of the engineering design for the aquaculture facility when the exact mapping coordinates of the facility are known.

Figure 7: Coastal Management Plan



Assessment criteria

DERM's assessment methodology for development applications in the Erosion Prone Area is outlined in the *Queensland Coastal Hazards Guidelines*.[22] These require a buffer zone to mitigate the risk of permanent loss of land due to shoreline recession. Development must:

[18] Coastal management districts are established under the *Coastal Protection and Management Act 1995* *Coastal Protection and Management Act 1995*. Coastal management districts are referenced under the *Sustainable Planning Regulation 2009* to trigger assessable development and the concurrence referral of certain development application types to DERM.
[19] Coastal erosion involves shoreline recession due to sea erosion, causing permanent loss of land. Erosion prone areas are declared under the *Coastal Protection and Management Act 1975*.
[20] Map 33.8 (segment number 73) for Queensland, Far North Qld.
[21] Map 21.
[22] Note: these apply to the *State Coastal Management Plan*, rather than the *Queensland Coastal Plan*.

- Maintain vegetation, sediment volumes of dunes and coastal landforms, and physical coastal processes outside the development footprint, and
- Not increase the risk of shoreline erosion for areas adjacent to the development footprint.

The *Qld Coastal Plan* provides a set of acceptable circumstances for not fully achieving the policy. These include where the development:

- Provides an overriding need in the public interest, including where overall social, economic and environmental benefits outweigh any detrimental effect upon the natural values of the site/adjacent areas or policy outcome
- Cannot be located elsewhere, and
- Is a development commitment or for a public benefit asset.

The development, however, is still required to achieve the policy outcome to the extent possible. This includes provision: of an environmental offset for any residual adverse impacts on areas of High Ecological Significance that cannot be avoided; and, for the natural effect of physical coastal processes to continue outside the development area.

Wetlands

Assessment for impact on wetlands is required where developments are close to wetlands of High Ecological Significance within the Great Barrier Reef Wetlands Protection Area[23]. Run-off must be filtered to protect the Reef from the damage caused by sediment and nutrients associated with land-based activities.

The need for assessment is determined by the distance of the development from the wetland protection area and the amount of soil disturbance[24]. For urban areas, the legislative trigger is:

- Less than 100m[25] from the wetland protection area of High Ecological Significance, and
- Operational work involving 100m^3 or more of excavation or fill, i.e. High Impact Earthworks.

The aquaculture facility is expected to trigger need for assessment. DERM's mapping shows the location of the aquaculture facility is close to wetlands of High Ecological Significance and construction is expected to involve more than 100m^3 of excavation or fill.[26] However, as the map is not precise, DERM will require mapping coordinates to confirm the exact location of the site relative to the wetlands protection area.

Due to overlap in assessment information requirements and criteria, assessment for impact on wetlands is not required for development applications that are assessed for impact on Erosion Prone Areas (as per the above requirements).

[23] The wetland protection area represents the area of hydrological influence of the wetland.
[24] High impact earthworks have potential to divert water to or from a wetland.
[25] The short distance recognises the natural drainage of land has already been substantially altered.
[26] A wetlands protection area of High Ecological Significance covers large areas of Lot 207. The development site for the pilot is expected to be within the urban footprint but close to a trigger area, i.e. is within 100m of the wetlands protection area of High Ecological Significance. The footprint for the commercial facility could extend outside the urban area and into the trigger area.

The Gunggandji PBC will need to approach DERM when the exact location of the site is known to clarify assessment requirements against either wetlands of High Ecological Significance or Erosion Prone Area[27], as discussed above.

Assessment criteria

Development applications requiring assessment for impact on wetlands of High Ecological Significance are assessed against the 'applicable code', contained in the State Planning Policy.[28] The code specifies a set of acceptable outcomes to demonstrate that the aquaculture facility is "planned, designed, constructed and operated to minimise or prevent the loss or degradation of the wetlands and their values, or enhances these values". See **Attachment A: Wetlands of HES, Demonstrating compliance with overall outcomes.**

The code provides for 'acceptable outcomes' where adverse effects on wetlands of High Ecological Significance cannot be avoided. The development achieves the policy outcome in urban areas when those effects are minimised (compliance is assessed against Development Outcome 3). If these circumstances arise, the Gunggandji PBC will need to provide justification for a reduced buffer zone and provide an environmental offset for any remaining environmental impacts.

Reduced buffer zones may require a Wetland Buffer Implementation Plan that documents the Buffer Design Method to reduce impact and an ongoing monitoring/management program. The requirements for buffers and offsets are outlined in the *Queensland Government Buffer Planning Guidelines* and *Queensland Government Environmental Offset Policy 2008*, respectively.

The State Planning Policy also provides for circumstances for 'not fully achieving the policy outcome'. This includes where the development provides for an "overriding need in the public interest", specifically:

- The overall social, economic and environmental benefits of the development outweigh
    - any detrimental effect upon the natural values of the land and adjacent areas
    - conflicts with the policy outcome, and
- The development cannot be located elsewhere so as to avoid conflicting with the policy outcome.

Figure 8: Wetlands trigger area

[27] It will be clear at this time whether the development will be assessed against existing or proposed maps of erosion prone areas, that is, the current Erosion Prone Areas (Map 21) of the Wet Tropical Coastal Management District or the proposed Far North Qld Coastal Hazard Area Maps of the Coastal Management District for Queensland (Cairns Region).

[28] State Planning Policy 4/11 Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments, Annex 1, Table 1.

The Gunggandji PBC will need to provide evidence to support the fact that the aquaculture facility will provide significant social, environmental and economic benefits to the community. Furthermore, DERM requires justification as to why alternative sites were disregarded in favour of the current site.

5.4 Clearing Permit/Nature Conservation Permit

Clearing Permits provide for clearing where the native vegetation includes listed species of ecological significance within an area of remnant vegetation[29], or 'an of concern regional ecosystem'. The need for a Clearing Permit is identified during the application process for a Development Permit and, as such, a Clearing Permit is required for approval of that Development Permit.

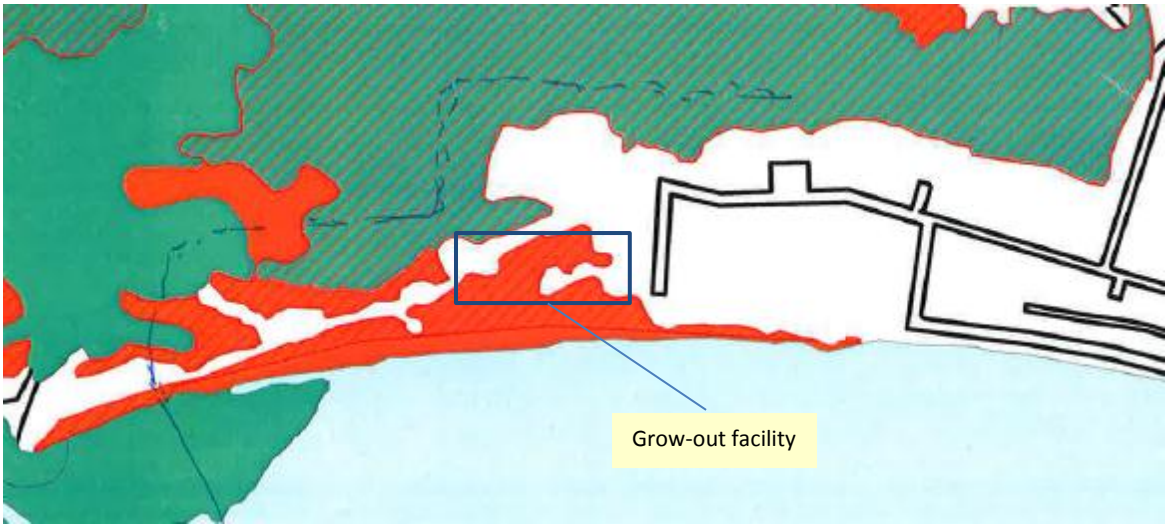
Urban areas are exempt from the need for Clearing Permits.[30] The exemption is likely to apply to the Pilot Project, as the site boundary is expected to be within an urban zone. However, this is not the case for the commercial facility, given the expectation that it will extend beyond the urban boundary.

The location of development contains remnant vegetation.[31] A desk-top review has identified the presence of two regional ecosystems systems.[32] A Clearing Permit will be required if a vegetation survey confirms the development area contains listed species of ecological significance and is more

[29] Remnant vegetation refers to predominantly undisturbed vegetation, where the canopy includes: 50% undisturbed, 70% (on average) undisturbed height, and a composition of species that are characteristic of the vegetation's undisturbed canopy.
[30] Clearing of native vegetation that is exempt from development approval under the *Vegetation Management Act 1999* includes freehold and Indigenous land in urban areas, as described in Schedule 24, Part 2, Item 2(g) or 3(g) of the *Sustaining Planning Regulation 2009*, respectively. Urban areas include those identified in zoning maps.
[31] Yarrabah is located within the Wet Tropics Bioregion.
[32] Regional Ecosystems 7.2.3 and 7.3.25 potentially contain 'ant plants', which are required to support other species germane to the local ecology.

than two hectares in size (see **Attachment B: Regional Management Code for Bioregions, Part P, AS P.4**).

Figure 9: Remnant vegetation 'of concern'



Assessment criteria

To obtain a Permit, Gunggandji PBC must demonstrate[33] that:

- The development has first avoided/minimised the impacts
- An equivalent area is set aside ('offset areas') that exceeds the extent and value of the area impacted by the development, and
- Clearing meets Part P of the Code the Regional Vegetation Management Code for Coastal Bioregions for maintaining biodiversity and ecological processes.

The Permit will provide for the relocation of species to the 'off-set area', which must be within the location of the development. This includes the applicant's agreement to conserve or rehabilitate the offset area. The offset area to be conserved/rehabilitated must meet the vegetation offset criteria set out in the Policy for Vegetation Management Offsets.[34] These are designed to take into account the current level of protection of the vegetation in the offset area, the location and size of the offset area and the ecological equivalence of the vegetation in the offset area to that of the vegetation in the area to be cleared.

[33] Performance Criteria of the Concurrence Agency Policy for Material Change of Use apply. These are PR F1, PR F2, and PR F3.

[34] Policy for Vegetation Management Offsets, Version 3, 30 September 2011. The seven criteria relate to: offset limitations; performance requirements; obtaining ecological equivalence; ensuring the offset area is legally secured; information requirements; when an offset ceases to have effect; and offset requirements to satisfy concurrency agency policies, assessment criteria Table F-1.

DERM has advised that a suitable off-set area for transplantation purposes is highly likely, given the size and similarity of ecosystems across the block. Lot 207 involves an approximate area of 15,600h on the False Cape peninsula, extending from within the urban footprint at Mission Bay to the Coral Sea.

To minimise cost to the project, the following process is recommended:

1. Determine the need for a vegetation survey, based on the size of the development area, i.e. after the engineering design establishes map coordinates for the development site associated with the production facility. A vegetation survey is required if the facility exceeds two hectares (including any other specific requirements at AS P.4).
2. Determine the need for a Clearing Permit, by conducting a vegetation survey to determine whether any listed species of ecological significance are in the vegetation to be cleared.
3. Determine the timing for relocation of species, confirming with DERM that relocation is only required for the commercial facility. This will include confirmation from YASC that the boundary of the pilot project is within the urban area, once the Town Plan is finalised. Seek agreement from DERM through the application process that the timing for relocation of species should occur after completion of the pilot project, when the decision is taken to commercialise the facility.

The cost of a vegetation survey is approximately $0.01 million (this cost is included in the Development Permit cost above). Relocation work would be at additional cost.

5.5 Marine Parks Permit (for aquaculture)

A Marine Parks Permit is likely to be issued through the joint permitting system of GBRMPA and DERM (QPWS)[35]. The requirement for GBRMPA's involvement will be confirmed, once the engineering design verifies that the discharge outfall pipeline will extend into the area of the GBR Marine Park below the mean low water mark.[36] The decision also takes account of the likelihood of EPBC approval, as detailed below.

The Marine Parks Permit will be issued for aquaculture, which is permissible as a result of Mission Bay being defined as a 'Conservation Park Zone' (yellow). Conservation Parks provide opportunities for ecologically sustainable use where the use is consistent with the primary management objective for the long-term protection and conservation of GBR Marine Park's environmental, biodiversity and heritage values.

The *Marine Parks Permit Application* can be submitted to either GBRMPA or QPWS. The application will need to meet both commercial viability and environmental considerations.

Commercial viability considerations

[35] This is due to the overlap between the GBR Marine Park and the State Marine Park.
[36] Responsibility for assessment of development proposals is delineated at the mean low water mark where: QPWS has responsibility for the area between the mean low water mark and highest astronomical tide; and, GBRMPA for the area below the mean low water mark.

GBRMPA has stipulated that the application must address the commercial viability of the project in order to be assessed. The requirement adds an upfront cost of approximately $0.30 million for an engineer-endorsed design of the aquaculture facility[37] that meets conditions of approval.

The need to demonstrate commercial viability is within a context where the Mission Bay site was chosen as suitable for conducting the pilot but not necessarily for establishing the commercial facility. This is due to the more stringent environmental management needs associated with the extra land area required for a commercial facility. The further area required will likely extend the development, that is:

- Into a protection area for wetlands of High Ecological Significance[38], and
- Beyond the urban[39] boundary.

GBRMPA's need for the application to demonstrate commercial viability is also likely to result in additional cost for any redesign work required of the commercial facility post the Pilot Project. This is because the Marine Parks Permit application will precede the availability of more detailed information from the Pilot Project—further research on animal husbandry techniques in particular is expected to result in higher stocking densities and grow-out rates by the end of the Pilot Project. As such, there will be need to reassess the design and scale required of the commercial facility following the Pilot Project to account for any changes of underpinning assumptions. The additional upfront cost, however, is likely to be offset by reduced overall application fees, since GBRMPA (and other agencies) will require only one permit application rather than separate applications for the Pilot Project and subsequent Commercial Project.

Environmental considerations

GBRMPA is required by legislation to assess proposals for commercial development against a set of mandatory conditions.[40] GBRMPA may also assess against discretionary considerations and/or set conditions to a permit approval. A copy of the mandatory and discretionary considerations is provided at **Attachment C: Great Barrier Reef Marine Park regulations**.

The foremost mandatory consideration is the potential environmental impact of the proposed development on the GBR Marine Park. An immediate management goal is to halt and reverse the decline in water quality entering the Reef by 2013, for instance, by reducing the amount of nutrients, pesticides and/or sediments entering the Reef.[41] The onus is on the applicant to establish the acceptability of any environmental impacts, including the options for monitoring, managing and mitigating impacts.

GBRMPA applies four different levels of project assessment, according to the environmental risk of the development to the GBR Marine Park. Each level has accompanying management requirements

[37] The aquaculture facility includes the production facility and the intake/discharge pipes.
[38] The wetlands protection area will only be significant if the area is not subject to assessment for either a declared erosion prone area or coastal hazard area.
[39] Urban areas are exempt from development approval under the *Vegetation Management Act 1999*.
[40] See *Great Barrier Reef Marine Park Regulations* 1983, Sections 88Q Consideration of applications—mandatory considerations and 88R Consideration of applications—discretionary considerations.
[41] See the *Reef Water Quality Protection Plan 2009*, p. 14.

that cover monitoring for compliance, management arrangements[42], deeds of agreement and monetary bonds. Examples of assessment levels are provided at **Attachment D: Great Barrier Reef Marine Park environmental impact management tools**.

Two primary sources of information are needed for GBRMPA's risk assessment of the aquaculture facility:

- Baseline data of the water quality in Mission Bay, and
- Level of nutrient discharge expected from the aquaculture facility.

GBRMPA may require the applicant to undertake an EIS to collect such data. This compares with the less demanding Public Environment Report for developments that are considered low risk to the GBR Marine Park, i.e. an impact may be present but not to the extent that it would impair the overall condition of the ecosystem, sensitive population or community in the long-term. An EIS involves an approximate cost of $0.50 million compared with $0.10 million for a Public Environment Report.

Table 2: Marine Parks Permit—Assessment information

Type of cost	Environmental Impact Statement	Public Environment Report
Professional	$400,000	$40,000
Assessment fee	$105,000	$39,000
Public notice	-	$7,800
Total	**$505,000**	**$105,000**

The need for an EIS will depend upon whether GBRMPA accepts water quality data that is understood to be held by YASC. YASC undertakes water quality testing for the sewerage works, which discharges via a creek into Mission Bay. This is within a context where the aquaculture facility is expected to have negligible environmental impact because:

- Water quality in Mission Bay is already known to be poor as a result of discharge from the sewerage works and seepage from Yarrabah's rubbish dump, and
- Nutrient discharge levels from the aquaculture facility are expected to be minimal.

To enable a decision on the requirement or otherwise for an EIS, Gunggandji PBC will need to:

- Follow up with YASC the extent of water quality testing to determine its suitability to meet GBRMPA's needs, and
- Request from DEEDI more precise nutrient load levels expected from the pilot and commercial facility.[43]

[42] Level 3 and 4 assessments require an Environmental Management Plan and Advisory Committee, and Level 4 an Environmental Site Supervisor.
[43] DEEDI recently commenced research on nutrient discharge levels for spiny lobster grow-out in anticipation of the project application needs.

GBRMPA's other key information requirements relate to the design and management of the aquaculture facility. GBRMPA has stipulated that the design should involve a recirculation system to reduce the level (volume) of discharge from the facility. A registered engineer needs to endorse the design to give assurance that design specifications will result in the purported/claimed nutrient discharge levels and in reduced environmental impact (e.g. the point/s of nutrient discharge to take advantage of ocean currents, diffusion of nutrient discharge to lower concentration levels across Mission Bay, and discharge times to take advantage of discharge from the sewerage facility and/or tidal activity).

GBRMPA will likely require an Environmental Management Plan[44] to monitor and manage environmental risks. The Plan is expected to include identification of potential environmental impacts, how activities will be managed to reduce impacts, a monitoring program, emergency response plans and any relevant issue-based plans. The plan is accompanied by a monetary bond of $0.25 million for Level 3 projects and $0.50 million for Level 4 projects.

5.6 EPBC Act Approval

If required, an EPBC Act approval will be issued by SEWPaC in respect of MNES. The application will be assessed against a set of criteria for each type of MNES in the area of the aquaculture facility to determine the significance[45] of environmental impacts. The relevant MNES include: World Heritage Properties, GBR Marine Park, National Heritage Places, listed threatened species and ecological communities, and listed migratory species. The assessment will involve consideration of short and long-term direct and indirect impacts on MNES, including appropriate mitigation measures and consideration of offsets where residual impacts exist. The EPBC Act also requires the assessment to consider social and economic factors. A copy of the significant impact criteria for each relevant MNES is provided at **Attachment E: Significant impact criteria**.

Assessment criteria

There are three levels of assessment for applications, depending on the significance of the impact on MNES. Where the development is unlikely to have a significant impact, no further consideration of the application is required.[46] Applications that need further assessment will involve either a formal approval under the EPBC as a 'controlled action' or a conditional approval as a 'not controlled action particular manner'.

The depth of assessment for a controlled action is determined at the time the decision is taken to assess the application as a controlled action. Factors considered include the nature and scale of the development, the number of MNES affected and the level of information already provided in the application. Several assessment levels are possible, ranging from assessment on referral information (no additional information required) to a full EIS. Gunggandji PBC would be responsible for providing any additional information, including the EIS.

[44] The requirements specified in DEEDI's Aquaculture Site Management Plan could be accommodated in GBRMPA's Environmental Management Plan.
[45] The general test for significance is whether an impact is 'important, notable or of consequence, having regard to its context or intensity'.
[46] This assumes the project is carried out in accordance with the application.

The assessment process for applications that involve a controlled action is coordinated with GBRMPA, providing a single assessment for the Minister to make decisions under both the EPBC Act and GBR Marine Park Act.[47] SEWPaC generally coordinates with GBRMPA regarding the EIS, with the approval decision is subject to any other Commonwealth, state or local government requirements. Further, as the EPBC Act requires triple bottom line factors[48] to be taken into account, it is expected that the Yarrabah community will have a strong case for approval of the project based on economic and social advantages.

SEWPaC does not charge an assessment fee. Gunggandji PBC, however, may be required to cover costs associated with any need for public consultation at the assessment stage. The need for public consultation depends on the depth/nature of assessment.

SEWPaC has indicated that the approval decision will take account of the project's long-term objective to establish a commercial facility. A key focus will be the likely levels/volume of nutrient discharge into the GBR Marine Park and the mitigation measures to avoid, reduce or offset impacts on MNES. The Environmental Offsets Policy may be relevant, depending on the levels of nutrient proposed to be discharged and the baseline quality of the receiving environment.

As with GBRMPA, the need for a full EIS is unclear until such time as it is established whether SEWPaC will accept the baseline water quality data held by YASC. SEWPaC will need data on whether the poor water quality in Mission already exceeds current Great Barrier Reef water quality guidelines, including all available information on the key contributors (i.e. the sewerage system and rubbish dump). SEWPaC will give careful assessment to any proposals that further increase the nutrient load against this backdrop.

In terms of listed threatened species/ecological communities and listed migratory species, some data may need to be collected for both the marine and terrestrial environment. The terrestrial data would be collected through a vegetation survey at a cost of approximately $0.01 million, with the vegetation surveys not inclusive of any cost associated with the need for relocation of species found at the site.

If a full EIS were required, both SEWPaC and GBRMPA's data requirements would be met through the same EIS.

Favourable factors for an EPBC Act approval include:

- Yarrabah community has a strong case for economic and social considerations
- Small scale of the commercial aquaculture development, and
- Low predicted nutrient discharge from use of recirculation and filtration systems (better practice), concentration of solid waste and artificial feeds.

[47] The Minister makes a single decision under both the EPBC Act and GBR Marine Park Act.
[48] Triple bottom line accounting principles include consideration of environmental, social and economic factors.

5.7 Conclusion

There are significant environmental management requirements associated with development at Mission Bay. Apart from the potential to be in an Erosion Prone Area, several requirements are only expected to apply if the site is also used for expansion to the commercial facility. These include wetlands of High Ecological Significance, an 'of concern' regional ecosystem and Matters of National Environmental Significance.

Qld regulators have advised that permits and approvals are likely with development conditions. GBRMPA and SEWPaC are required to coordinate their permit and approval assessments. Approval under the EPBC Act will likely involve heavy reliance on the socio-economic advantages of the aquaculture facility to the Yarrabah community, where SEWPaC applies triple bottom line accounting principles to the assessment.

The greatest prohibitive factor to the Pilot Project proceeding at this point in time is the cost of permit and approval processes. The total cost is expected to be between $0.85 million and $1.11 million. The cost of the EIS accounts for the majority of the difference. The second major cost is the engineering design at a cost of $0.30 million.

6. BUSINESS CASE

This Part provides an analysis of the factors that contribute to the Business Case for establishment of the Pilot Project at Yarrabah. These include details of the business applicant, socio-economic considerations, marketing opportunities and competition, production systems and processes, and economic data.

6.1 Scope

The timeframe of the Pilot Project is three years. The projected profit and loss is based on economic modeling provided by DEEDI for a pilot scale facility, using data for a commercial operation over a ten-year period. This includes construction and operating costs of the commercial facility, based around having nursery tanks in addition to grow-out tanks.

The main production data includes assumptions of grow-out rates, stocking densities and per annum production cycles prior to preparation of the Business Case. Since provision of data for this Report, DEEDI's ongoing R&D program has reduced nutrient discharge levels to almost nil. DEEDI expects to continue the R&D program at its Northern Fisheries Centre and the Pilot Project. A central focus of the program is on factors affecting the economics of farming spiny lobster in Australia. Additional R&D associated with the hatchery will also enhance the economics, including in relation to the efficiency of feeding regimes (accompanied by reductions in waste) and supply of seed stock (i.e. more reliable and cost-effective supply than wild caught seed stock).

6.2 Business applicants

Name: Gunggandji PBC Aboriginal Corporation

Mission: To establish a commercially viable aquaculture business that:

- Sets the standard for the grow-out of spiny lobsters in Australia, and
- Encourages other ATSI communities to become involved in the industry.

Objective: To establish a pilot facility that demonstrates proof of concept for the grow-out of spiny lobster in an Aboriginal community

Location: Lot 207, Mission Bay, Yarrabah, Australia

Products: Spiny Lobster *Panulirus ornatus*

The Gunggandji PBC Aboriginal Corporation is a Registered Native Title Body Corporate under the *Corporations (Aboriginal and Torres Strait Islander) Act 2006*. The organisation represents Traditional Owners and descendants of people who were forcibly removed off traditional homelands to Yarrabah. The Gunggandji PBC is, or will be, trustee for the location selected to conduct the Pilot Project, with the ability to convert Lot 207 to freehold title.

The Gunggandji PBC is the applicant body that will source funding to establish the Pilot Project, on the expectation that the facility will become a commercially viable enterprise. As the business owners, the PBC will be responsible for sourcing a combination of grant and loan funding for:

licensing and permitting, planning and construction, training and employment of local community people, purchasing of seed stock and feed, and operating costs for the three-year period of the Pilot Project.

The PBC is in its early stage of development, having been established in December 2012. Directors of the organisation will require business support funding to assist with the Pilot Project. The focus of business support will be on governance, management capacity and the organisational structure needed to manage the business effectively.

The PBC will require a MoU with DEEDI for the provision of technical support and extension services. DEEDI's primary focus will be:

- R&D and extension services to support the Pilot Project, and
- Commercialisation of the hatchery technology.

6.3 Community profile

The socio-economic circumstances of the Yarrabah community are expected to have a significant bearing on the outcome of the assessment process. Yarrabah is the second largest discrete Aboriginal community in Australia, having a population of 2,371[49] people. According to the 2006 Census[50], it comprises 2,297 Indigenous residents, 50 other Australians and a further 24 people who did not state their cultural background. It should be noted that the total Indigenous population may be understated. Compared with the Census data, YASC believes the population to be approximately 4,300 people.

The Yarrabah Indigenous population has a high proportion of young people, with 37.5 per cent aged between 0—14 years and a further 19.1 per cent aged 15—24 years.

School attendance is low. Of the 544 children aged between 5—14 years, only 263 attend school, i.e. 48.3 per cent. The proportion of early school leavers increases with age, with only 37 of the 248 youth aged between 15—19 years, or 14.9 per cent, continuing in either high school or other education institution. The total school attendance rate is only 37.9 per cent for 5—19 year olds. Further, the average student attendance may be on the decline. The quarterly reports by the Qld Department of Health *Quarterly Report on Key Indicators in Queensland's Discrete Indigenous Communities* (July–September 2009) indicate that Yarrabah was one of a number of communities where school attendance for children aged 5—14 years had declined by over 5 per cent in Term 3 2009 compared with the same period in the previous year, the others communities being Doomadgee, Hope Vale, Kowanyama, Pormpuraaw and Woorabinda. This contrasts with a steady rate of attendance at Cherbourg, Lockhart River, Mapoon, Mossman Gorge, Northern Peninsula Area and Palm Island, and improvements in attendance for Aurukun, Coen, Mornington Island and Wujal Wujal.

[49] Commonwealth of Australia 2007, Australian Bureau of Statistics, *2006 Census Community Profile Series*, Yarrabah, Indigenous Profile, Catalogue No. 2002, '101 Selected Person Characteristics by Indigenous Status by Sex'.
[50] 2011 Census data is not yet available.

The high rate of early school leavers has a corresponding low level of school attainment across the community. Of the 59.9 per cent of Yarrabah's Indigenous population who indicated their highest year of school completed, 63.1 per cent only completed Year 8, 9 or 10. The Year 11 completion rate was 16.6 per cent and Year 12 completion rate 20.0 per cent. Anecdotally, older people have better literacy and numeracy skills.

The number of Indigenous people of work age was 1,415 people, or 59.7 per cent. This number equals the total population aged 15—64 years. Of the group, 981 were in the labour force, 419 were not in the labour force and 15 did not indicate their status. Approximately 84.8 per cent (832 individuals) of the labour force were registered as job seekers.

The Yarrabah Aboriginal community strongly supports the Pilot Project as a result of employment opportunities associated with the aquaculture facility.

6.4 Market analysis

Current state of industry and market demand

Aquaculture is the fastest growing fishery in the world, not only commercially but as a food security production system for poor rural communities in developing countries. The rapid increase in the demand for seafood includes the spiny lobster, particularly in China where a growing economy and a rising middle class will continue to increase demand for spiny lobster. The Chinese market was worth $190 million USD in 2011.

The Pilot Project will not target a proportion of the market share, due to the status of the project as proof of concept and the small numbers of live product involved. The objective of the Pilot Project is to test 'live' product into the Chinese market through the commercial wholesaler.

The market opportunities will be reassessed as part of commercialization, taking into account the quantity of product to be produced, market prices, and contract conditions offered by exporters at this time. Selling direct to Chinese customers may also be a future consideration. Selling plate size lobster, i.e. under 600 gr, will also be a consideration. The latter will be feasible as a result of DEEDI's hatchery technology and aquaculture production, where there are no controls over the size/quantity of spiny lobster product compared with the Australian wild take commercial lobster fishery.

Competition and competitive advantage

In Australia, the Gunggandji PBC will always face competition from the wild take commercial lobster fishery, which consists of both live and frozen tails. There are no other major competitors in Qld.

The commercial lobster fishery in Qld is a dive-based hand collection fishery that primarily targets the spiny lobster. DEEDI manages and regulates the fishery through:

- A limited entry fishery, with restrictions placed on new primary boat and tender boat (dory) boat licenses since 1996
- A quota system since 1996, with an industry Total Allowable Catch of 195 metric tonnes,
- A minimum size limit, with a 115 mm tail length (or 90 mm carapace length), and

- A closed season (commercial & recreational), with the closure applied to all species of tropical rock lobster from 1 October to 1 February in Qld tidal waters.[51]

The annual seasonal closure is in place to reduce fishing mortality on breeding stocks. The closure applies to all commercial and recreational fishing within the commercial fishery area. The current zoning of the Qld east-coast lobster fishery does not extend south from the Aboriginal community of Lockhart River, where the community established the Pichiwu Fishing Ltd based on the wild capture of mud crabs and spiny lobsters for sale to seafood markets in Cairns.

Competition outside Australia includes Vietnam. The Vietnamese industry was developed around the collection of live lobster juveniles (seed) from the wild, grown out in floating sea cages and fed trash fish.

Vietnam is one of the two countries involved in the ACIAR project with Australia, the other being Indonesia. In Vietnam, the total transition from wild caught seed and use of trash feed to a sustainable industry that uses hatchery-produced seed and formulated diets is expected to take many years. This is because (1) Australia will take some time before sufficient numbers of seed is produced to satisfy expected demand, and (2) the culture of the industry and current supply chain of wild caught and trash feed supplies are well-established.

Nevertheless, Vietnam will continue to be a major competitor in the marketplace. Vietnam has a fully established distribution chain and is exporting at a much larger scale than Australia's current commercial spiny lobster industry.

Indonesia may also pose a threat to establishment/growth of Australia's spiny lobster industry. Indonesia has advantages of less regulation and significantly lower establishment and operating costs.

The competitive advantage for developing the industry in Australia is the involvement of DEEDI scientists, which place the Pilot Project at the leading edge in terms of improvements in grow-out rates and production cycles. Australia is also recognized internationally as a producer of high quality seafood products.

SWOT Analysis

The Pilot Project has significant strengths and opportunities that provide the best prospect of successfully establishing spiny lobster farming for Yarrabah and Australia. These include application of best practice system technology and proximity of DEEDI scientists to provide technical expertise and ongoing R&D. Collectively, these aspects:

- Minimise any adverse environmental impacts, which may otherwise affect the ability to obtain the necessary development permits and approvals
- Support the production of a quality product at a size, weight and price, which satisfy market demand, and

[51] Qld Government Department of Primary Industry and Fisheries, June 2004, *An Ecological Assessment of Queensland's East Coast Tropical Rock Lobster Fishery*, collated by Joanne Atfield, pp. 25-6.

- Improve grow-out rates and production cycles, which underpin continuing improvements in the economics of farming spiny lobster in Australia.

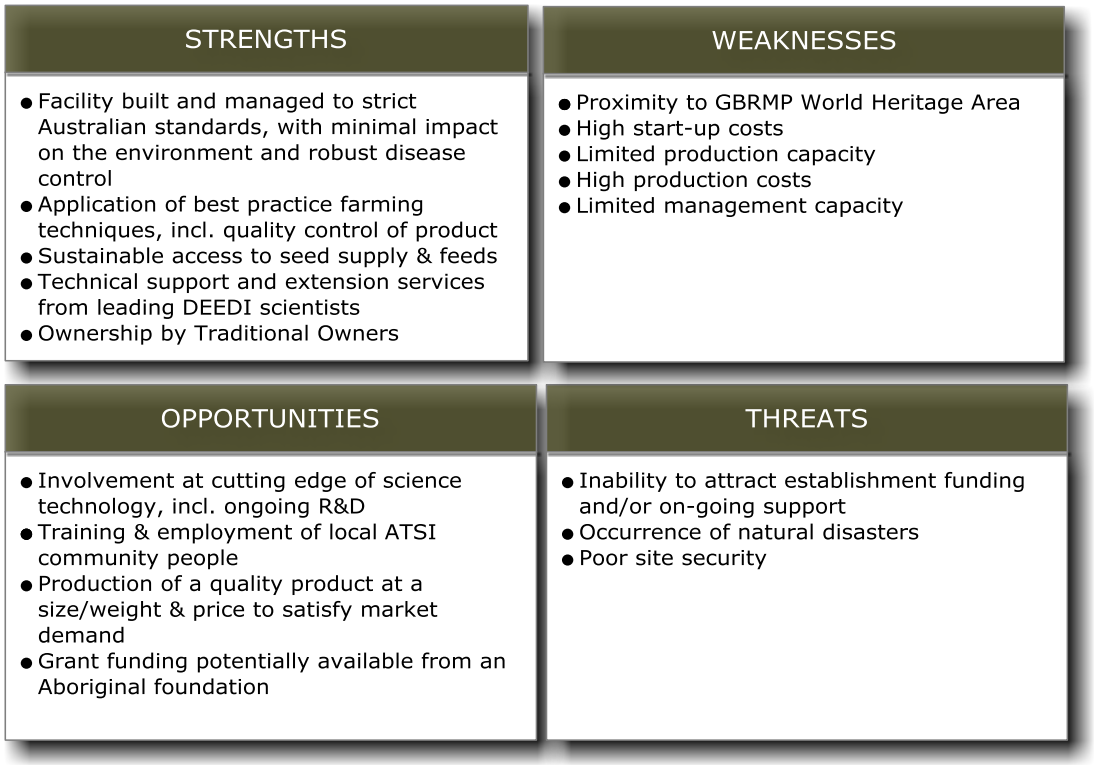
In addition, significant levels of grant funding are expected to be available through the Wungal Environmental Foundation. The Foundation has been established with philanthropic funds to assist ATSI people establish enterprises that are environmentally sustainable and that conserve cultural and natural resources on country. The Foundation is based in Cairns.

The key threat is nutrient discharge into the GBR Marine Park World Heritage Area, which may affect the ability to obtain a Marine Parks Permit. This is manageable through:

- The economic opportunity afforded by establishment of a sustainable industry that offers training and employment opportunities for the Yarrabah community where, otherwise, there are limited commercial activities, and
- DEEDI's ongoing R&D program that has already reduced nutrient discharge levels since development of this Business case.

The SWOT does not canvas aspects of the commercial facility, given the need to reassess market opportunities and to take account of advances in economics post the Pilot Project.

Figure 10: SWOT analysis



6.5 Operations

Grow-out system

The aquaculture facility for conducting the Pilot Project will involve a tank-based recirculation system, designed and managed to meet Australia's strict regulatory requirements, as per Part 5—Permits and Approvals. A schematic of the proposed system is contained in Part 3—Project details.

Tanks

The recirculation system has 11 tanks, as follows:

Tank details	Nursery	Grow-out Phase 1	Grow-out Phase 2	Grow-out Phase 3
Average tank height (m)	1	1	1	1
Average tank width (m)	3	3	3	3
Average tank depth (m)	1	2	2	2
Average tank size (m^3)	3	6	6	6
Number of tanks	3	2	2	4
Total aquaculture volume (m^3)	**9**	**12**	**12**	**24**

To achieve optimal stocking densities, spiny lobster will be moved through each grow-out phase to avoid overcrowding.

Production process

The production process comprises:

1. Receipt of juveniles—sourced from DEEDI's hatchery
2. Juveniles stock in nursery tanks—to a weight of 113 grams
3. Grow-out to commercial size—to a weight of 1+ kg weight
4. Harvesting and processing—on-site
5. Dispatch to commercial wholesaler—as live product.

Seed stock and stocking densities

Seed information	Nursery	Grow-out Phase 1	Grow-out Phase 2	Grow-out Phase 3
Stocking density (#/m3)	60	31.5	28.4	12.8
Stocking rate (#/tank)	180	189		
No. lobsters stocked (#/crop)	540	378		
Stocking biomass (kg/crop)	3.0			
Size of stocked individual (g/individual)	5.5	122.6	314.6	628.6
Survival rate (%)	70	90	90	90
Total no. surviving individuals	378	340	306	276
Price of seed	10			
Cost of seed	5,400			

Feed

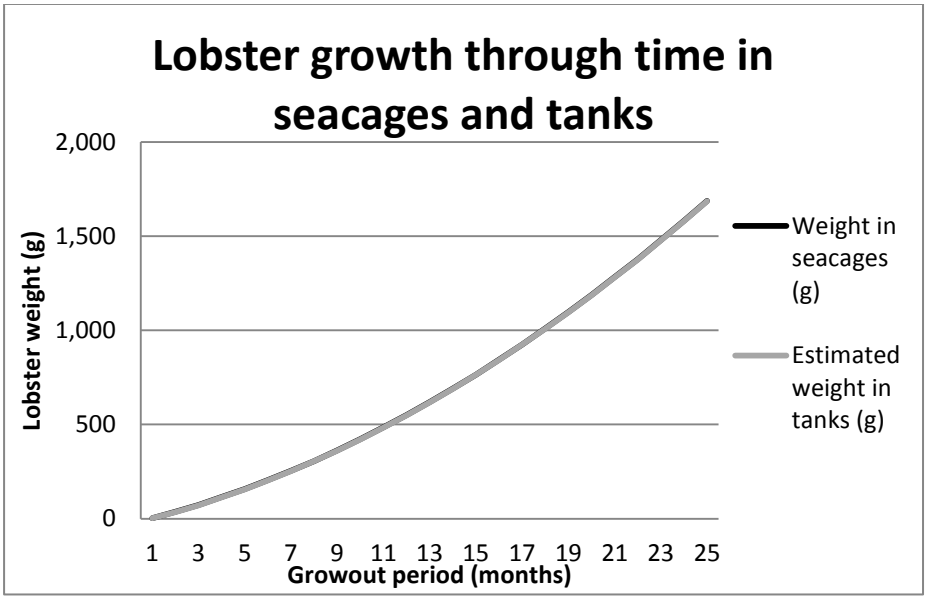
	Feed conversion ratio	Quantity of food eaten	Quantity of food eaten	Quantity	Feed cost $	Total feeding cost
	g food eaten/g weight gain	g/lobster/phase	kg/phase/crop	% body weight	AUD/kg	AUD/crop
Nursery	5.0	585	221	10.0	5.00	1,107
Grow-out 1	3.5	672	229	3.2	3.50	800
Grow-out 2	3.5	1,099	337	2.4	3.00	1,010
Grow-out 3	3.5	1,670	460	1.9	3.00	1,381
Total		**4,027**	**1,247**			**4,297**

Grow-out rates

The total grow-out period is estimated to be around 18 months, from three grams to a marketable size of 1+ kg. This is based on receipt of juvenile spiny lobsters at approximately 5.5 months old at a weight of three grams.

The grow-out rate has been calculated on data collected from DEEDI hatchery experiments at the Northern Fisheries Centre and grow-out rates of lobsters in Vietnam using sea cages. The grow-out rates are virtually identical, as shown in the following table.

Figure 11: Estimated grow-out rate



Production levels

Production is expected to be 202 kg per year, i.e. 303 kg over 18 months. Six crops are expected to be produced over the ten-year period.

Staff

Three staff are required to operate the facility. These include: a facility manager and two aquaculture technicians. Annual wages are in Australian industry rates, as follows:

- Manager, at $90,000, and
- Aquaculture technicians, at $80,000 (2 x $40,000).

Staff will receive a minimum Certificate III in Aquaculture (Seafood). The training costs will be borne by a Government-funded training program.

Repairs and maintenance

$5,000 per annum.

Price

The farm-gate price is estimated at $75 per 1 kg live animal.

6.6 Financial analysis

Limitations

The major limitation of preparing the Business Case is the provision of data for a ten-year period. Production levels during this period are for a facility at the scale of the Pilot Project, i.e. no data is included for a commercial scale facility for years four to ten following the Pilot Project.

Other limitations include the following:

- This is the first time that economic modeling of spiny lobster grow-out has been attempted for Australia
- Economic modeling is based on the Vietnam experience of growing out wild caught spiny lobsters in sea cages, with a different feeding regime based on trash fish, and
- Further R&D is taking place to collect more primary data on nutrient discharge using formulated dietary needs, both of which will improve the business case.

At DEEDI's request, the Business Case does not include costs associated with permit and approvals that are contained in Part 5 – Permits and Approvals of this Report. These costs would be in addition to the economic analysis.

Assumptions

Tank-based recirculation system
11 tanks with total capacity of 57m^3
Tank replacement period of 25 years
Juvenile stock weight of 113 grams per individual
Sale weight of 1+ kg
Seed stock cost of $5,400 per crop
Feed cost of $4,297 per crop

Food conversion rate (gr food eaten/gr weight gain): 5 for nursery; and, 3.5 per grow-out phase
Grow-out period of 18 months
Six crops over 10 years
Total wages of $170,000 per annum
Cost of repairs & maintenance estimated at $5,000 per annum
Sale price estimated at $75 per 1kg live animal
No application of GST
Full depreciation of equipment over 10 years

START UP

Start-up capital	Item		Cost
Utilities	Phone/Internet	$	300
Advertising & promotion	Office signage	$	900
Sub-total		**$**	**1,200**
Capital expenses (assets)			
Pumps & filters		$	28,663
Reservoir		$	13,000
Tanks		$	58,100
Feeding equipment	Fridge	$	2,000
	Freezer	$	2,000
Back-up generator		$	10,000
Shed & buildings (incl. construction)		$	80,000
Water quality meter (multiprobe)		$	4,500
Palintest		$	1,500
Miscellaneous consumables		$	1,000
Office furniture	Table & chairs	$	500
	Computer	$	1,500
	Computer desk	$	300
	Computer chair	$	300
	Printer	$	600
Motor vehicles	Ute	$	25,000
Sub-total		**$**	**228,963**
Security & Collateral for Loan		**$**	**0**
Owners investment		**$**	**0**
Total loan required for start-up		**$**	**230,163**

PROFIT AND LOSS, YEARS 1-10

SALES	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Product	$ -	$ 22,740	$ 22,740	$ -	$ 22,740	$ 22,740	$ -	$ 22,740	$ 22,740	$ -
Owners investment	$ 1	$ -	$ -	$ 1	$ -	$ -	$ 1	$ -	$ -	$ 1
Total sales	$ 1	$ 22,740	$ 22,740	$ 1	$ 22,740	$ 22,740	$ 1	$ 22,740	$ 22,740	$ 1
OPERATING COSTS										
Fixed costs										
Labour	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000
Lease of land	$ 2,250	$ 2,250	$ 2,250	$ 2,250	$ 2,250	$ 2,250	$ 2,250	$ 2,250	$ 2,250	$ 2,250
Loan repayment	$ 10,439	$ 10,439	$ 10,439	$ 10,439	$ 10,439	$ 10,439	$ 10,439	$ 10,439	$ 10,439	$ 10,439
Insurances	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Professional (accounting)	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500	$ 3,500
Repairs & maintenance	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Telephone/Internet	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65
Electricity	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
Sub-total	$ 203,254	$ 203,254	$ 203,254	$ 203,254	$ 203,254	$ 203,254	$ 203,254	$ 203,254	$ 203,254	$ 203,254
Variable costs										
Seed stock	$ 5,400	$ 5,400	$ -	$ 5,400	$ 5,400	$ -	$ 5,400	$ 5,400	$ 5,400	$ -
Feed	$ 4,297	$ 4,297	$ -	$ 4,297	$ 4,297	$ -	$ 4,297	$ 4,297	$ 4,297	$ -
Fuel	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Printing & stationary	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600
Office consumables	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600	$ 600
Sub-total	$ 15,897	$ 15,897	$ 6,200	$ 15,897	$ 15,897	$ 6,200	$ 15,897	$ 15,897	$ 15,897	$ 6,200
Total operating costs	$ 219,151	$ 219,151	$ 209,454	$ 219,151	$ 219,151	$ 209,454	$ 219,151	$ 219,151	$ 219,151	$ 209,454
Gross profit (Sales less Operating)	-$ 219,150	-$ 196,411	-$ 186,714	-$ 219,150	-$ 196,411	-$ 186,714	-$ 219,150	-$ 196,411	-$ 196,411	-$ 209,453
Less depreciation	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896
Profit before tax	-$ 242,046	-$ 219,307	-$ 209,610	-$ 242,046	-$ 219,307	-$ 209,610	-$ 242,046	-$ 219,307	-$ 219,307	-$ 232,349
Tax @ 30%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net profit	-$ 242,046	-$ 219,307	-$ 209,610	-$ 242,046	-$ 219,307	-$ 209,610	-$ 242,046	-$ 219,307	-$ 219,307	-$ 232,349
% of revenue	**-24204600%**	**-964%**	**-922%**	**-24204600%**	**-964%**	**-922%**	**-24204600%**	**-964%**	**-964%**	**-23234900%**

PROJECTED CASH FLOW - TEN YEARS

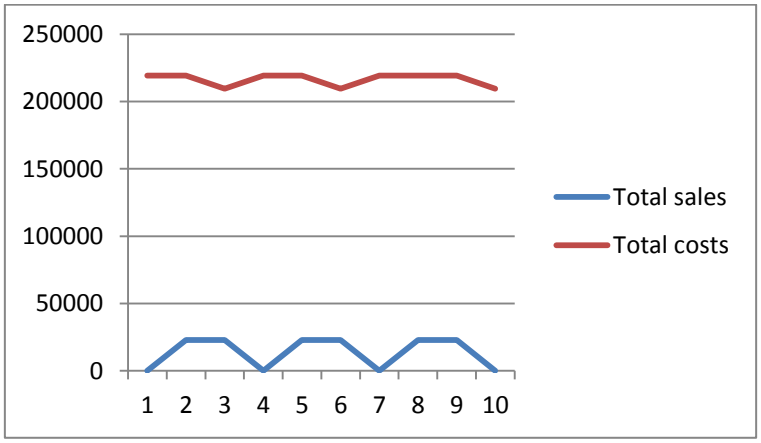
Cash flow	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Net profit after tax	-$ 246,046	-$ 219,307	-$ 209,610	-$ 242,046	-$ 219,307	-$ 209,610	-$ 242,046	-$ 219,307	-$ 219,307	-$ 232,349
Add depreciation	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896
Less loan principle	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896	$ 22,896
Add loan funds received	$ 228,963	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Less start-up capital expenditure	$ 228,963	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net cash flow	**-$ 246,046**	**-$ 219,307**	**-$ 209,610**	**-$ 242,046**	**-$ 219,307**	**-$ 209,610**	**-$ 242,046**	**-$ 219,307**	**-$ 219,307**	**-$ 232,349**
Operating cash balance	$ 10	-$ 246,036	-$ 465,343	-$ 674,953	-$ 916,999	-$ 1,136,306	-$ 1,345,916	-$ 1,587,962	-$ 1,807,269	-$ 2,026,576
Closing cash balance	**-$ 246,036**	**-$ 465,343**	**-$ 674,953**	**-$ 916,999**	**-$ 1,136,306**	**-$ 1,345,916**	**-$ 1,587,962**	**-$ 1,807,269**	**-$ 2,026,576**	**-$ 2,258,925**

Balance sheet	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Assets											
Cash	$ 228,973	-$ 246,036	-$ 465,343	-$ 674,953	-$ 916,999	-$ 1,136,306	-$ 1,345,916	-$ 1,587,962	-$ 1,807,269	-$ 2,026,576	-$ 2,258,925
Fixed assets	$ -	$ 228,963	$ 206,067	$ 183,171	$ 137,379	$ 68,691	-$ 22,893	-$ 137,373	-$ 274,749	-$ 435,021	-$ 618,189
Less accumulated depreciation	$ -	$ 22,896	$ 45,792	$ 68,688	$ 91,584	$ 114,480	$ 137,376	$ 160,272	$ 183,168	$ 206,064	$ 228,960
Total assets	**$ 228,973**	**-$ 39,969**	**-$ 305,068**	**-$ 560,470**	**-$ 871,204**	**-$ 1,182,095**	**-$ 1,506,185**	**-$ 1,885,607**	**-$ 2,265,186**	**-$ 2,667,661**	**-$ 3,106,074**
Liabilities											
Loan	$ 228,963	$ 206,067	$ 183,171	$ 160,275	$ 137,379	$ 114,483	$ 91,587	$ 68,691	$ 45,795	$ 22,899	$ 3
Total liabilities	**$ 228,963**	**$ 206,067**	**$ 183,171**	**$ 160,275**	**$ 137,379**	**$ 114,483**	**$ 91,587**	**$ 68,691**	**$ 45,795**	**$ 22,899**	**$ 3**
Net assets	**$ 10**	**-$ 246,036**	**-$ 488,239**	**-$ 720,745**	**-$ 1,008,583**	**-$ 1,296,578**	**-$ 1,597,772**	**-$ 1,954,298**	**-$ 2,310,981**	**-$ 2,690,560**	**-$ 3,106,077**
Shareholder equity											
Issued capital	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10
Retained profits	$ -	-$ 246,046	-$ 488,249	-$ 720,755	-$ 1,008,593	-$ 1,296,588	-$ 1,597,782	-$ 1,954,308	-$ 2,310,991	-$ 2,690,570	-$ 3,106,087
Total shareholder equity	**$ 10**	**-$ 246,036**	**-$ 488,239**	**-$ 720,745**	**-$ 1,008,583**	**-$ 1,296,578**	**-$ 1,597,772**	**-$ 1,954,298**	**-$ 2,310,981**	**-$ 2,690,560**	**-$ 3,106,077**

6.7 Conclusion

The Business Case does not support pursuing the establishment of the Pilot Project at Yarrabah at this point in time. The financial analysis shows that a break-even point will never be achieved, due to the small level of sales relative to costs. The stocking densities, grow-out rates, number of production cycles and farm-gate unit price of spiny lobster will need to improve significantly to achieve annual profit margins.

Figure 12: Production sales versus costs



The Business Case, however, was underpinned by an 18 month grow-out period to meet GBRMPA's requirement for a business case that supports a commercial facility as a condition of assessment for a Marine Parks Permit. This does not reflect the purpose of the Pilot Project, which was expected to involve:

- Only a six-month grow-out period, which is based on the purchase of spiny lobster at minimum legal size rather than grow-out over 18 months from hatchery-produced seed, and
- A further three years of R&D, which is needed to obtain the biometric data required to develop a business case for a commercial facility.

The key strength of pursuing the Pilot Project is the socio-economic benefits to Yarrabah and other ATSI communities across northern Australia. This will remain the case and justifies a review of how to take the Pilot Project forward without the constraints imposed by permit and approval requirements, including utilisation of less expensive grow-out technology such as sea cages.

ATSI communities are in a position to source the funds needed to establish environmentally sustainable enterprises.

ATTACHMENT A: Wetlands of HES, Demonstrating compliance with overall outcomes

Table 1 – Demonstrating compliance with development outcomes

Development outcome (DO)	Acceptable outcomes (AO)
Development is located outside the HES wetland	AO1.1
Development avoids adverse effects on the wetland	AO2.1–2.3, AO3.1, AO4.1–4.3, AO5.1, AO5.8, AO6.1, AO7.1, AO8.1, AO9.1, AO10.1 and AO11.1–11.2.
Development minimises adverse effects on the wetland and an environmental offset is provided for any remaining impacts.	AO3.2-3.3, AO5.2–5.7, AO6.2, AO7.2, AO8.2–8.4, AO9.2–9.3, AO10.2–10.4 and AO11.1–11.2.
Where there is a development commitment	All of the above to the greatest extent practicable without compromising the intrinsic characteristics of the development.

4.0 Code provisions

Specific outcomes (SO)	Acceptable outcomes (AO)
Development positioning	
SO1 Development is not carried out in a HES wetland.	AO1.1 Development is located outside: a) the mapped boundary of a HES wetland in a Great Barrier Reef wetland protection area; or b) an alternative mapped boundary of the HES wetland— (1) submitted as part of the development application; and (2) supported by a detailed assessment and site analysis of the wetland to delineate its extent in accordance with the Queensland Wetland Definition and Delineation Guidelines (2010); and (3) that the alternative assessment manager or concurrence agency agrees is a more accurate representation of the boundary.
SO2 An adequate buffer to a HES wetland is provided.	**To avoid adverse effects:** AO2.1 A buffer surrounding a HES wetland in a Great Barrier Reef wetland protection area is provided and has a minimum width of: a) 200 metres where a HES wetland is located outside an urban area or b) 50 metres where a HES wetland is located within an urban area. OR AO2.2 An alternative buffer is provided, the width of which is supported by an evaluation of the values, functioning and threats to the wetland. AND AO2.3 A buffer surrounding a wetland of ecological significance is maintained. **Note:** DERM should be contacted for information on maintaining a wetland buffer and the process for determining an alternative buffer width.

Specific outcomes (SO)	Acceptable outcomes (AO)
Hydrology	
SO3 The existing surface water hydrological regime of the Great Barrier Reef wetland protection area (including the HES wetland) is maintained or enhanced. **Note:** The hydrological regime of surface waters includes: • peak flows • volume of flows • duration of flows • frequency of flows • seasonality of flows • water depth (seasonal average • wetting and drying cycle.	**To avoid adverse effects:** AO3.1 Development does not change the existing surface water hydrological regime of a HES wetland, including through channelisation, redirection or interruption of flows. **Note:** An assessment of the extent of change must take into account the natural variability of the hydrological regime of the wetland. **To minimise adverse effects:** AO3.2 If AO3.1 does not apply, the extent of the change is minimised to ensure the wetland values and functioning are protected. The change is minimised if, at least: a) there is no change to the reference duration high-flow and low-flow duration frequency curves, low-flow spells frequency curve and mean annual flow to and from the wetland; and b) any relevant stream flows into the wetland comply with relevant environmental flow objectives (EFOs) of the applicable water resource plan for the area; and c) for development resulting in an increase to the velocity or volume of stormwater flows into the HES wetland – the collection and reuse of stormwater occurs in accordance with (a) and (b). **Note:** Reference durations for wetland types are available in the SPP guideline. OR AO3.3 If neither AO3.1 nor AO3.2 apply, the following apply in relation to the development: a) a net ecological benefit and improvement to the values and functioning of the wetland; and b) development is limited to rehabilitating the existing hydrological regime or restoring the natural hydrological regime of the wetland to enhance the ecological functions and biodiversity values of the wetland. **Note:** Refer to the Wetland Rehabilitation Guidelines for the Great Barrier Reef Catchment (2008).
SO4 The existing groundwater hydrological regime of the Great Barrier Reef wetland protection area (including the HES wetland) is protected or enhanced.	**To avoid adverse effects:** AO4.1 The water table and hydrostatic pressure within the Great Barrier Reef wetland protection area is not lowered or raised outside the bounds of variability under existing conditions. OR AO4.2 The water table and hydrostatic pressure in the Great Barrier Reef wetland protection area is returned to its natural state. AND AO4.3 Development does not result in the ingress of saline water into freshwater aquifers.

Specific outcomes (SO)	Acceptable outcomes (AO)
Water quality – stormwater	
SO5 During construction and operation of development: • a wetland is not used for stormwater treatment • the buffer and water quality values of a HES wetland are protected from stormwater impacts. **Note:** Best practice stormwater management is available in the following guidelines: • for urban areas: Queensland Best Practice Environmental Management Guidelines – Urban Stormwater • for outside urban areas: Wetland Management Handbook: Farm Management Systems guidelines for managing wetlands in intensive agriculture.	**In an urban area** **To avoid adverse effects:** AO5.1 Development does not result in any measurable change to the quantity or quality of stormwater entering the HES wetland during construction or operation. **To minimise adverse effects:** AO5.2 Stormwater quality is managed in accordance with best practice environmental management for erosion and sediment control. AND AO5.3 During construction, development incorporates erosion and sediment control measures to achieve best practice design objectives. **Note**: An erosion and sediment control plan should be prepared by a suitably qualified person to demonstrate compliance with acceptable outcomes AO5.2 and AO5.3. AND AO5.4 During construction, release of sediment-laden stormwater is avoided for the nominated design storm, and minimised if the design storm is exceeded, consistent with the erosion and sediment control plan, including the following best practice: • stormwater runoff during any construction works is diverted or bypassed around the HES wetland; and • all stormwater runoff saved for dewatering flow from site catchments achieves a maximum concentration of 50 mg/L of total suspended solids; and • all drainage lines, diversion and collection drains and bank, chutes and outlets are able to safely carry peak flow in accordance with the Queensland Best Practice Environmental Management Guidelines – Urban Stormwater. AND AO5.5 During construction, erosion and sediment control practices including approved proprietary products are designed, installed, constructed, maintained and monitored in accordance with local conditions and recommendations by suitably qualified persons/professionals[14]. AND AO5.6 During operation, stormwater discharges are treated in accordance with best practice load reduction design objectives before stormwater flow enters the buffer area of the wetland. Stormwater treatment should address pollutants including, but not limited to: • total suspended solids • total phosphorus • total nitrogen • gross pollutants >5 mm. AND AO5.7 During operation, development incorporates stormwater flow control measures to achieve best practice design objectives.

<table>
<tr><th>Specific outcomes (SO)</th><th>Acceptable outcomes (AO)</th></tr>
<tr><td></td><td>Other than in an urban area
To avoid adverse effects:
AO5.8 Development does not result in any measurable change to the quantity or quality of stormwater entering the HES wetland during construction or operation.</td></tr>
<tr><td colspan="2">Ecological values</td></tr>
<tr><td colspan="2">Vegetation and land degradation</td></tr>
<tr><td>SO6 Development involving the clearing of vegetation protects the biodiversity, ecological values and processes, and hydrological functioning of a HES wetland, including:
• water quality values
• aquatic habitat values;
• terrestrial habitat values
• usage of the site by native wetland fauna species or communities, including threatened or near threatened species, and species of regional and local significance.</td><td>To avoid adverse effects:
AO6.1 Vegetation clearing undertaken as a consequence of development does not occur:
• in a HES wetland; or
• in a buffer area under specific outcome SO2.
In an urban area
To minimise adverse effects:
AO6.2 Development is undertaken outside of the HES wetland and buffer, so as to minimise the extent of vegetation clearing required.</td></tr>
<tr><td>SO7 Development avoids land degradation in a Great Barrier Reef wetland protection area, including:
• mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding
• loss or modification of chemical, physical or biological properties or functions of soils.</td><td>To avoid adverse effects:
AO7.1 Development in the Great Barrier Reef wetland protection area does not occur on landforms that are particularly vulnerable to soil loss, such as steep slopes.
To minimise adverse effects:
AO7.2 Mechanical clearing of vegetation within a Great Barrier Reef wetland protection area is located outside of the HES wetland and buffer, and occurs only in accordance with the following:
<table>
<tr><th>Soil stability class</th><th>South-east Queensland bioregion</th><th>Coastal bioregions</th><th>Western bioregions</th><th>Brigalow Belt & New England Tablelands</th></tr>
<tr><td></td><td colspan="4">On a slope less than—</td></tr>
<tr><td>Very stable</td><td>15 %</td><td>-</td><td>-</td><td>15 %</td></tr>
<tr><td>Stable</td><td>12 %</td><td>32 %</td><td>10 %</td><td>12 %</td></tr>
<tr><td>Unstable</td><td>8 %</td><td>10 %</td><td>3 %</td><td>8 %</td></tr>
<tr><td>Very unstable</td><td>5 %</td><td>1 %</td><td>1 %</td><td>5 %</td></tr>
</table></td></tr>
</table>

Specific outcomes (SO)	Acceptable outcomes (AO)
Ecological corridors	
SO8 Existing ecological corridors are protected or enhanced and have dimensions and characteristics that will: • effectively link habitats on and/or adjacent to the site • facilitate the effective movement of terrestrial and aquatic fauna accessing and/or using the site as habitat.	**To avoid adverse effects:** AO8.1 Development does not occur within an existing ecological corridor. **To minimise adverse effects:** AO8.2 If an ecological corridor is required to facilitate fauna movement, access or use of the HES wetland, the ecological corridor has a minimum width of 100 metres, and is provided and maintained in accordance with the Wetland Rehabilitation Guidelines for the Great Barrier Reef Catchment (2008) or other relevant guidelines. OR AO8.3 The width of the ecological corridor is sufficient to facilitate fauna movement, access or use of the HES wetland and is provided and maintained in accordance with the Wetland Rehabilitation Guidelines for the Great Barrier Reef Catchment (2008), or other relevant guidelines.[15] AND AO8.4 Unimpeded movement of fauna associated with and/or likely to use the HES wetland as part of their normal life cycle is facilitated within and through the Great Barrier Reef wetland protection area, particularly along identified ecological corridors by: • ensuring that development (e.g. roads, pedestrian access, in-stream structures, etc), both during construction and operation, does not create barriers to the movement of fauna along or within ecological corridors; and • providing wildlife movement infrastructure where necessary and directing fauna to locations where wildlife movement infrastructure has been provided to enable fauna to safely negotiate a development area; and • separating fauna from potential hazards (e.g. through fencing).
Pest and invasive species	
SO9 Development does not result in pest management impacts that pose a risk to the ecological values and processes of a HES wetland.	**To avoid adverse effects:** AO9.1 Development does not result in the introduction of any non-native fauna or pest species. **To minimise adverse effects:** AO9.2 Exclusion fencing is provided in appropriate locations to manage the threat of pest species to the HES wetland, and to prevent stock from carrying weeds/exotics into the HES wetland AND AO9.3 The exclusion fencing does not result in a barrier or hazard to the movement of wetland fauna.

Specific outcomes (SO)	Acceptable outcomes (AO)
Noise, light and visual disturbance	
SO10 During construction and operation of development wetland fauna values are protected from impacts associated with noise, light or visual disturbance.	**To avoid adverse effects:** AO10.1 Development does not result in any measurable impact on wetland fauna values from noise, light or visual disturbance during construction or operation. **To minimise adverse effects:** AO10.2 Lighting is managed to ensure it does not have an adverse effect on the wetland fauna values of a HES wetland, in accordance with expert ecological advice. AND AO10.3 Noise is managed to ensure it does not have an adverse effect on the wetland fauna values of a HES wetland, in accordance with expert ecological advice. AND AO10.4 Visual disturbance is controlled to ensure it does not have an adverse effect on the wetland fauna values of a HES wetland, in accordance with expert ecological advice. Visual disturbance may be controlled through exclusion of activities in certain areas (e.g. line of sight buffers, exclusion fencing, etc), and the use of visual screens or similar during sensitive periods, such as breeding periods and roosting periods.
Operational management, maintenance and monitoring issues	
SO11 Ongoing management, maintenance and monitoring is undertaken to ensure adverse effects on hydrology, water quality and ecological processes of a HES wetland are avoided or minimised during construction and operation of the development.	**To avoid or minimise adverse effects:** AO11.1 Construction and operations related to the development are carried out in accordance with an operational management plan where appropriate. The plan can form an amendment to an existing approved management plan for the site. AND AO11.2A Performance bond and agreement is lodged, where appropriate, with the concurrence agency or alternative assessment manager to ensure the approved management, maintenance or monitoring program is implemented.
Environmental offsets in urban areas	
SO12 For development in an urban area where it is not possible to avoid adverse effects on HES wetlands, development: a) minimises adverse effects and; b) an environmental offset[16] is provided for any remaining environmental impacts on the HES wetland.	
Note: An environmental offset to compensate the loss of environmental values caused by the development is consistent with the policy principle of the Qld Government Environmental Offsets Policy 2008 and corresponding specific issue offsets policy.	

ATTACHMENT B: Regional Management Code for Bioregions, Part P, AS P.4—S

Part P: Requirements for clearing for public safety and infrastructure

a) Public safety and infrastructure includes clearing that is:
b) for establishing a necessary fence, firebreak, road or vehicular track, or for constructing necessary built infrastructure, if there is no suitable alternative site for the fence, firebreak, road, track or infrastructure; or
c) a natural and ordinary consequence of other assessable development for which a development approval as defined under the Integrated Planning Act 1997 (IPA) was given, or a development application as defined under IPA was made, before 16 May 2003; or to ensure public safety.

<table>
<tr><th colspan="2">Performance requirement</th></tr>
<tr><td colspan="2">PR P.1: Limits to clearing for public safety and infrastructure
To regulate the clearing of vegetation in a way that conserves remnant vegetation that are regional ecosystems, does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes—subject to the limitations required to meet PR P.2 to PR P.10—clearing is limited to the extent that is necessary—
a) for establishing a necessary fence, firebreak, road or vehicular track, or for constructing necessary built infrastructure, if there is no suitable alternative site for the fence, firebreak, road, track or infrastructure; or
b) as a natural and ordinary consequence of other assessable development for which a development approval as defined under the IPA was given, or a development application as defined under IPA was made, before 16 May 2003; or
c) to ensure public safety.</td></tr>
<tr><th>Performance requirement</th><th>Acceptable solution
(applicants can propose an alternative solution to meet the performance requirement)</th></tr>
<tr><td>PR P.2: Wetlands
To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes—assessable vegetation associated with any natural significant wetland and/or natural wetland is protected to maintain—
a) water quality by filtering sediments, nutrients and other pollutants; and
b) aquatic habitat; and
c) terrestrial habitat.</td><td>AS P.2
P.2.1 Clearing does not occur—
a) in any natural wetland; and
b) within 100 metres from any natural wetland; and
c) in any natural significant wetland; and
d) within 200 metres from any natural significant wetland.

AND

P.2.2
Where clearing is for a significant community project, maintain the current extent of assessable vegetation associated with any natural significant wetland and/or natural wetland to provide—
a) water quality by filtering sediments, nutrients and
b) aquatic habitat; and
c) terrestrial habitat.</td></tr>
</table>

PR P.3: Watercourses To regulate the clearing of vegetation in a way that does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes—assessable vegetation associated with any watercourse is protected to maintain— a) bank stability by protecting against bank erosion; and b) water quality by filtering sediments, nutrients and other pollutants; and c) aquatic habitat; and d) terrestrial habitat.	**AS P.3** P.3.1 Clearing does not occur— a) in any watercourse; and b) within the relevant distance stipulated in Table 1, of each high bank of each watercourse. AND P.3.2 Where clearing is for a significant community project, maintain the current extent of assessable vegetation associated with any watercourse to provide— a) bank stability by protecting against bank erosion; and b) water quality by filtering sediments, nutrients and other pollutants; and c) aquatic habitat; and d) terrestrial habitat.
PR P.4: Connectivity To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes—areas of mapped remnant vegetation are retained that are— a) of sufficient size and configured in a way to maintain ecosystem functioning; and b) of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes; and c) located on the lot(s) that are the subject of the application to maintain connectivity to mapped remnant vegetation on adjacent properties.	**AS P.4** P.4.1 Where clearing is less than— a) 10 metres wide; or b) 2 hectares; clearing does not— i) reduce the width of mapped remnant vegetation to less than 200 metres; and ii) occur where the width of mapped remnant vegetation is less than 200 metres; AND P.4.2 Clearing does not— a) reduce areas of contiguous mapped remnant vegetation to less than 10 hectares; and b) occur in areas of contiguous mapped remnant vegetation that are less than 10 hectares; and c) reduce the width of mapped remnant vegetation to less than 200 metres; and d) occur where the width of mapped remnant vegetation is less than 200 metres; and e) reduce the total extent of mapped remnant vegetation to less than 30%; and f) occur where the total extent of mapped

	remnant vegetation is less than 30%. AND P.4.3 Where clearing is for a significant community project, maintain the current extent of mapped remnant vegetation where the vegetation is— a) of sufficient size and configured in a way to maintain ecosystem functioning; and b) of sufficient size and configured in a way to remain in the landscape in spite of any threatening processes; and c) located on the lot(s) that are the subject of the application to maintain connectivity to mapped remnant vegetation on adjacent properties.
PR P.5: Soil erosion To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes—the effect of clearing does not result in— a) mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding; and b) any associated loss of chemical, physical or biological fertility—including, but not limited to water holding capacity, soil structure, organic matter, soil biology, and nutrients, within and/or outside the lot(s) that are the subject of the application.	**AS P.5** P.5.1 Mechanical clearing only occurs on— a) stable soils on a slope less than 30%; and b) unstable soils on a slope less than 10%; and c) very unstable soils on a slope less than 1%.
PR P.6: Salinity To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes—clearing does not contribute to— a) waterlogging; or b) the salinisation of groundwater, surface water or soil.	**AS P.6** P.6.1 Where clearing is less than— a) 2 hectares; or b) 10 metres wide; clearing does not occur in any discharge area. AND P.6.2 Where clearing is less than— a) 5 hectares; or b) 50 metres wide— clearing does not occur— i) in any discharge area; and ii) within 200 metres of any discharge area.

	AND P.6.3 Clearing does not occur in areas greater than 5 hectares
PR P.7: Conserving remnant vegetation that are *endangered* regional ecosystems and *of concern* regional ecosystems To regulate the clearing of vegetation in a way that conserves remnant vegetation that are *endangered* regional ecosystems and *of concern* regional ecosystems—maintain the current extent of *endangered* regional ecosystems and *of concern* regional ecosystems.	**AS P.7** P.7.1 Clearing— a) does not occur in an *endangered* regional ecosystem or an *of concern* regional ecosystem that is listed in Table 2; and b) in an *endangered* regional ecosystem or an *of concern* regional ecosystem that is not listed in Table 2 only occurs where the clearing is less than 10 metres wide or 0.5 hectares.
PR P.8: Essential habitat To regulate the clearing of vegetation in a way that prevents the loss of biodiversity—maintain the current extent of essential habitat.	**AS P.8** P.8.1 Clearing does not occur in an area shown as essential habitat on the essential habitat map.
PR P.9: Conservation status thresholds To regulate the clearing of vegetation in a way that conserves remnant vegetation that are regional ecosystems and prevents the loss of biodiversity—maintain the current extent of regional ecosystems listed in Table 3.	**AS P.9** P.9.1 Clearing in a regional ecosystem listed in Table 3, does not occur unless the clearing is less than— a) 10 metres wide; or b) 2 hectares.
PR P.10: Acid sulfate soils To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes—clearing activities do not result in disturbance of acid sulfate soils or changes to the hydrology of the location that will either— a) aerate horizons containing iron sulfides; or b) mobilise acid and/or metals.	**AS P.10** P.10.1 Clearing in land zone 1, land zone 2 or land zone 3 in areas below 5 metre Australian Height Datum— a) is carried out in accordance with an acid sulfate soils environmental management plan as outlined in the *State Planning Policy 2/02 Guideline: Planning and Managing Development involving Acid Sulfate Soils;* and b) follows management principles in accordance with the Soil Management Guidelines in the *Queensland Acid Sulfate Soil Technical Manual*.

ATTACHMENT C: Great Barrier Reef Marine Park Regulations

Division 2A.4 Consideration of applications

88Q Consideration of applications — mandatory considerations

In deciding whether or not to grant a permission in relation to an application, and whether or not to impose any conditions on the permission, the Authority must consider the following:

(a) the potential impacts of the conduct proposed to be permitted by the permission (the proposed conduct) on the environment and on the social, cultural and heritage values of the Marine Park or a part of the Marine Park;

(b) options for monitoring, managing and mitigating the potential impacts of the proposed conduct;

(c) if the proposed conduct will take place in an area to which a zoning plan applies — the objectives of the zone as set out in the zoning plan;

(d) if the proposed conduct also requires an approval or permit under the Environment Protection and Biodiversity Conservation Act 1999:

(i) whether the approval or permit has been, or is likely to be, granted and, if granted, the terms and conditions of it being granted; and

(ii) any relevant assessment documentation (within the meaning given by subsection 133 (8) of that Act) in relation to the approval or permit;

(e) any written comments received about the application in response to the public advertisement published in accordance with regulation 88D;

(f) any other matters relevant to the orderly and proper management of the Marine Park.

Note Subsection 7 (3) of the Great Barrier Reef Marine Park Act 1975 provides that the Authority must, in managing the Marine Park and performing its other functions, have regard to, and seek to act in a way that is consistent with, the objects of the Act, the principles of ecologically sustainable use and the protection of the world heritage values of the Great Barrier Reef World Heritage Area.

88R Consideration of applications — discretionary considerations

In deciding whether or not to grant a permission in relation to an application, and whether or not to impose any conditions on the permission, the Authority may consider the following:

(a) the requirement in section 37AA of the Act for users of the Marine Park to take all reasonable steps to prevent or minimise harm to the environment in the Marine Park that might or will be caused by the user's use or entry;

(b) the effect that the grant of the permission will have on public appreciation, understanding and enjoyment of the Marine Park;

(c) the impact of the conduct proposed to be permitted under the permission in the context of other conduct in the relevant area or nearby areas, or in the Marine Park, that is being undertaken, is planned,

is in progress, or is reasonably foreseeable at the time of the Authority's consideration of the application, whether or not related to or a consequence of the proposed conduct;

(d) any policies or guidelines issued by the Authority about the management of the Marine Park or the performance of the Authority's functions under the Act and these Regulations;

(e) if the application for the permission relates to an undeveloped project the cost of which will be large — the capacity of the applicant to satisfactorily develop and manage the project;

(f) if the proposed conduct also requires an approval or a permission under a law of Queensland — whether the approval or permission has been, or is likely to be, granted and, if granted, the terms and conditions of it being granted; and

(g) any international Convention to which Australia is a signatory, or any agreement between the Commonwealth and a State or Territory, that is relevant to the application;

(h) any relevant law of the Commonwealth, or a relevant law of Queensland as in force from time to time, or a relevant plan made under such a law, relating to the management of the environment, or an area in the Marine Park;

(i) any relevant recovery plan, wildlife conservation plan, threat abatement plan or approved conservation advice, under the Environment Protection and Biodiversity Conservation Act 1999;

(j) whether the applicant for the permission is a suitable person to hold such a permission, having regard to:

(i) the applicant's history in relation to environmental matters; and

(ii) if the applicant is a body corporate — the history of its executive officers in relation to environmental matters; and

(iii) if the applicant is a company that is a subsidiary of another company (the parent body) — the history of the parent body and its executive officers in relation to environmental matters; and

(iv) any charge, collected amount or penalty amount that is overdue for payment by the applicant as the holder of a chargeable permission (whether or not the permission is in force); and

(v) any late payment penalty that is payable by the applicant as the holder of a chargeable permission (whether or not the permission is in force); and

(vi) any unpaid fines or civil penalties required to be paid by the applicant in relation to a contravention of the Act or of these Regulations;

(k) any other matters relevant to achieving the objects of the Act.

Attachment D: Great Barrier Reef Marine Park environmental impact management tools

Table 1: Indicative level of environmental impact management tools

Assessment	Monitoring	Environmental Management Plan	Deed	Bond
Level 1	Compliance	No*	No	No
Level 2	Site Inspection	No	Yes (standard)	~$50,000
Level 3	Site Inspection + Issue Based	Yes + Advisory Committee	Yes (standard)	~$250,000
Level 4	Site Inspection + Issue Based + Reactive + Monitoring Consultant	Yes + Advisory Committee + Environmental Site Supervisor	Yes (specific)	~$500,000+

Table 2: Examples of assessment levels of projects (these examples are for guidance only and are not binding on a GBRMPA delegate)

Level 1 Minor Project Minimal and/or transient impact Example – small navigation marker
Level 2 Small project Low and/or short-term impact Example – Jetty or Pontoon (less than 15m long), small boat ramp (1 or 2 lane ramp or widen existing ramp by up to 2 lanes).
Level 3 Medium scale project Public interest , sensitive environment, Moderate and/or medium term impact Example – spoil disposal from maintenance dredging associated with ports
Level 4 Complex or large scale project Public interest, irreversible and/or major impact Example – Large marina development (over 30 berths), large capital dredge and spoil disposal

ATTACHMENT E: Significant impact criteria

Listed threatened species and ecological communities

Extinct in the wild species
An action is likely to have a significant impact on extinct in the wild species if there is a real chance or possibility that it will:

- Adversely affect a captive or propagated population or one recently introduced/reintroduced to the wild, or
- Interfere with the recovery of the species or its reintroduction into the wild.

Critically endangered and endangered species
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population
- Reduce the area of occupancy of the species
- Fragment an existing population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of a population
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- Introduce disease that may cause the species to decline, or
- Interfere with the recovery of the species.

Vulnerable species
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of an important population of a species
- Reduce the area of occupancy of an important population
- Fragment an existing important population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of an important population
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- Introduce disease that may cause the species to decline, or
- Interfere substantially with the recovery of the species.

<u>Critically endangered and endangered ecological communities</u>
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community

- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
- Adversely affect habitat critical to the survival of an ecological community
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
    - assisting invasive species, that are harmful to the listed ecological community, to become established, or
    - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
- Interfere with the recovery of an ecological community.

Listed migratory species

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

World Heritage Properties

An action is likely to have a significant impact on the World Heritage values of a declared World Heritage property if there is a real chance or possibility that it will cause:

- One or more of the World Heritage values to be lost
- One or more of the World Heritage values to be degraded or damaged, or
- One or more of the World Heritage values to be notably altered, modified, obscured or diminished.

National Heritage Places

An action is likely to have a significant impact on the National Heritage values of a National Heritage place if there is a real chance or possibility that it will cause:

- One or more of the National Heritage values to be lost
- One or more of the National Heritage values to be degraded or damaged, or
- One or more of the National Heritage values to be notably altered, modified, obscured or diminished.

Great Barrier Reef Marine Park

An action is likely to have a significant impact on the environment of the Great Barrier Reef Marine Park if there is a real chance or possibility that the action will:

- Modify, destroy, fragment, isolate or disturb an important, substantial, sensitive or vulnerable area of habitat or ecosystem component such that an adverse impact on marine ecosystem health, functioning or integrity in the Great Barrier Reef Marine Park results
- Have a substantial adverse effect on a population of a species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, life expectancy) and spatial distribution
- Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological health or integrity or social amenity or human health
- Result in a known or potential pest species being introduced or becoming established in the Great Barrier Reef Marine Park
- Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, or social amenity or human health may be adversely affected, or
- Have a substantial adverse impact on heritage values of the Great Barrier Reef Marine Park, including damage or destruction of an historic shipwreck.