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# PINDIMAR ABALONE FARM

# ENVIRONMENTAL ASSESSMENT REPORT

## MP (10_0006)

## February 2014

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| Job No/ Document No | Description of Issue | Prepared By/ Date | Reviewed by Project Manager/Director | Approved by Project Manager/Director |
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| N-12014/ Rev A | Draft EA | J. Kral 25.03.13 | G. Fielding 25.03.13 |  G. Fielding |
| N-12014/ Rev 0 | Final Draft EA | J. Kral 26.03.13 | - | |
| N-12014/ Rev 1 | Draft Amended EA- client review | J. Kuczera 30.01.14 | M. Gibson 30.01.14 |  M. Gibson |
| N-12014/ Rev 2 | Final EA | J. Kuczera 07.02.14 | M. Gibson 30.01.14 |  M. Gibson |
| N-12014/ Rev 3 | Final EA- DP&I changes | J. Kuczera 28.02.14 | - | |
| **Note:** This document is preliminary unless it is approved by a Project Manager or Director of City Plan Services | | | | |

*Cover photogrpahs: Blacklip Abalone in shell- Department of Primary Industries (Victoria). Abalone dish- www.21food.com. Remaining photos are the proponent's own*

# DECLARATION

**Environmental Assessment prepared by:**

| | |
|---|---|
| Name: | Jillian Kuczera |
| Qualifications: | BEnvSc (Ncle) MPIA |
| Address: | City Plan Services. Suite 2, No. 14 Watt Street Newcastle NSW 2300 |
| In respect of: | Proposed Pindimar Abalone Farm |

**Project Application:**

| | |
|---|---|
| Proponent name: | Austasia Leefield Pty Ltd c/o Dominic Bressan |
| Proponent address: | Suite 26, No. 450 Elizabeth Street, Surry Hills NSW 2010 |
| Land to be developed | Part Lot 2 in DP 1014683. No. 180 Clarke Street, Pindimar South NSW 2324 |

**Environmental Assessment:** An Environmental Assessment (EA) is attached.

**Certificate:** I certify that I have prepared the content of this Environmental Assessment report and to the best of my knowledge:

- It is in accordance with *the Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000*
- It is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

Signature:

Name: Jillian Kuczera

Date: 28 February 2014

# ACKNOWLEDGEMENTS & NOTES ON THE TEXT

The Project team wishes to thank the individuals, organisations and government bodies who provided their feedback and assisted in the preparation of this Environmental Assessment.

## 'WOULD'/ 'WILL'

It is noted that determination of the Project will only be made after the EA has been publicly exhibited and submissions considered. However, for ease of reference should the Project be given approval to proceed (and the EA referenced within approval conditions), the term 'will' has been used throughout the text in preference to 'would'.

# GUIDELINES FOR MAKING A SUBMISSION

As part of the assessment process, submissions will be sought from members of the public, government agencies and other stakeholders in response to the public exhibition of this EA.

Those who are interested are invited to lodge a submission with the Department of Planning & Infrastructure (DP&I), providing information or comments in relation to the Project. The lodgement of a submission is a way to provide input into the environmental assessment process. All submissions will be reviewed by the proponents and a response to these submissions will be provided to the DP&I to assist in its ongoing assessment of the Project.

Any person wishing to make a submission should use the online form if possible. To find the online form go to the web-page for this proposal on DP&I's website at www.majorprojects.planning.nsw.gov.au/page/on-exhibition.

Before making your submission please read DP&I's Privacy Statement at www.planning.nsw.gov.au/privacy or for a copy ring DP&I's information centre on 1300 305 695.

DP&I will publish your submission on its website in accordance with the privacy statement.

If you cannot lodge online you can write to:

**NSW Department of Planning & Infrastructure**
**GPO Box 39, Sydney, NSW 2001**

If you want DP&I to delete your personal information before publication, please make this clear at the top of your letter. You need to include:

- your name and address, at the top of the letter only;
- the name of the application and the application number (MP 10_0006); and
- a declaration of any reportable political donations made in the previous two years. To find out what is reportable, and for a disclosure form, go to www.planning.nsw.gov.au/donations or ring the number above for a copy.

Helpful information that could be included within a submission includes the following:

- the reasons for your interest in the Project;

- a statement on your opinion of the Project, including reasons for your support / objection;
- any additional factual information you feel may be relevant to the environmental assessment of the Project; and
- any errors or omissions you feel may have been made within the EA.

It will be particularly helpful if, within your submission:

- each point / issue raised is set out as a separate section / point, so that the issues raised are clearly understood;
- if you are referring to a specific section within the EA, you list the Section and/or page number; and
- provide sketches and/or diagrams if they will assist in presenting your submission.

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AEA | Aquatic Ecology Assessment |
| AHAA | Aboriginal Heritage & Archaeological Assessment |
| AHD | Australian Height Datum |
| AHIMS | Aboriginal Heritage Information Management System |
| ANZECC | Australian and New Zealand Environment Conservation Council |
| AS | Australian Standard |
| ASS | Acid Sulphate Soils |
| ASSPA | Acid Sulphate Soil Preliminary Assessment |
| ARRF | Advanced Resource Recovery Facility |
| BDMP | Biosecurity & Disease Management Plan |
| BPA | Bushfire Protection Assessment |
| cm | Centimetre |
| DA | Development Application |
| dB | Decibels |
| DP | Deposited Plan |
| DCP | Development Control Plan |
| DGRs | Director-General's Environmental Assessment Requirements |
| DPI | NSW Department of Primary Industries |
| DP&I | NSW Department of Planning & Infrastructure (formerly the Department of Planning) |
| EA | Environmental Assessment report |
| EEC | Endangered Ecological Community |
| e.g. | Example |
| EPBC Act | Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* |
| EP&A Act | NSW *Environmental Planning & Assessment Act 1979* |
| EP&A Regulation | NSW *Environmental Planning & Assessment Regulation 2000* |
| EPI | Environmental Planning Instrument |
| EPL | Environment Protection License |

| | |
|---|---|
| ESD | Ecologically Sustainable Development |
| FM Act | NSW *Fisheries Management Act 1994* |
| F&F Report | Statement of Effect on Threatened Flora and Fauna (Flora & Fauna Report) |
| GLLEP | Great Lakes Local Environmental Plan |
| ha | Hectares |
| HAZCHEM | Hazardous Chemicals |
| HDPE | High Density Polyethylene |
| kg | Kilogram |
| KL | Kilo litre (1,000 litres) |
| LEC | NSW Land & Environment Court |
| LEP | Local Environmental Plan |
| LGA | Local Government Area |
| L/min | Litres per minute |
| kW | Kilowatt |
| MHWM | Mean High Water Mark |
| MLWM | Mean Low Water Mark |
| MNES | Matters of National Environmental Significance (pursuant to the EPBC Act) |
| MSDS | Material Safety Data Sheets |
| m | Metre |
| ml | Millilitre |
| $m^3$ | Cubic metre |
| mg/L | Milligrams per litre |
| ML | Megalitre (1,000,000 litres) |
| ML/day | Megalitres per day |
| NA-2003 | Noise Assessment (2003) |
| NIA-2011 | Noise Impact Assessment (2011) |
| NSW | New South Wales |
| NV Act | NSW *Native Vegetation Act 2003* |
| OEH | NSW Office of Environment & Heritage |
| OISAS | NSW Oyster Industry Sustainable Aquaculture Strategy |

| | |
|---|---|
| PASS | Potential Acid Sulphate Soils |
| PSLEP | Port Stephens Local Environmental Plan |
| POEO Act | NSW *Protection of the Environment Operations Act 1997* |
| ppm | Parts per million |
| ppt | Parts per thousand |
| PSNL | Project Specific Noise Levels |
| RF Act | NSW *Rural Fires Act 1997* |
| SEPP | State Environmental Planning Policy |
| SMP | Stormwater Management Plan |
| SOC | Statement of Commitments |
| TACC | Total Allowable Commercial Catch |

# GLOSSARY OF TERMS

| | |
|---|---|
| Acid sulphate soils (ASS) | Acidic soil material resulting from the oxidation of iron sulfides. 'Acid Sulfate Soils' means actual acid sulfate soils and/or potential acid sulfate soils. |
| Aerobic | Associated with the presence of free oxygen. |
| Anaerobic | A condition in which no free oxygen nitrates are present. |
| Aquaculture | Cultivating of fish or marine vegetation for the purposes of harvesting the fish or marine vegetation or their progeny with a view to sale. |
| Australian Height Datum (AHD) | A common national place of level corresponding approximately to mean sea level. |
| Benthic | The collection of organisms living on or in sea, lake or estuary bottoms. |
| Biochemical Oxygen Demand (BOD) | The quantity of oxygen used in the biochemical breakdown of organic matter in the effluent expressed in milligrams per litre or ppm. |
| Blackwater | Wastewater containing human waste. |
| Broodstock | A parent fish or organism. |
| Depurate | The process of eliminating waste products. |
| Diatom | Microscopic algae with silica cell walls. |
| Entrainment | In marine ecology, the drawing in of marine organisms into water intake pipes. |
| Fecundity | Reproductive rate. |
| Gametes | Sex cells. |
| Greywater (sullage) | Wastewater from domestic laundry and ablution areas, may include kitchen areas. |
| Groundwater | Underground waters (aquifers). |
| Growout | Stage and/or unit where the cultivation of aquatic animals is undertaken from initial seeding of young fry or juveniles up to harvesting of marketable sizes. |
| Impingement | In marine ecology, the pinning and trapping of fish or other organisms against the screens of water intake structures. |
| Indian Spring Low Tide | An arbitrary tidal datum approximating the level of the mean of the lower low waters at spring time. First used in waters surrounding India. |

| | |
|---|---|
| Indian Spring High Tide | An arbitrary tidal datum approximating the level of the mean of the higher high waters at spring time. First used in waters surrounding India. |
| Indigenous species | A species native to a particular region or country. |
| Intertidal | The region between the high tide mark and the low tide mark. |
| Kilolitre | 1,000 litres |
| Mean High Water Mark | Where the elevation of the land on a parcel of oceanfront property intersects with the mean high water elevation determined to be associated with the property's geographic location. |
| Mean Low Water Mark | Where the elevation of the land on property seaward of the mean high water mark intersects with the mean low water elevation determined to be associated with the property's geographic location. |
| Megalitre | 1,000,000 litres. |
| Metamorphose | To transform. |
| Open system | An aquaculture facility which discharges on average between 15 to 100% per day of its culture water directly to a waterway. This system is sometimes referred to as a flow through system. |
| pH | A measure of acidity or alkalinity of a substance. |
| Proponent | The entity proposing the Project. In the case of this EA, Austasia Leefield Pty Ltd is the proponent. |
| Protein skimmers | A device used mostly in saltwater aquaria to remove organic compounds from the water before they break down into nitrogenous waste. |
| Quarantine | The holding of aquatic animals or plants in an isolation facility. |
| Raceway | Artificial channel used in aquaculture to culture aquatic organisms. |
| Solid separator | A device used to remove solid material from liquid or solid slurry to render clarified water. |
| Spawn | In this case, the process by which Abalone reproduce, involving the release of gametes into the water. |
| Subtidal | The benthic ocean environment below low tide that is always covered by water. |
| Swirl separator | A filter used in tank aquaculture to remove waste solids (e.g. uneaten feed and fish faeces) before they break down and releases nutrients and toxins into the culture water. |
| Tank aquaculture | Type of intensive aquaculture that utilises recirculating water technology in tanks (e.g. hatcheries and tank aquaculture of barramundi, and Abalone). |

# EXECUTIVE SUMMARY

## Background & Project Context

Austasia Leefield Pty Ltd proposes to develop a land-based Abalone aquaculture farm at Pindimar, on the northern shore of Port Stephens in coastal New South Wales. Austasia Leefield Pty Ltd is a small, Australian-owned and locally-based company. The farms' aquaculture operations are proposed to be managed by a qualified marine ecologist with about 30 years' experience in marine ecology research.

The proposal will be assessed under the transitional Part 3A provisions of the *Environmental Planning & Assessment Act 1979* (EP&A Act) as a 'Major Project'. As required, an Environmental Assessment (EA) report has been prepared for the Project.

A proposal for an Abalone farm on the site was originally granted development consent (under Part 4 of the EP&A Act) by Great Lakes Council in 2006. However an objector appealed to the Land & Environment Court under Section 98 of the EP&A Act against the granting of consent. During the Court hearing, detailed documents were requested which were not able to be immediately produced, and the applicant had concerns about the financial implications of the legal proceedings. The applicant therefore agreed to the making of consent orders allowing the appeal, and the proposal was withdrawn.

Since that time, a decision to make a new application was made due to the ongoing commercial viability of the proposal and the anticipated scientific, environmental, social and commercial benefits of the development. The farm proposal has been refined by the proponent and it is considered that all documents that would reasonably be required to allow determination of the Project have been produced. The proposal is essentially the same as the previously approved development, with the exception of a change in the proposed yearly production rate (i.e. to 60 tonnes) and certain amendments and improvements resulting from ongoing research and development.

## Subject Site & Local Context

The subject site is located at No. 180 Clarke Street, South Pindimar (Lot 2 in DP 1014683). It comprises a total area of approximately 51 hectares (ha), although farm development will only be located within a 5ha precinct in the southern portion of the site. The site has a direct frontage to the waters of Port Stephens. The land is located within the Great Lakes Local Government Area, and the adjacent water is within the Port Stephens Local Government Area.

The site is located about 40km north-east of Newcastle and is to the west of the small coastal village of South Pindimar. With the exception of the village, the site and all surrounding land is zoned for rural purposes. An aerial image showing the location of the site in its local context is provided below (***Location Plan - Aerial***).

## Project Description

The proposal is for a land-based aquaculture farm for the production of about 60 tonnes per year of Blacklip Abalone (*Haliotis rubra*) for human consumption. Blacklip Abalone is an indigenous gastropod mollusc and a popular food product, particularly overseas. The wild NSW populations have suffered declines in recent years, with fishing pressures a key contributor. Abalone farms exist in most states and territories of Australia, although there are currently no farms in NSW.

The proposed farm will comprise a series of land-based tanks, sheds and ancillary structures to accommodate the quarantine, breeding and grow-out of Abalone. Abalone will be harvested and transported to market as live product, with no post-harvest processing on-site.

The farm will have a building footprint of approximately 1.2ha (about 2.3% of the total site area). Construction will require the clearing of about 1.2ha of vegetation, and the partial clearing / disturbance of 1.2 additional hectares for bushfire hazard reduction and other purposes. The vast majority of the site area will remain as-is (i.e. bushland, agricultural consideration). The in-perpetuity conservation and management of a 5.14ha high-quality portion of the land (10% of the total site) for ecological purposes is proposed to compensate for vegetation clearing / disturbance.

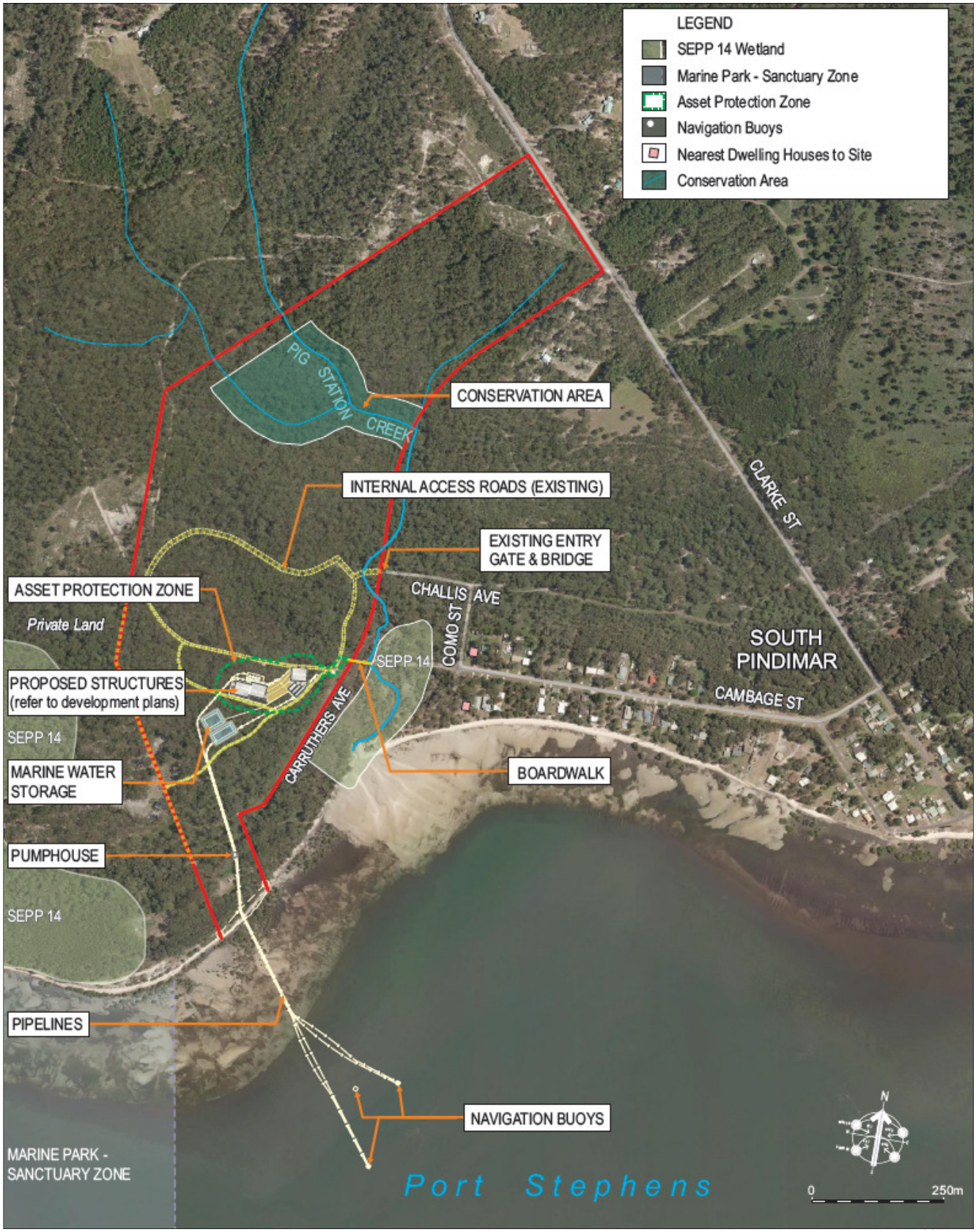
At full production, up to 50 mega litres of marine water will pass through the farm systems daily. The water will be sourced from Port Stephens via new pipelines, and will receive in-farm water quality treatment before its return to the Port. Pipelines will be buried underground along the Port's foreshore and intertidal areas but will be positioned above the seabed below the low tide mark. No farm structures are likely to be readily visible from outside the site due to their setback from boundaries and the retention of surrounding bushland.

It is expected that the Project will result in the creation of approximately 35 construction jobs and 15 full-time equivalent operational positions. Aquaculture research and education opportunities are also envisaged.

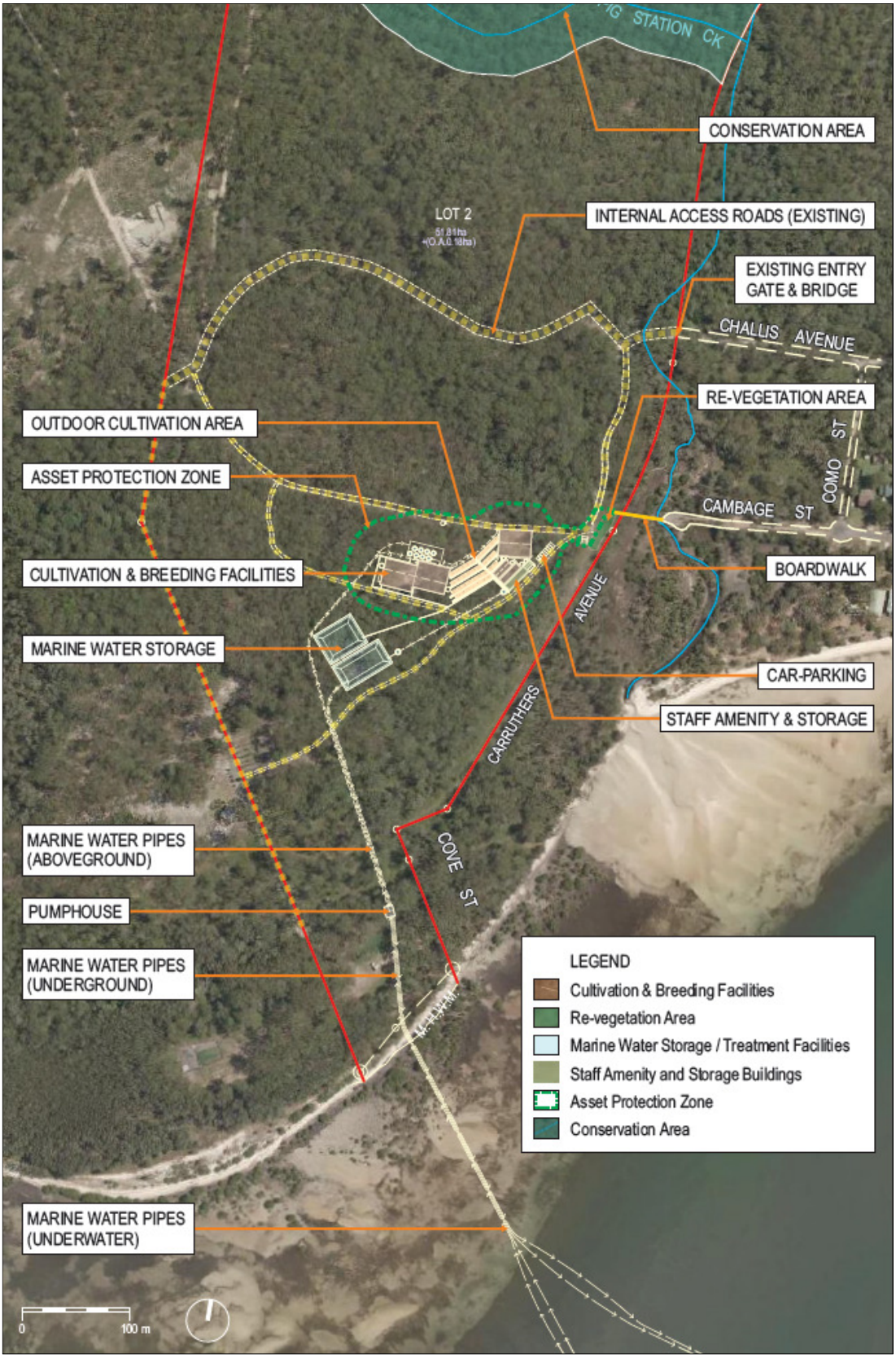
An aerial image, showing an overview of development within the subject site and adjacent Port Stephens, is provided below (***Subject Site & Proposed Development -***

***Local Context***). A more detailed view of proposed terrestrial development is also shown (***Proposed Terrestrial Development - Overview***).


**Location Plan - Aerial**




**Subject Site & Proposed Development - Local Context**




**Proposed Terrestrial Development – Overview**

## Project Need & Alternatives Considered

The Project is considered to be justifiable for a number of reasons, including the following:

- may help to reduce fishing pressure on wild Abalone populations by helping to meet increasing product demand through sustainable farming practices;
- species is suited to farming and the environmental parameters of the site;
- site is suitable with regard to logistical, strategic and environmental concerns; and
- will result in local economic benefits, including the creation of employment and training opportunities.

A number of alternatives to the Project were considered, including alternative locations, species and cultivation procedures. Alternative scenarios were not considered to adequately meet the needs of the farm, and were likely to result in increased environmental impacts.

## Planning Framework

The Project is permissible with consent under the *Great Lakes Local Environmental Plan 1996*, *Port Stephens Local Environmental Plans 2000* and *2013,* and *State Environmental Planning Policy No 62 - Sustainable Aquaculture.* The following legislation and planning instruments also have some application.

### *COMMONWEALTH MATTERS*

- ***Environment Protection & Biodiversity Conservation Act 1999*****:** the Project is not likely to significantly impact any Matters of National Environmental Significance. Nevertheless, at the time of writing, a referral to the Federal Department of Sustainability, Environment, Water, Population & Communities was being prepared to confirm whether or not approval for the Project is also required under this Act.

### *STATE MATTERS*

Approval of the Project is being sought pursuant to (the former) Part 3A of the EP&A Act and the *Environmental Planning & Assessment Regulation 2000*. The State Environmental Planning Policies (SEPPs) and additional State legislation considered within the EA is outlined in the Table below.

**State Matters Relevant to the Project**

| | Comment |
|---|---|
| SEPP 14- Coastal Wetlands | No mapped coastal wetlands will be directly impacted by the proposal. |
| SEPP 44- Koala Habitat Protection | The site contains 'Potential Koala Habitat' but no 'Core Koala Habitat'. |
| SEPP 55- Remediation of Land | The site is not likely to be affected by contamination. |
| SEPP 62- Sustainable Aquaculture | The Project is permissible with consent, and satisfies the SEPP's objectives, site and project-specific requirements. It is consistent with the provisions of the *NSW Land Based Sustainable Aquaculture Strategy* and the *NSW Oyster Industry Sustainable Aquaculture Strategy,* as required. |
| SEPP 71- Coastal Protection | The Project satisfies the matters for consideration. |
| SEPP (Major Development) 2005 | The SEPP provides that the proposal is a 'major project' to which (the former) Part 3A provisions of the EP&A Act apply as it comprises *aquaculture development within environmentally sensitive areas of State significance* (i.e. 'coastal waters of the state' and a 'marine park'). |
| SEPP (State & Regional Development) 2011 | This SEPP would define the proposal as 'state significant development' (however it is already defined as a 'major project' under the Major Development SEPP). |
| *Crown Lands Act 1989* | A license to occupy Crown Land shall be sought as required (i.e. for marine pipelines). |
| *National Parks & Wildlife Act 1974* | No permit to 'harm' Aboriginal objects will be required for the proposal. |
| *Native Vegetation Act 2003* | No approval to clear vegetation is required under this Act, due to the application of Part 3A of the EP&A Act. |
| *Coastal Protection Act 1979* | Concurrence for the Project from the Minister administering this Act is not required, due to the application of Part 3A of the EP&A Act. |
| *Protection of the Environment Operations Act 1997* | An Environment Protection License in relation to 'aquaculture and mariculture' will be sought, as the Project will be a 'scheduled activity'. |
| *Marine Parks Act 1997, Marine Parks Regulation 1999, & Marine Parks (Zoning Plan) Regulation 1999* | The pipelines will extend into the 'General Use Zone' of the Port Stephens - Great Lakes Marine Park. The proposal is a permissible activity with consent, and satisfies the relevant objectives and provisions. |
| *Fisheries Management Act 1994* | Certain permits will be sought for the Project as required (e.g. aquaculture permit pursuant to Section 144); however other permits will not be required, due to the application of Part 3A of the EP&A Act. |

| | Comment |
|---|---|
| *Water Management Act 2000* | No approvals under Section 89, 90 or 91 will be required, due to the application of Part 3A of the EP&A Act. |
| *Rural Fires Act 1997* | A bush fire safety authority under Section 100B is not required, due to the application of Part 3A of the EP&A Act. |
| *Threatened Species Conservation Act 1995* | Potential impacts on threatened species were considered as part of this EA. No significant impacts are anticipated. |
| *Heritage Act 1977* | No listed items of non-Aboriginal heritage are known to occur within the site. |

### *LOCAL MATTERS*

- ***Great Lakes Local Environmental Plan 1996***: the site is zoned 1(a) Rural and 'aquaculture' is permissible with development consent. The proposal satisfies the objectives of the plan and the zone.
- ***Port Stephens Local Environmental Plan 2000***: this plan was in force at the time the major project application was lodged. The waters of Port Stephens (proposed to accommodate marine pipelines) were zoned 7(w) Environment Protection 'W' (Waterways) under this plan. The farm can be described as 'intensive agriculture', and is permissible with development consent. The proposal satisfies the objectives of the plan and the zone.
- ***Port Stephens Local Environmental Plan 2013****:* this plan came into force in late 2013. The waters of Port Stephens (proposed to accommodate marine pipelines) are zoned W2 Recreational Waterways under this plan. The farm can be described as 'aquaculture', and is permissible with development consent. The proposal satisfies the objectives of the plan and the zone.

## Stakeholder Consultation

### *GOVERNMENT CONSULTATION*

As part of the environmental assessment process, feedback and advice was sought from the following government authorities and groups via a formal letter, email or telephone:

- Great Lakes Council;
- Port Stephens Council;
- NSW Office of Environment & Heritage;
- NSW Department of Industry & Investment;

- NSW Office of Water;
- Hunter-Central Rivers Catchment Management Authority;
- Maritime NSW;
- NSW National Parks & Wildlife Service;
- NSW Advisory Council on Recreational Fishing;
- NSW Department of Primary Industries - Crown Lands;
- NSW Department of Primary Industries - Fisheries;
- NSW Environmental Protection Authority;
- NSW Food Authority;
- NSW Marine & Estuarine Recreational Charter Management Advisory Committee;
- NSW Rural Fire Service; and
- Port Stephens & Myall Lakes Estuary Management Committee.

Additional feedback was sought from government agencies through informal means. All issues raised were addressed within the EA.

## *COMMUNITY CONSULTATION*

In addition to required consultation, the proponent elected to undertake voluntary consultation with the local community and interested stakeholders. The purpose was to ensure the community was made aware of the proposal early on, so they could be involved in identifying key issues of concern and could provide constructive input into the design and assessment process based on local knowledge and experience. This consultation involved:

- Hand-delivery of letters to about 250 residential dwellings within Pindimar, Bundabah and selected businesses within Tea Gardens and Hawks Nest (June 2012). The letter contained information on the Project, plans, and an invitation to attend a Community Feedback Session;
- Posting of the information letter in several public locations, including the notice board of the local community association (June 2012);
- Delivery of the letter to key stakeholders, including the Pindimar-Bundabah Community Association; the NSW Oyster Farmers' Association; the Commercial Fishermen's Co-Operative; and local State and Federal Members of Parliament (June 2012);
- The holding of a Community Feedback Session (July 2012), involving a presentation about the Project and the environmental assessment process, and an invitation to raise issues of concern to be addressed within the EA;

- Hand-delivery of an additional information / update letter to about 250 residential dwellings (similar to the above catchment) in April 2013; and
- Distribution of a letter to local Fishing Co-Operatives seeking information on local fishing grounds (May 2013).

As a result of the consultation, several queries and submissions were received. Queries were addressed immediately where possible, and the issues raised were considered throughout the environmental assessment process. A response to each issue is provided within the EA.

## Environmental Assessment

A Risk Assessment was undertaken to identify key potential impacts of the Project. These impacts were allocated a risk value (between 'low' and 'extreme') based on the anticipated *consequences* of the impact and the *likelihood* of the impact occurring. Initial results indicated that several impacts would be associated with a 'moderate' to 'high' risk, based on farm design alone. However, after the application of proposed mitigation measures (presented within the EA) all impacts were considered to have a 'low' and therefore acceptable level of risk. These key issues are addressed briefly below.

### *DISEASE & BIOLOGICAL SECURITY*

As for all agricultural operations, disease risk was considered a key issue of concern. Apart from other reasons, effective management of disease risk is in the farm's commercial interest. A *Biosecurity and Disease Management Plan* (BDMP- **Appendix 5**) was prepared to manage the risk of Abalone disease occurring within the farm and potentially escaping and affecting wild marine populations.

There are two key diseases known to affect Abalone in Australia, comprising Abalone Viral Ganglioneuritis (AVG) and Perkinsosis. Perkinsosis (caused by a parasite) has already affected Abalone near Port Stephens, but AVG is not known to occur in wild NSW populations. Both diseases have the potential to cause significant Abalone mortalities. Neither Perkinsosis nor AVG is known to affect the health of humans, and AVG is not known to affect oysters or other key commercial species.

The BDMP presented protocols to manage disease risk, and to reduce the incidence and severity of disease should it present in the farm. It focussed on AVG and Perkinsosis but can be applied to disease management in general. Key measures include:

- **Broodstock source**: the sourcing of farm breeding stock from NSW populations only (where AVG is not known to occur), with no translocation of specimens from interstate;
- **Separation from wild Abalone populations:** the nearest wild populations are approximately 10km east of the farm. This distance significantly reduces the likelihood of disease transmission to these populations;
- **Segregation of higher risk stock (quarantine):** stringent quarantine measures will be implemented, with all new stock subject to at least 8 weeks quarantine within a secure, on-site facility. Detailed quarantine protocols will be implemented, including the comprehensive disinfection of all quarantine water with Ozone and UV treatment after use;
- **General management standards & protocols:** including hygiene and record keeping standards; and
- **Diagnosis, monitoring, control & eradication measures**: should disease present.

A risk assessment provided within the BDMP concluded that, with the implementation of recommended management measures, the risk of impacts associated with disease matters was considered '*negligible - an acceptable risk*'.

## *MARINE WATER QUALITY*

To promote optimal health and growth, Abalone require access to good quality water that does not significantly vary over short timescales. Marine water in Port Stephens is generally considered to be of 'good' quality. However, immediately after passing through large populations of Abalone within the farm, there is the potential for water quality to be reduced e.g. through an increase in nutrient concentrations (particularly Nitrogen - a natural nutrient produced from Abalone waste). No impacts on water odour or appearance are anticipated.

The farm proposes a number of measures to manage marine water quality before release back into the Port, including:

- **Strict feeding protocols**: the type and volume of Abalone feed to be used is designed to minimise waste and dispersal into the water column;
- **Filtering**: all water will be filtered before release, including the use of 'swirl separators' and 'protein skimmers';
- **Settlement & biological treatment**: whilst not a crucial part of the treatment train, all water will spend time within Settlement Ponds and/or tanks to allow

residual particulates to settle out, and naturally established organisms to break down nutrients and other substances; and

- **UV and ozone disinfection**: to manage potential disease pathogens from 'higher risk' stock such as quarantine specimens.

Despite the above measures, the farm is still likely to release water with a somewhat elevated concentration of Nitrogen. A report titled *Dilution and Transport of Discharged Material from a Proposed Abalone Farm (***Appendix 19***)* was prepared to determine the fate of water released from the farm, including any impacts on the Port's water quality. It concluded that:

- Nutrient loads from the farm water will be minimal compared to other sources around the Port (e.g. urban stormwater runoff);
- The farm will not result in a significant increase in the overall concentration of nutrients within the Port; and
- Nutrients in farm water will be almost immediately diluted to well below background levels and ANZECC trigger (*water quality guideline*) levels once released from the farm. No impacts on nearby seagrass beds, oyster farming areas or other ecological or aesthetic values are anticipated.

Accordingly, the farm is not likely to have any measurable impacts on the overall water quality of the Port. Nevertheless, the implementation of a rigorous water quality monitoring regime is proposed.

## *SOILS & POTENTIAL ACID SULPHATE SOILS*

Some parts of the site are mapped as having the potential to accommodate Acid Sulphate Soils (ASS). In order to manage the risk of exposing and oxidising Potential ASS during earthworks and other construction activities, an *Acid Sulphate Soil Preliminary Assessment* (**Appendix 4**) was prepared. It outlined appropriate management methodologies for activities in areas with a higher risk of encountering ASS, including the rapid return of Potential ASS to anaerobic conditions, and the application of neutralising agents to excavations (e.g. lime).

Plans have also been prepared to manage the risk of sedimentation and erosion arising from construction works. In summary, the Project is unlikely to have any significant impacts on soil related matters.

## SURFACE WATER

*A Stormwater Management Plan* (SMP - **Appendix 17**) was prepared for the farm site. The SMP outlined the use of rainwater tanks to provide the (minimal) freshwater needs of the farm, and the provision of vegetated swales to manage overflows from rainwater tanks and runoff from impervious area such as carparks. The swales will also provide water quality treatment and peak flow attenuation prior to release to receiving waters. All wastewater produced from the on-site amenities (e.g. toilet) will be collected in holding tanks and trucked off-site by a contractor.

The SMP concluded that the farm *will have a neutral or beneficial effect on water quality* due to the implementation of proposed control measures.

## GROUNDWATER

There are considered to be two potential groundwater impacts associated with the farm, comprising seepage of marine water from farm facilities into the groundwater system, and contamination of the groundwater via chemical use or spillage.

Marine water seepage will be addressed through the use of impermeable barriers between marine water and the ground. Settlement Ponds will be lined with impermeable pond liners, and the few open channels will be constructed of lengths of plastic half-pipe. Even if marine water should spill onto the ground via accident, it would have a negligible impact on ground water quality. Accordingly, there is little potential for seepage to affect groundwater.

Chemical use and management within the farm will be managed in a variety of ways, including adherence to protocols within Material Safety Data Sheets, as outlined in the EA. Accordingly, there is a low risk that spilled or misused chemicals will impact upon the groundwater system.

## TERRESTRIAL FLORA & FAUNA

A *Statement of Effect on Threatened Flora and Fauna* (**Appendix 13**) was prepared to address terrestrial ecology issues. The study area (the subject site and certain adjoining land) was found to contain the following key terrestrial flora and fauna values:

- 14 vegetation communities, including 3 Endangered Ecological Communities (EECs);
- 191 'habitat trees' (within the southern portion of the study area);
- 290 flora species, but no threatened flora species;

- 105 fauna species, including 6 threatened fauna species;
- 4 'nationally significant migratory species'; and
- land forms part of a sub-regional habitat corridor.

Suitable habitat was present for a large number of additional threatened species. Two coastal wetlands (listed under SEPP 14) are located close to the study area, however no development is proposed within mapped wetland boundaries.

The farm is likely to result in the following impacts:

- clearing of approximately 65 trees (over an area of about 1.2ha) within 2 non-threatened vegetation communities. This includes the clearing of around 13 habitat trees;
- partial clearing/ modification of around 1ha of land for bushfire protection purposes within 1 non-threatened vegetation community;
- disturbance to about 0.2ha of understorey vegetation from pipeline construction, including 0.14ha of an EEC (*Swamp Mahogany Paperbark Forest*); and
- disturbance to small areas of saltmarsh vegetation (an EEC) and mangroves associated with the construction of an emergency egress boardwalk.

The *Statement of Effect on Threatened Flora and Fauna* recommended a number of measures to minimise impacts, including the raising of pipelines on low supports in some areas (to allow Koala and Wallum Froglet movement underneath); the preparation and implementation of a *Vegetation Management Plan;* and the implementation of site controls to manage stormwater runoff from the site. With the implementation of these measures, the farm was not considered likely to have any significant impacts upon threatened species or communities as a result of construction or operation activities.

Nevertheless, the in-perpetuity management of a 5.14ha conservation area within the site is proposed to compensate for the 2.4ha of cleared / disturbed land (i.e. an offset ratio of around 2:1).

## *AQUATIC / MARINE FLORA & FAUNA*

An *Aquatic Ecology Assessment* (AEA - **Appendix 16**) was prepared to assess the impacts of the farm on aquatic habitats, species and populations. The AEA found that the proposed marine pipelines would traverse the following habitats:

- **Intertidal mangrove habitat**: pipes proposed to be buried through this area, requiring the trimming of two mangroves, potentially resulting in the death of one tree. Disturbance to a number of seedlings and mangrove pneumatophores

(including lateral and aerial roots) is also likely. Transplantation of disturbed seedlings is proposed.

- **Intertidal sand flat**: pipes proposed to be buried through this area. Only temporary disturbance to benthic (bottom-dwelling) fauna is anticipated.
- **Subtidal vegetated seagrass meadow:** predominantly containing *Posidonia australis* seagrasses (not listed as a threatened population). Pipes are proposed to be suspended over the seabed in this area (around 50cm high) to reduce impacts from shading and crushing of seagrasses. However, the crushing of approximately 40m$^2$ of seagrasses is anticipated from pipe supports. Any *Zostera capricorni* seagrasses which may be present along the pipeline route at the time of construction (although few specimens are currently present) will be transplanted.
- **Subtidal un-vegetated soft sediments:** pipes proposed to be suspended over the seabed in this area. Only temporary disturbance to benthic fauna is anticipated from the placement of supports.

The two pipe inlets would be located at a depth of around 15-20m and the two pipe outlets would be at around 6m depth (both within the *subtidal un-vegetated soft sediments*). The AEA recommended a number of measures to mitigate impacts including the fitting of passive fish screens on water inlets (to reduce the risk of fish entrainment / impingement); the 'ushering' of vulnerable pipefish / seahorse species out of the way of pipeline placement activities; and the preparation and implementation of a *Seagrass Monitoring Plan*. With the implementation of these measures, the farm is not likely to have any significant impacts upon threatened species or communities as a result of construction or operation activities.

## *ABORIGINAL HERITAGE*

An *Aboriginal Heritage & Archaeological Assessment* (**Appendix 15**) was prepared for the Project. It confirmed the presence of a 'potential' Aboriginal shell midden along the foreshore of Port Stephens at the southern boundary of the site. The undertaking of intrusive excavations to confirm that the midden was an Aboriginal artefact (rather than a natural shell deposit) was not considered necessary, and it was conservatively assumed to be a midden. No other items or places of likely or actual heritage significance were identified.

The farm initially proposed to position pipelines in close proximity to the area containing the midden and an associated area of sensitivity. However assessment and consultation with registered Aboriginal stakeholders concluded that the pipelines were too close to this

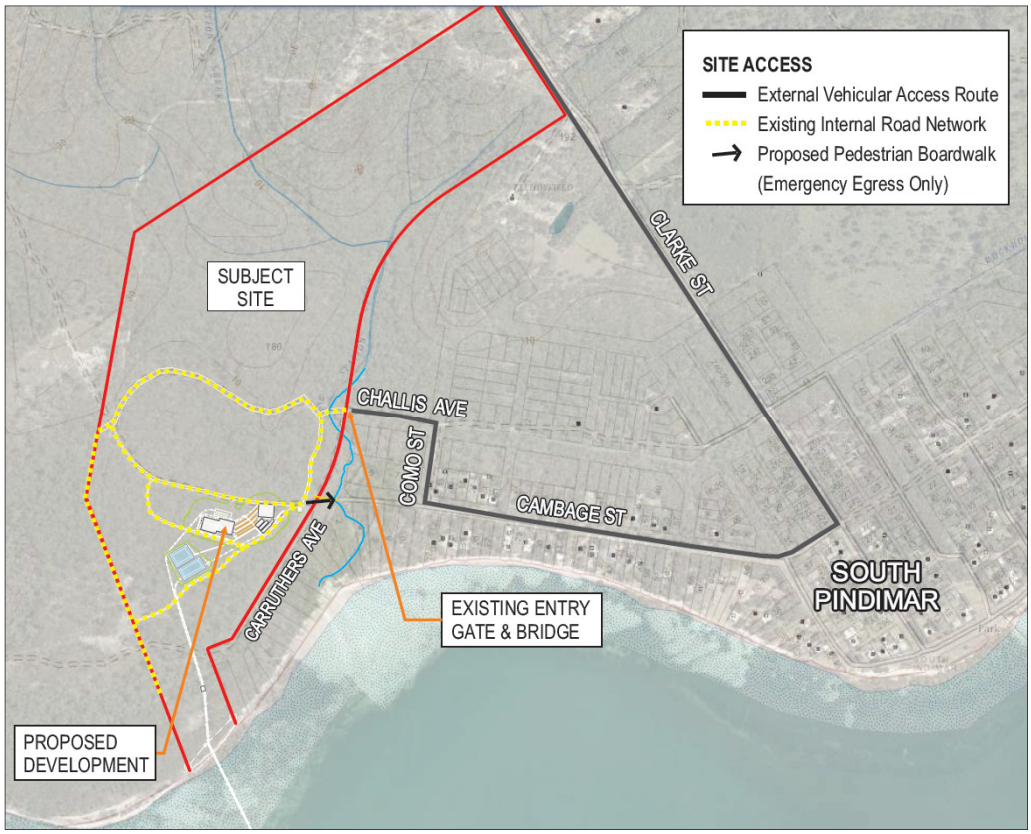
area. Accordingly, the farm design was amended so that the pipelines will be positioned further west to avoid impacts on the midden.

Taking this re-design into account, as well as additional recommended mitigation measures (such as the preparation of an *Aboriginal Heritage Management Plan*), it was concluded that the farm is unlikely to have any impacts on Aboriginal heritage values.

## *TRAFFIC, ACCESS & PARKING*

While no formal data was available, it was conservatively assumed that existing traffic volumes in the Pindimar area were 'low' due to the small residential population and the lack of thoroughfares.

The farm is proposed to be accessed via the existing public road network, including Cambage Street (*sealed local road*) via Como Street and Challis Avenue (*both comprising compacted gravel pavement*) - see the ***Site Access Plan*** below. Existing vehicular tracks within the site will be used to access the farm area. Some widening and grading of these roads will be required, but no significant vegetation clearing is necessary. The creation of new roads was considered undesirable due to impacts associated with additional vegetation clearing.




**Site Access Plan**

The farm is estimated to generate around 20 daily two-way vehicle movements during the construction period, and around 12 such movements during the operational period. This will include a small rigid truck, utility vehicle and trailer, and garbage collection trucks during operation. This traffic generation is considered to be low and unlikely to affect the amenity, safety or functionality of the local road network.

A proposed pedestrian boardwalk is proposed to connect the farm area to an existing track at the western terminus of Cambage Street, in order to provide emergency pedestrian egress from the farm (e.g. in the case of bushfire).

Parking spaces for eight vehicles (including one space for people with disabilities) are proposed, as well as a loading bay adjacent to buildings. There are not likely to be any significant issues from the farm associated with traffic, access or parking.

## *NOISE*

The area surrounding the subject site has a predominantly bushland / rural character, with the exception of the suburban environment of the South Pindimar village. The closest dwelling-house to the site is approximately 200m east of the site boundary (300m from the main farm area) and separated by dense vegetation. The 'acoustically significant' plant and equipment proposed to be used within the farm during operation includes water pumps (in the Pumphouse); generators (to be used during power failure); air conditioning units; and a small number of truck movements associated with deliveries. The Pumphouse, which will accommodate pump operations 24 hours a day, will be positioned over 500m south-west of the nearest house and predominantly buried underground.

A *Noise Impact Assessment* (NIA - **Appendix 21**) was undertaken to assess the likely impact of the farm on the noise environment, and included background noise monitoring. The NIA assessed the modelled noise impacts of the farm and found that noise emissions from the site would meet the requirements of the relevant guidelines (i.e. the *NSW Industrial Noise Policy* and the *Interim Construction Noise Guideline* during operation and construction, respectively). Also, traffic noise impacts would meet the objectives of the *Environmental Criteria for Road Traffic Noise* (and the more recent *NSW Road Noise Policy*). Accordingly, there are not likely to be any significant noise impacts from the farm on neighbours.

## *BUSHFIRE*

The site is classed as 'bushfire prone land'. A *Bushfire Protection Assessment* (BPA - **Appendix 22**) was prepared to assess bushfire risk associated with the farm. The BPA

found that the site comprised a high bushfire risk area with no direct safe vehicular / pedestrian access to the 'safer place' provided by the South Pindimar village. Accordingly, a range of measures were recommended to mitigate bushfire hazard risk, including:

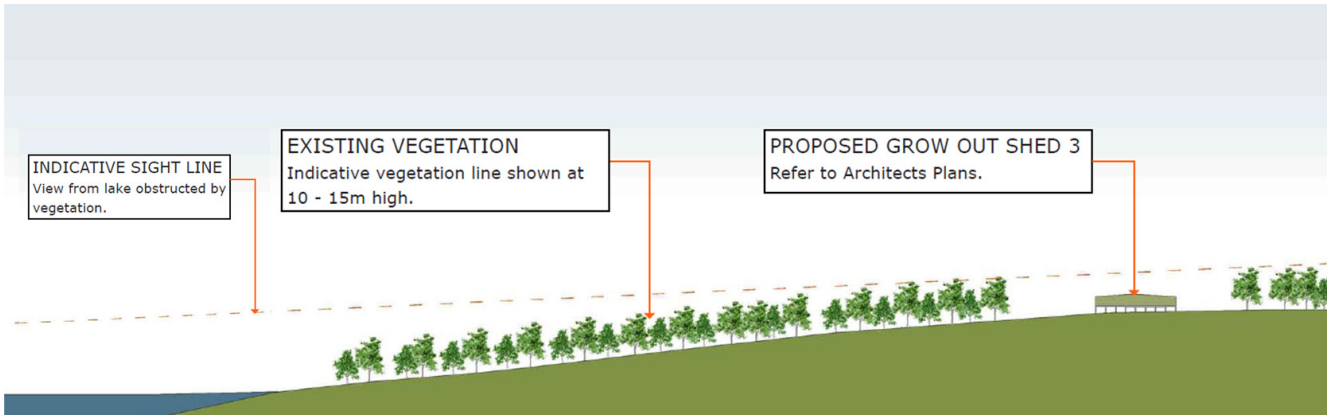
- **Defendable space**: the establishment and management of 'defendable spaces' (or 'Asset Protection Zones') around habitable farm buildings (resulting in the need for the thinning / under scrubbing of about 1ha of vegetation);
- **Maintenance of bushfire fighting access**: via widening and grading of internal access tracks and passing bays where required;
- **Emergency egress boardwalk**: construction of a boardwalk over wetlands and Pig Station Creek, to provide emergency pedestrian egress to Cambage Street and South Pindimar;
- **Preparation of plans**: addressing emergency evacuation, vegetation management and bushfire emergency procedures;
- **Construction standards for buildings**: buildings to be constructed to Bushfire Attack Level (BAL) 40; and
- **Water supplies for firefighting**: including the provision of a dedicated, static water supply.

The BPA included consultation with representatives of the Rural Fire Service during its assessment.

## *VISUAL AMENITY*

The Port Stephens area is considered visually sensitive and significant. Views towards the site from the Port and the southern shores are expansive and dominated by densely vegetated ridgelines and nearby high points. A *Visual Impact Assessment* (VIA - **Appendix 23**) was undertaken for the Project, which identified key viewpoints into the site and assessed the likely impact of the farm on visual amenity.

The VIA found that, overall, the farm would have a minimal impact on the surrounding environment in terms of landscape and scenic values. Due predominantly to the extent of vegetation proposed to be retained around the farm; it is unlikely the farm will be visible from most viewpoints. The height of farm buildings will not exceed the ridgeline or tree line and there will be minimal loss of tree canopy. The image below shows an indicative sight line from the Port to the farm, illustrating how views of farm structures will be screened by trees. The proposed pipelines will be buried within the foreshore and intertidal area and will not be visible during typical tidal cycles.




**Site cross-section showing an indicative sight-line from the Port towards the farm**

## *AIR QUALITY, ODOUR & GREENHOUSE GAS EMISSIONS*

Potential impacts from the farm include dust generation during construction, emissions from (the controlled use of) aquaculture chemicals, and odours during (occasional) pond cleaning activities.

Overall, the potential for odour generation from the farm will be low as there will be no post-harvest Abalone processing on-site. Potential odour generation will be primarily restricted to the temporary storage of any Abalone mortalities and waste vegetative biomass (e.g. excess pond algae) before garbage collection. Greenhouse gas emissions are predominantly associated with electricity use.

Measures are recommended to mitigate impacts on air quality, including dust management provisions during construction; the chilling of Abalone mortalities before garbage collection; and the sealing of waste collection receptacles. Overall, the farm is not likely to have an adverse impact on air quality.

## *FLOODING*

The subject site is located adjacent to the Port Stephens estuary. Factors which influence flooding in the estuary include elevated ocean levels, wave run-up and catchment runoff. Sea level rise and increased rainfall intensities, as a result of climate change, are also likely to impact on flood levels over the coming decades.

The Flood Planning Level for the site was calculated to be at 3.8m AHD, based on a government-funded flood study. All farm buildings and structures, with the exception of the pipelines and Pumphouse, will be above this level and will therefore be unlikely to be affected by flooding. Flooding of the Pumphouse and around the pipelines is unlikely to

have any significant impact on farm operations due to proposed contingency measures during flooding events.

## *COASTAL PROCESSES*

The key coastal processes that may impact on the farm relate to flooding; potential scouring around pipelines and water outlets; and wave / tidal impacts on the general stability of the pipelines.

The potential for scouring will be managed through the appropriate positioning of water outlets and the low water flow velocity from the pipes. The stability of the pipelines will be managed through the anchoring of pipelines with concrete supports. Regular monitoring of pipeline supports for potential scouring impacts, along with appropriate management measures, is proposed.

## *CLIMATE CHANGE*

The NSW Government projects that the Hunter Region will be affected by a hotter climate, increased rainfall and increased storminess and sea levels by 2050. Assessments indicate there are not likely to be any impacts on the farm from climate-change situation flooding levels; nor from potential increased coastal erosion (due to the attributes of the site and the presence of protective mangrove stands). While hotter days may result in increased temperatures within the farm, these can be managed via a range of measures, including air cooling, insulation and temporary water recirculation within facilities. Accordingly, no significant impacts from climate change are envisaged.

## *EXISTING USES OF THE PORT & NAVIGATIONAL SAFETY*

The Port is utilised by a range of stakeholders for various activities, including recreational and commercial fishing, dolphin watching, general tourism and swimming. Due to the proposed pipeline placement (i.e. burial in the intertidal and foreshore areas) there will be no impact on amenity or public access in this area. Potential conflict between the pipelines and boats (including anchor entanglement) will be managed through pipeline design features and the positioning of proposed navigational marker buoys.

There are not likely to be any impacts on the viability or use of the nearby 'Sanctuary Zone' of the Marine Park, or on nearby potential oyster leases. No impacts on commercial (or recreational) fishing or dolphin watching activities are anticipated. There are not expected to be any noticeable changes to the Port's water quality (e.g.

appearance, odour etc.) from the farm, as outlined in the EA. In summary, the farm is unlikely to have any significant impacts on the existing uses of the Port.

## *SOCIAL & ECONOMIC*

A demographic analysis of the Pindimar area is presented within the EA. The key potential economic and social impacts of the farm were identified and included:

- inconvenience and nuisance associated with construction and operational traffic;
- the creation of up to 35 construction phase jobs and 15 full time equivalent operational jobs;
- flow-on economic impacts to the local economy during construction and operation; and
- the potential for educational and research opportunities.

On balance, the farm is not considered likely to result in any significant changes to the existing quality of life for people in the surrounding area. The farm is not likely to be visible from outside the site; will not create any detrimental noise impacts; and will result in only low volumes of traffic generation. Any potential negative impacts are likely to be temporally limited and outweighed by the potential social and economic benefits.

## *IMPACTS ON WILD ABALONE POPULATIONS*

A maximum of 120 wild Abalone will be sourced to act as breeding stock for the farm (initially), followed by up to 24 additional individuals per year. To gain an understanding of the significance of these numbers, under current NSW government regulations a single recreational fisherperson may take between 210 and 730 Abalone per year. In this context, Abalone numbers required to provide for the farm can be considered negligible and their removal is unlikely to impact on the viability of wild populations.

Several features of the farm will help to reduce the potential for viable larvae escaping and breeding with wild Abalone populations (and potentially introducing 'exotic' genetic material). These include the water outlet locations (over sandy sediment, inhospitable to Abalone); the use of settlement ponds and the keeping of only NSW-sourced broodstock.

Regardless of these measures, previous research indicates that the probability of larvae escaping from a farm, maturing and breeding with wild populations is in the order of 'four in one million'.

### *FOOD PRODUCTION & HEALTH*

Research indicates that the consumption of Abalone meat has lower human health risks than with bivalve molluscs such as oysters. Regardless, the preparation and implementation of a *Food Safety Program* is proposed to manage food quality risks.

### *POND SAFETY & INTEGRITY*

Two Settlement Ponds are proposed to collect and temporarily hold marine water within the farm. These ponds will be designed and constructed in accordance with best practice at the time of construction, and appropriate safety measures implemented to reduce the risk of human or animal drowning.

### *FUELS, CHEMICALS & PHARMACEUTICALS*

Like all aquaculture or agricultural operations, various fuels, chemicals and pharmaceuticals are considered necessary for the operation of the farm from time to time. Appropriate management measures are proposed for the storage, use and clean-up of any chemical spills.

## Statement of Commitments

The proponent commits to the implementation of the environmental mitigation measures outlined within the EA. Further, the proponent commits to the preparation and implementation of comprehensive *Environmental Management Plans* (EMPs) for the site, to encompass both the construction and operational phases. The EMPs (Construction and Operational) would include the following elements:

- **Background:** including introduction, project description, environmental policy;
- **Environmental Management:** including environmental management structure and responsibility, approval and licensing requirements, emergency contacts and response;
- **Implementation:** including risk assessments, environmental management activities and controls, and environmental schedules; and
- **Monitor and Review:** including environmental monitoring measures, corrective actions and provisions for EMP review.

## Concluding Statement

Based on the environmental assessment, the Project is not likely to have significant detrimental impacts on the physical or social environment. Any potential impacts are proposed to be adequately managed through the implementation of recommended management and mitigation measures as outlined in the Statement of Commitments. The Project is considered to be justifiable taking into account potential environmental, economic and social considerations.

# 1 INTRODUCTION

This Environmental Assessment report (EA) is submitted to the Minister for Planning and Infrastructure under the former Part 3A provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is to support a Major Project Application for a proposed Abalone farm at Clarke Street, Pindimar, in the Great Lakes and Port Stephens Local Government Areas (LGAs).

This EA has been prepared by City Plan Services on behalf of the proponent, Austasia Leefield Pty Ltd.

## 1.1 Project Outline

The application is for the development of a land-based farm for the production of approximately 60 tonnes per year of live Blacklip Abalone (*Haliotis rubra*) for human consumption. Blacklip Abalone is a native mollusc species and a popular seafood item in Australia and overseas.

It is proposed to source marine water from Port Stephens for use within the farm, before treatment and return of the water to the same source. Approximately 50 megalitres (ML) of marine water is expected to pass through the farm on a typical day (at full production). Abalone will be accommodated within a number of sheds and outdoor tanks within the site, and pipelines will provide connections to Port Stephens. A number of supportive and ancillary buildings and structures are also proposed.

Abalone will be spawned and raised from broodstock on-site, and will be reared to mature market size. Abalone will then be harvested and transported to market as live product. No post-harvest processing is proposed on-site.

It is expected that the Project will result in the creation of approximately 35 construction jobs and 15 full-time equivalent operational positions. Aquaculture research and education opportunities are also envisaged.

## 1.2 Background & Project Context

The development of an Abalone farm on the subject site was originally proposed in 2003, when a Development Application (DA 313/2003) was lodged with Great Lakes Council (GLC). Although areas of the proposal also fell within the Port Stephens LGA, Port Stephens Council (PSC) delegated their consent authority role to GLC at the time. The proposal was classed as 'designated development' (under Part 4 of the EP&A Act) and

underwent intensive review and assessment by GLC and a number of government agencies, and was subject to extensive public exhibition and consultation periods. This process resulted in the refinement of the proposal and the subsequent issuing of development consent by the Council on 4 July 2006. As required, all relevant government agencies issued their General Terms of Approval.

However a local objector appealed to the NSW Land & Environment Court against the granting of the development consent under Section 98 of the EP&A Act (LEC Proceedings 10679/2006). During the Court hearing, detailed plans and documents were requested which were not able to be immediately produced, and the applicant had concerns about the financial implications of the legal proceedings. The applicant therefore agreed to the making of consent orders allowing the appeal, and the proposal was withdrawn.

Since that time, a decision to make a new application was made due to the ongoing commercial viability of the proposal and the anticipated scientific, environmental, social and commercial benefits of the development. The farm proposal has been further refined by the proponent and it is considered that all plans and assessments that would reasonably be required to allow determination of the Project have been produced. The proposal is essentially the same as the previously approved development, with the exception of a change in the proposed yearly production rate and certain amendments and improvements resulting from ongoing research and development.

In late 2005, Part 3A of the EP&A Act was introduced. On 17 October 2007, the Minister for Planning formed the opinion that the proposed development was a project to which Part 3A of the Act applied, as it is *development for the purposes of aquaculture located in environmentally sensitive areas of State Significance*. Such environmentally sensitive areas include 'coastal waters of the State' and 'marine parks'. This class of development was listed in Schedule 1 of *State Environmental Planning Policy (Major Projects) 2005*, now known as SEPP (Major Development) 2005.

Accordingly, a Major Project Application for the proposal, accompanied by a Preliminary Environmental Assessment Report, was lodged with the former NSW Department of Planning (now Department of Planning & Infrastructure - DP&I) in December 2009. Subsequently, Director-General's Environmental Assessment Requirements (DGRs) for the Project were prepared in consultation with government agencies, and were issued to the proponent in May 2010 (**Appendix 1**).

Further legislative changes have occurred since the issuing of DGRs, most importantly the repeal of Part 3A from the EP&A Act in October 2011. Regardless of this repeal, Schedule 6A of the EP&A Act provides transitional arrangements for existing Part 3A

projects that have not yet been determined. Accordingly, the Project will continue to be assessed as a 'transitional' Part 3A project to which the repealed Part 3A provisions continue to apply.

Note that, in November 2012, the proponent was advised by DP&I that the (draft) EA for this Project was to be submitted by 30 March 2013. As required, the draft EA was submitted, and was subsequently reviewed by DP&I and relevant government agencies. The current EA document has been amended and finalised with regard to the outcomes of that review and in consultation with government stakeholders (where relevant).

## 1.3 The Proponent

The proponent for this Project is Austasia Leefield Pty Ltd, a small, locally-based and Australian-owned company.

Graham Housefield, the company's Technical Director, is proposed to manage the aquaculture operations of the farm. He has worked as a Fisheries Technical Officer at the Port Stephens Fisheries Research Institute for many years. Housefield has been involved in research into aquaculture and related techniques for conservation purposes for about 15 years, with around 30 years' experience in marine ecology research.

He has worked extensively on issues such as weir impacts on water flows and the consequent effects on fish migrations; developed systems to ascertain the impact of water diversions and floodgates on fish passages; and seagrass cultivation. This has also involved the culture and care of ancillary species for food including various algae species.

His previous experience included the maintenance of an Abalone hatchery at Tomaree Heads, Port Stephens, for several years; as well as support and assistance to many post-graduate marine ecology research students from the University of Sydney. He has also worked with the CSIRO's division of Water Resources, with a focus on the reduction of nitrogen contamination of waterways.

## 1.4 Impact Assessment Requirements

Under the former Section 75F of the EP&A Act, an Environmental Assessment report (EA) must be prepared in accordance with the requirements of the Director-General of the DP&I. As outlined in **Section 1.2**, the Director-General issued project-specific Environmental Assessment Requirements (DGRs) in 2010.

A copy of these DGRs is attached at **Appendix 1**. For ease of reference, the section of the EA in which each DGR is addressed is also provided.

## 1.5 Structure of this Document

This EA describes the key elements of the proposed development, addresses the potential impacts of the proposal, and prescribes management and design strategies to mitigate any impacts. It is presented as follows:

**Section 2** - describes the existing site and its local context;

**Section 3** - describes the proposal, and discusses the need for the proposal and alternatives considered;

**Section 4** - addresses the planning and legislative framework of the proposal;

**Section 5** - provides an assessment of the potential environmental issues associated with the proposal, and provides proposed management measures;

**Section 6** - describes the consultation undertaken in relation to the proposal;

**Section 7** - provides a Statement of Commitments;

**Section 8** - provides concluding comments; and

**Section 9** - identifies reference material used within the EA.

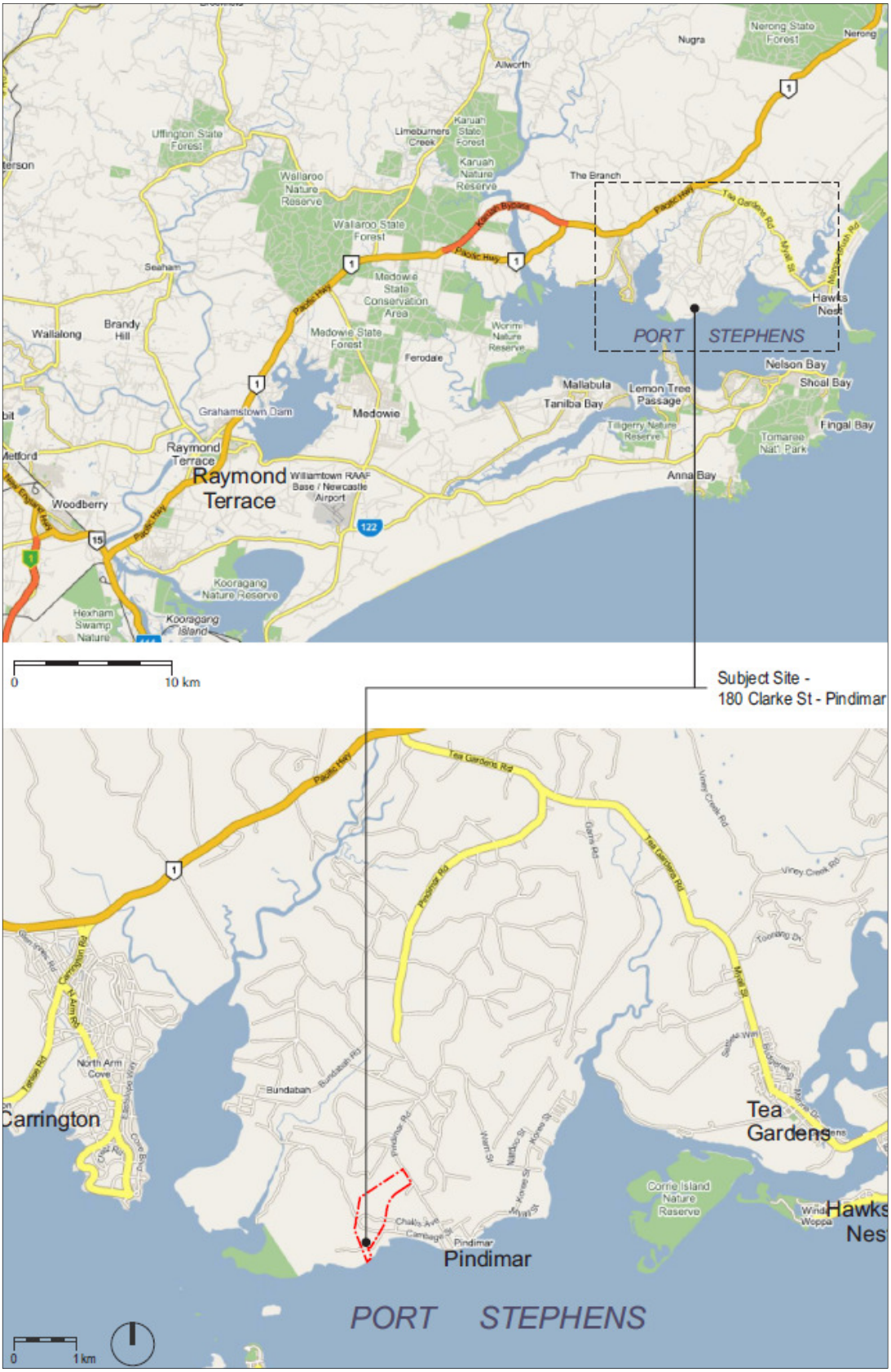



**Figure 1: Location - Subject Site**


**Figure 2: Location Plan - Aerial**


**Figure 3: Site Plan - Subject Site**


**Figure 4: Aerial View - Subject Site**

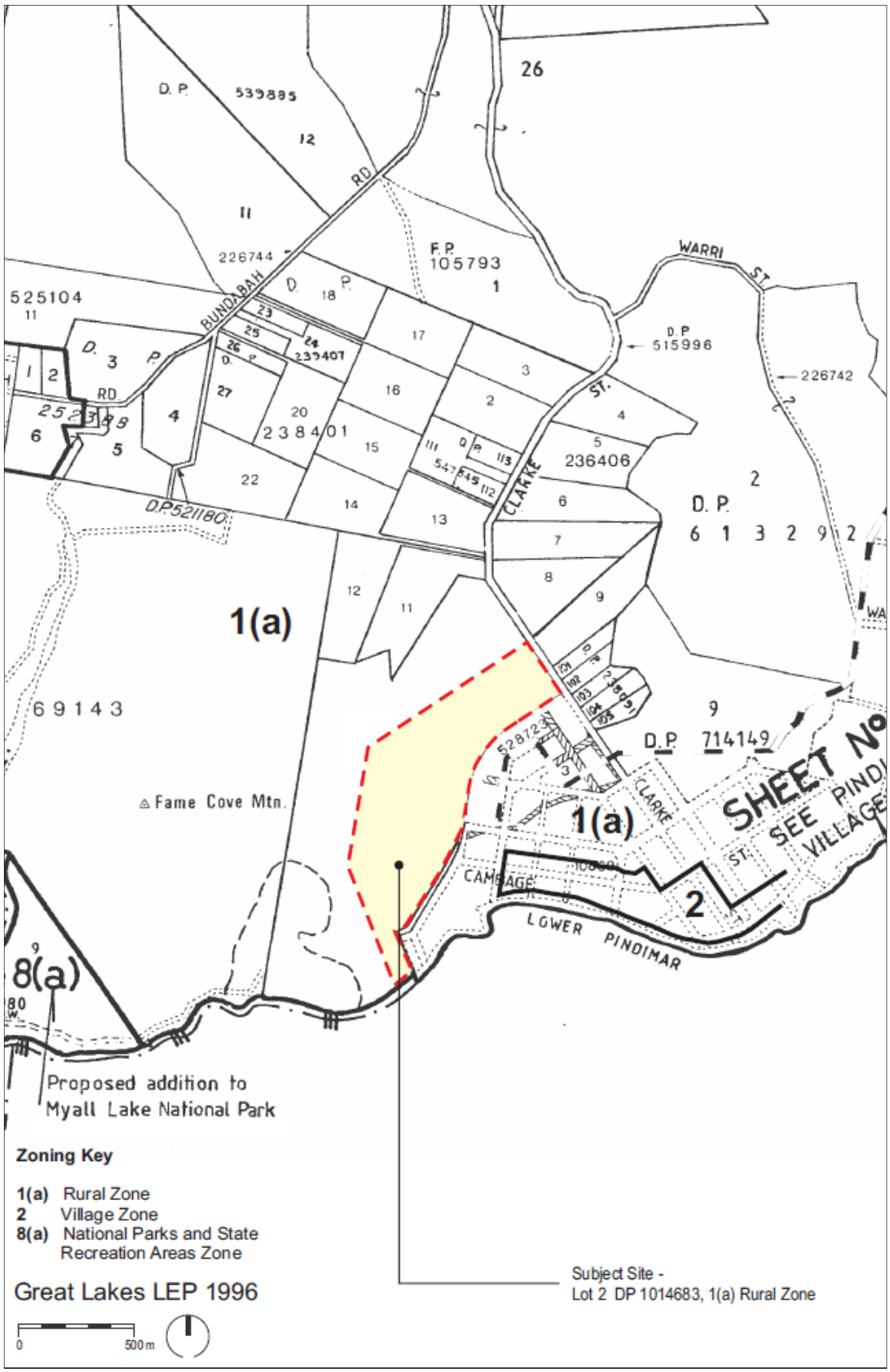



**Figure 5: Great Lakes LEP 1996 Zoning - Subject Site**

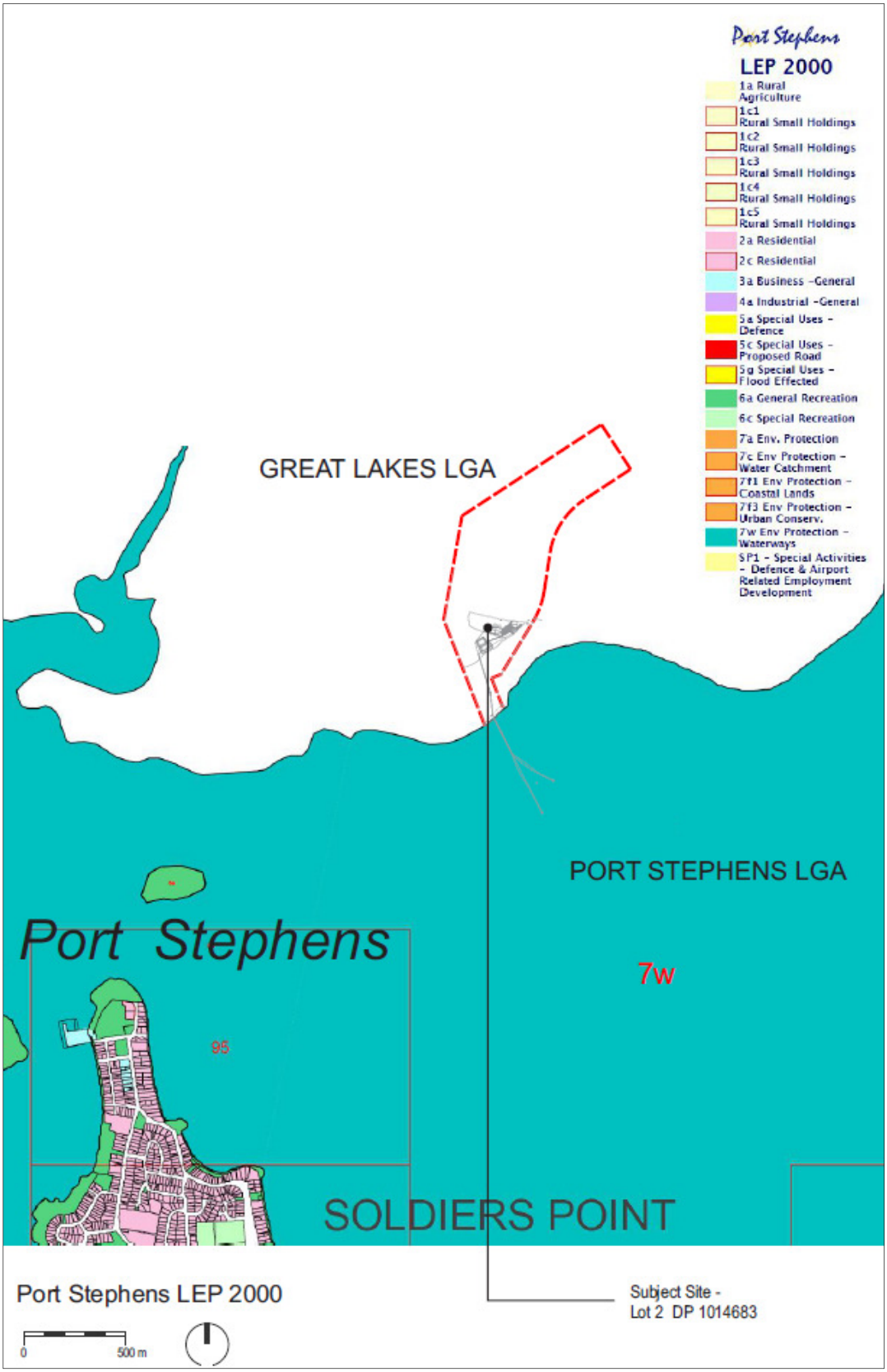



**Figure 6: Port Stephens LEP 2000 Zoning - Subject Site & Proposed Pipeline Extent**

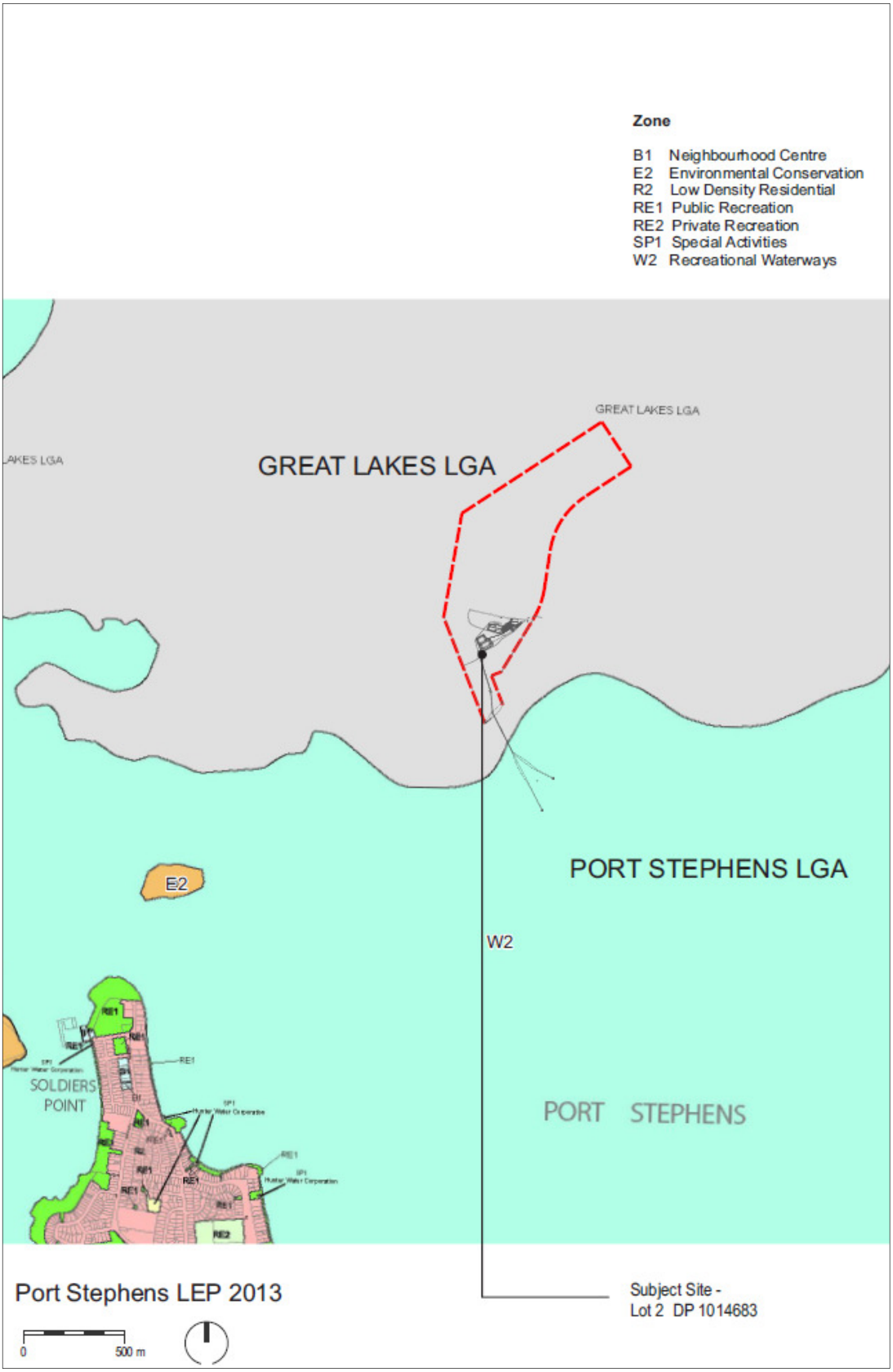



**Figure 7: Port Stephens LEP 2013 Zoning - Subject Site & Proposed Pipeline Extent**

# 2 LOCATION & CONTEXT

## 2.1 Location

The Project site is located at South Pindimar, on the northern shore of the waters of Port Stephens in NSW. South Pindimar is a small coastal village located approximately 13km east of Karuah; 7km west of Tea Gardens / Hawks Nest, and approximately 34km north-east of the major centre of Raymond Terrace. Newcastle is located approximately 40km to the south-west.

The subject land is located on the boundary between the Great Lakes LGA (i.e. land comprising the subject site), and the Port Stephens LGA (i.e. located below the Mean High Water Mark of Port Stephens).

The Project will be accommodated within 2 sectors, referred to as the '**subject site**' (comprising the primary location for the development) and 2 '**additional areas**' which will accommodate ancillary parts of the development. These 2 sectors are described in the following sections.

The subject site's location is shown in **Figure 1**.

## 2.2 Site Ownership & Legal Description

The subject site is located at No. 180 Clarke Street, South Pindimar, and is described as Lot 2 in DP 1014683 (see **Figure 3**). The site is owned in its entirety by Richard Halliday, Helen Halliday, Robert Bressan and Andre Bressan.

The ownership of the additional areas (see **Section 2.3.2**) is described below. Note that Lot & DP descriptors for these areas are not available:

- The waterbody of Port Stephens is owned by the Crown; and
- The unformed road reserves of Carruthers Avenue and Cambage Street are vested in Great Lakes Council.

Consent to lodge the Project Application is required to be provided by all landowners before determination of the proposal, pursuant to Clause 8F of the *Environmental Planning & Assessment Regulation 2000* (the Regulation). This consent has already been granted by the various landowners, and is submitted separately with this EA.

Note that the requirement to obtain a license to occupy Crown land is discussed in **Section 4.2.4.1** of this EA.

## 2.3 Site Description

### 2.3.1 SUBJECT SITE

The subject site (Lot 2 in DP 1014683) comprises a single irregularly shaped allotment, with an area of approximately 51 hectares. An aerial image of the site is shown in **Figure 4**. The site has frontages to the following land:

- Clarke Street to the north (262m in length);
- Shore of Port Stephens to the south (120m);
- Unformed Carruthers Avenue to the east (516m);
- Unformed Challis Avenue to the east (34m); and
- Private land (remainder).

The key characteristics of the site are listed in **Table 1** below. Additional information on the site is provided throughout this EA.

**Table 1: Key Characteristics of the Subject Site (Lot 2 DP 1014683)**

| Characteristic | Comment |
|---|---|
| Existing character | Site is predominantly undeveloped and dominated by dense vegetation, with the exception of small, scattered clearings. It has a rural / bushland character. |
| Landform | • The southern portion of the site is generally flat and low-lying, with a frontage to Port Stephens. This area is composed of well-drained Pleistocene sand sheets and low dunes, as well as areas of poorly drained sand sheets. A narrow sandy beach forms the site's southern boundary with the Port.<br>• Further north the ground rises relatively gently to a knoll about 20m high in the centre of the site, composed of Carboniferous mudstones and minor interbeds of lithic sandstones of the Wootton Beds.<br>• A higher ridgeline (of the same composition) reaches approximately 40m above mean sea level, positioned in the northern area of the site.<br>• Three ephemeral drainage lines run across the site to Pig Station Creek (adjoining the site's eastern boundary).<br>• A Survey Plan of the site is shown within the development plans at **Appendix 2** (Sheet 1). |
| Existing development | The site is predominantly undeveloped with the following key exceptions:<br>• Cleared areas accommodating an orchard (i.e. Kaffir Lime trees), and associated storage areas/ buildings, straddling the site's south-western boundary;<br>• Small clearing and outbuildings near the site's southern boundary with Port Stephens;<br>• A former quarry and small associated clearing in the central portion of the site (associated with the knoll); |

| Characteristic | Comment |
|---|---|
| | • A small farm dam in the northern portion of the site.<br>• Electricity transmission lines and associated cleared areas along the site's south-eastern boundary (these continue underground in a westerly direction across the lot);<br>• Several small, scattered, cleared and/or underscrubbed areas throughout the site, predominantly located adjacent to roads; and<br>• A number of dirt roads traversing the site. |
| Access | The site is directly accessible from Challis Avenue, in turn accessible via Como Street and Cambage Street. A vehicular bridge crosses Pig Station Creek near the site's eastern boundary with Challis Avenue and provides entry to the site's network of dirt roads. |
| Historical use/ development | • The area near the farm dam was previously cleared and levelled to accommodate a dwelling house; however it was ultimately not constructed;<br>• Two small areas were previously cleared and used as quarries for sand and rock (non-commercial);<br>• Likely selective timber-felling occurred throughout the site in the early 19th century; and<br>• The site was likely to have been previously utilised by the Gringai Aboriginal people. |
| Significant ecological features | • One Endangered Ecological Community (Swamp Mahogany- Paperbark Forest) is located in the southern portion of the land;<br>• Six threatened fauna species have been identified within the site, however no threatened flora species have been found;<br>• Parts of the site may be considered 'Potential Koala Habitat', but not 'Core Koala Habitat', pursuant to *State Environmental Planning Policy No. 44- Koala Habitat.* |
| Bushfire hazard | The entire site comprises 'bushfire prone land'. |
| Flood liability | Parts of the site are flood liable (adjacent to Port Stephens). |
| Heritage features | A shell deposit, likely to constitute an Aboriginal shell midden, is located adjacent to the southern boundary of the site at the foreshore of Port Stephens, and may extend inland for some distance. No other areas of Aboriginal or Non-Aboriginal heritage significance have been identified. |
| Zoning | The site is zoned 1(a) Rural under the *Great Lakes Local Environmental Plan 1996* (GLLEP 1996), as shown in **Figure 5**. |

The following photographs show various views of the subject site.

**Plate 1: Entrance to subject site from Challis Avenue, looking west into site. The bridge across Pig Station Creek is located in the background of the photo**

**Plate 2: Native vegetation within the southern portion of the subject site**

**Plate 3: Electricity lines adjacent to the subject site's south-eastern boundary. These lines begin within the site before crossing into the unformed Carruthers Avenue, over Pig Station Creek & into Cambage Street**

**Plate 4: Existing informal roads providing access throughout subject site**

**Plate 5: Road leading to orchards & cleared storage areas (adjacent to south-western boundary of subject site)**

**Plate 6: Cleared area near southern boundary of subject site, with a frontage to Port Stephens**

**Plate 7: View of shore of Port Stephens, adjacent to southern boundary**

**Plate 8: View of site's northern boundary, from Clarke Street. Revegetating areas are visible in the foreground**

### 2.3.2 ADDITIONAL AREAS

In addition to the subject site, two external areas are proposed to be utilised to accommodate ancillary components of development. These areas are described in the following sections, and their approximate location in relation to the subject site is shown in **Figure 8**, below.

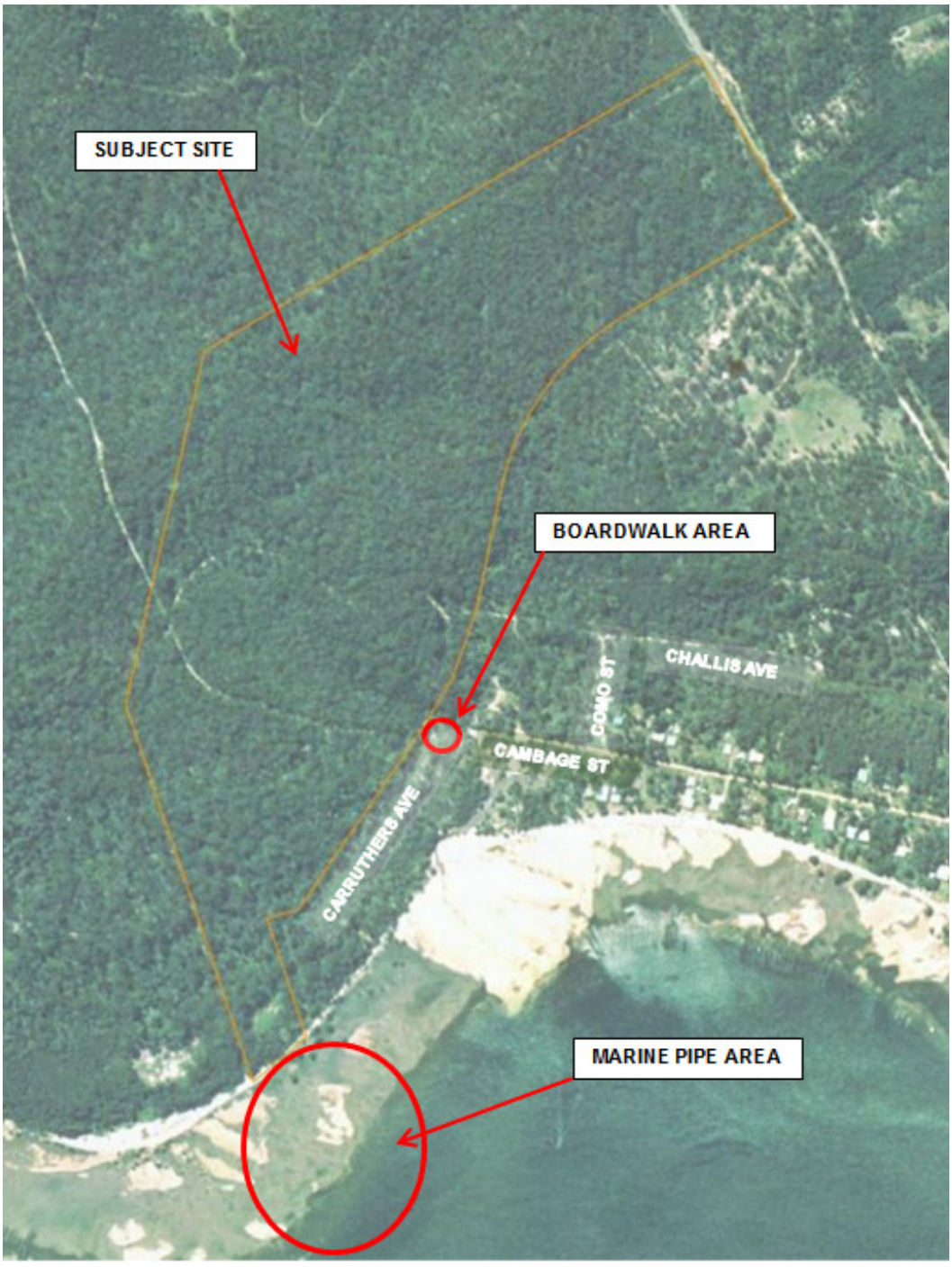



**Figure 8: Approximate Location of 'Additional Areas'**

#### 2.3.2.1 *Marine Pipe Area*

Four lengths of pipe are proposed to extend from the subject site into the marine waters of Port Stephens directly adjoining the site (covering a total distance of 450m - 540m from shore). These will be buried underground / underwater from within the site to a distance of approximately 200m from the shoreline. Details of this development are provided in **Section 3.7** of this EA.

The Port Stephens estuary lies at the confluence of the Myall River, Karuah River, Tilligerry Creek and the ocean. The Port is essentially a drowned river valley with a total waterway area of approximately 140km$^2$ (about 3 times the size of Sydney Harbour) and a total catchment of 2,900km$^2$ (Manly Hydraulics Laboratory 1999). Key features of the Port in the vicinity of the site are described in **Section 2.4.2** of this EA, and water quality in this area is discussed in **Section 5.4.1**.

Below the Mean High Water Mark at the shore of Port Stephens, land was zoned 7(w) Environment Protection - Waterways under the *Port Stephens Local Environmental Plan 2000* (PSLEP 2000), and is now zoned W2 Recreational Waterways under the *Port Stephens Local Environmental Plan 2013* (PSLEP 2013) as shown in **Figure 6** and **Figure 7**. Note that the PSLEP 2000 was in force at the time the current application was lodged.

This area comprises part of the *Port Stephens - Great Lakes Marine Park*, and is zoned 'General Use'.

#### 2.3.2.2 *Boardwalk Area*

A pedestrian boardwalk for emergency egress is proposed to connect the subject site to the terminus of Cambage Street, east of the site. Details of this development are provided in **Section 3.7.8.1**.

The area of interest comprises a narrow finger of land (approximately 2m wide and 45m long) extending from the subject site's eastern boundary; through the unformed Carruthers Avenue road reserve; over Pig Station Creek and into the Cambage Street road reserve. The area is directly beneath overhead electricity transmission lines for much of its length.

It is understood that there are discrepancies within the cadastral map of this area, in that the Cambage Street road reserve is illustrated as occurring north of the actual constructed road in government mapping systems (see Sheet 2 of the development plans at **Appendix 2**). Representatives of NSW Land & Property Information have confirmed

this apparent discrepancy. Should the Project proceed, it is proposed to undertake a detailed survey of the boardwalk area to clarify mapping and survey boundaries.

The land in this location is zoned 1(a) Rural under the GLLEP 1996, as shown in **Figure 5**.

The area contains Saltmarsh (an Endangered Ecological Community) and predominantly immature Mangrove vegetation. Pig Station Creek has a channel width of approximately 4m in this location. There are indications of previous crossings of Pig Station Creek by vehicles, evidenced by disturbance to the channel; apparent dumping of fill; and areas free of mature vegetation. The area lies close to the boundary of a coastal wetland pursuant to *State Environmental Planning Policy No. 14- Coastal Wetlands* (see **Section 4.2.3.1**).

Cambage Street in this location comprises an elevated dirt track through wetland areas, bordered by vegetation. Further east (near its intersection with Como Street) Cambage Street is surfaced with bitumen and accommodates dwelling houses on both the northern and southern frontages.

The following photographs show images of the additional areas described above.

**Plate 9: Approximate location of proposed boardwalk- looking west towards the subject site from the end of the Cambage Street track. Pig Station Creek (at low tide) is visible in the centre**

**Plate 10: Looking east along the Cambage Street track from its terminus (adjacent to Pig Station Creek)**

**Plate 11: Mangroves & sandflats to the south of the subject site (waters of Port Stephens), in the approximate location of proposed (underground) marine pipes**

## 2.4 Local Context & Surrounding Development

### 2.4.1 LAND

#### 2.4.1.1 *Overview of Pindimar*

The locality of Pindimar is relatively isolated, accessible via only one main road (Pindimar Road / Clarke Street). The Pindimar settlement is located on the shores of Port Stephens, and is divided into discrete southern and northern sections by Duckhole Creek and a large area of coastal wetlands. A 200m-long boardwalk over the creek and wetlands provides pedestrian connections between these sections. The remaining area generally has a bushland character interspersed with cleared rural areas

The village of South Pindimar, closest to the site, contains a mixture of generally older style 1 - 2 storey dwelling houses on standard residential allotments. It is zoned 2 Village under the GLLEP 1996. There is currently no commercial development within the village.

A small area of Fame Cove, located 1.8km to the west of the subject site, comprises part of the Gir-um-bit National Park.

### 2.4.1.2 *Adjacent Development*

Land immediately adjacent to the site comprises the following:

- **West**: heavily vegetated bushland with some scattered cleared areas;
- **North-west**: partially cleared agricultural land and bushland;
- **North-east**: heavily vegetated rural residential property containing a private wildlife refuge;
- **East**: heavily vegetated bushland, with some cleared areas used for camping and other minor uses; and
- **South-east:** coastal wetlands, Pig Station Creek and bushland (partially cleared for camping and other minor uses). A small Council reserve is located at the southern terminus of Como Street, and the village of South Pindimar lies further to the east.

All of the land immediately surrounding the subject site is zoned 1(a) Rural under the GLLEP 1996, including a number of standard residential-sized allotments (adjacent to South Pindimar village) which were created as part of a historic and non-commenced proposal for 'Pindimar City' (DP 10869 registered in 1920). Most lots (visible in **Figure 3**) remain undeveloped, with the exception of some clearing, minor structures and camping uses.

The zoning of the site's local context is shown in **Figure 5**.

The closest residential development to the subject site is a dwelling house located on the corner of Como Street and Cambage Street, approximately 200m east of the subject site boundary and separated by dense vegetation.

The following photographs show views of nearby development.


**Plate 12: View of rural / residential development adjacent to the subject site's Clarke Street frontage**

**Plate 13: View of low-density residential development within Cambage Street, closest to the subject site**

**Plate 14: View of residential development fronting Port Stephens (with a primary frontage to Cambage Street)**

**Plate 15: View of Council Reserve fronting Port Stephens, at the terminus of the unformed Como Street**

**Plate 16: View of the subject site (in background), looking south-west from the shore adjacent to the Council Reserve**

**Plate 17: View of vacant & partially cleared land adjacent to Port Stephens**

### 2.4.2 WATERWAYS

The Port Stephens estuary forms part of the *Port Stephens-Great Lakes Marine Park*. Piggy's Beach is located to the west of the subject site, associated with a 'Sanctuary Zone' pursuant to the Marine Park Zoning Plan (see **Figure 9** below).

The area of the Park directly south of the subject site is zoned 'General Use' under this Zoning Plan. A strip of Mangrove trees lines the foreshore in this area, and a shallow intertidal area extends for approximately 200m from the foreshore. A seagrass meadow (*Posidonia australis*) is present beyond the intertidal zone (see **Section 5.9.1** of this EA).

The waters of Port Stephens were zoned 7(w) Environment Protection - Waterways under the PSLEP 2000, as shown in **Figure 6**, and are zoned W2 Recreational Waterways under the PSLEP 2013 (as shown in **Figure 7**).

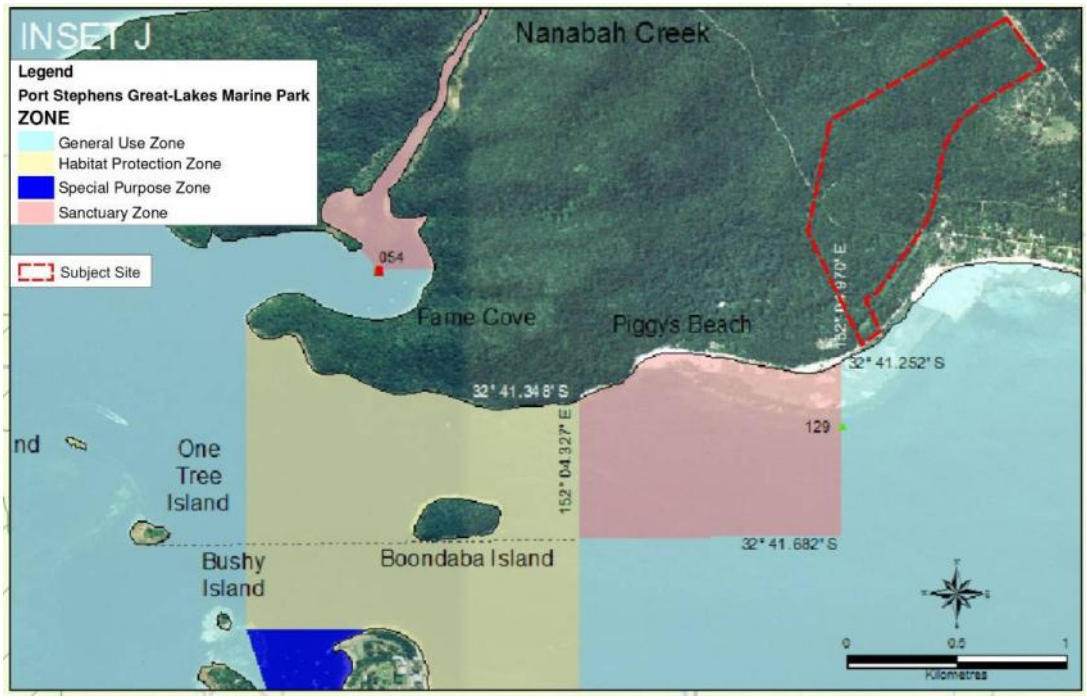



**Figure 9: Port Stephens - Great Lakes Marine Park Zoning Plan 2007 - Extract**

# 3 THE PROJECT

## 3.1 Overview of the Project

The Project comprises a land-based marine aquaculture farm for the production of approximately 60 tonnes per year of live Blacklip Abalone (*Haliotis rubra*) for human consumption.

Detailed information on the proposal is provided in the following sections.

## 3.2 Project Objectives

The primary objective of the Project is:

> *to nurture an environmentally and financially sustainable Abalone aquaculture enterprise, using proven technology and controlled conditions, with a minimal environmental footprint.*

Abalone meat is a popular food item that is generally high in demand throughout Australia and around the world, yet undersupplied, with a significantly declining wild population. The drivers behind the need for the Project are discussed further in **Section 3.5** of this EA.

This proposal seeks to establish a *sustainable commercial farm which will partially meet unmet consumer demand while reducing pressure on wild Abalone stocks; with the maintenance of the excellent quality of the surrounding environment a priority*.

While no Environmental Code of Practice particular to Abalone farming currently exists in NSW, the proponent will seek to achieve certification under the Aquaculture Stewardship Council's (ASC) *Abalone Standard 2012*. The ASC is an independent not-for-profit organisation, founded by the World Wildlife Fund and The Sustainable Trade Initiative to manage the global standards for responsible aquaculture.

In addition, the proponent will adhere to the relevant values presented within the Aquaculture Council of Western Australia's *Environmental Code of Practice for the Sustainable Management of Western Australia's Abalone Aquaculture Industry* (2013) and appropriate best-practice initiatives from Abalone farms within Victoria and South Australia.

## 3.3 Blacklip Abalone- Species Information

The Blacklip Abalone (*Haliotis rubra*) is a gastropod mollusc species indigenous to New South Wales, Victoria, South Australia and Tasmania. Individuals possess a single, ear-shaped shell lined with mother of pearl, with a distinct black lip on the foot which gives the species its name.

They are a member of the family *Haliotidae*, and generally inhabit coastal waters between 5 and 10 metres in depth, where they adhere to rocky surfaces and inhabit crevices and caves in reefs. Blacklip Abalone feed on drift algae and graze on seagrass leaves and algae growing on rocks, and prefer to feed at night (DPI n.d.*a*).

The reasoning behind the selection of Blacklip Abalone for commercial farming on the site is outlined in **Section 3.5** of this EA.

Images of Blacklip Abalone are shown in **Plate 18 and 19** below.

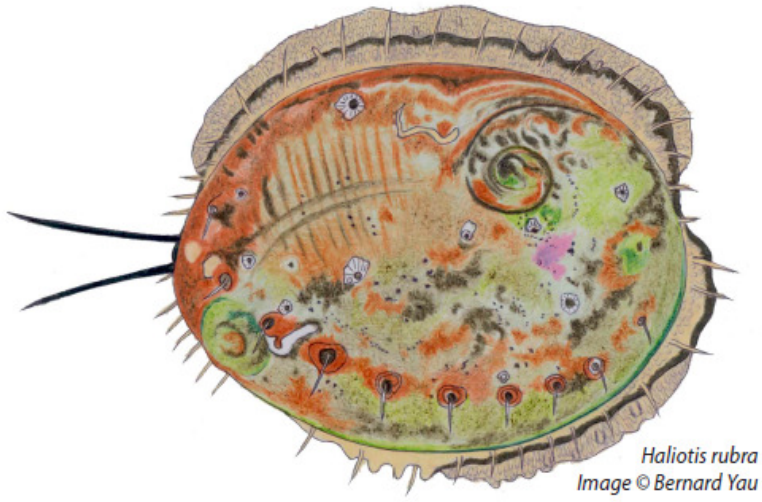



**Plate 18: Illustration of Blacklip Abalone (*Haliotis rubra*)**
**(*Source: Rowling et.al. 2010*)**

**Plate 19: Photograph of mature Blacklip Abalone**

**(*Source: Australian Museum n.d.)***

## 3.4 Background to the Abalone Industry

The Blacklip Abalone species is the focus of the commercial Abalone fishery in NSW, which first began operating around the 1960s. Commercial harvesting has traditionally occurred solely through the taking of Abalone from the wild by hand, by endorsed divers using breathing apparatus (DPI n.d.*b*). The bulk of the Abalone catch is currently exported to markets in South-East Asia, as live, fresh or frozen product for human consumption, although there is also a growing local demand.

In the last few decades there has been increasing concern about declining wild stocks in NSW, occurring mainly due to a combination of fishing pressure and mortalities due to a protistan parasite (*Perkinsus* sp.) in some regions. These concerns about the sustainability of the wild harvest have led to the progressive implementation of restrictive harvest measures for recreational and commercial fishers, including annually reviewed Total Allowable Commercial Catch (TACC) limits; bag limits; area closures (e.g. Marine Parks); and minimum shell lengths for legal harvest.

The NSW fishery is now a *limited entry, share managed fishery*, with commercial fishers required to be in possession of appropriate shares in order to take Abalone (Department of the Environment & Heritage 2006). The fishery is managed under the NSW *Fisheries Management (Abalone Share Management Plan) Regulation 2000*, which is a statutory plan in force under the NSW *Fisheries Management Act 1994* and *Fisheries Management (General) Regulations 2002.*

The past decade has continued to show significant declines in wild Abalone stock abundance (Rowling *et al* 2010), both in Australia and around the world. Continuing pressures on the NSW fishery include recreational and commercial fishing, and illegal poaching (The Ecology Lab 2007).

An alternative to the wild capture of Abalone is commercial farming, although there are currently no farms or facilities within NSW that produce Abalone for commercial purposes.

Commercial Abalone farms have been present in other parts of Australia for many decades. Advances in Abalone domestication and production techniques have driven a sharp rise in Australian production since 2002 (CSIRO 2011), with around a quarter of the total Australian Abalone production derived from aquaculture. For example, in 2008 - 2009 Tasmania, Victoria and South Australia produced 193 tonnes, 179 tonnes, and 227 tonnes of Abalone respectively, with production levels expected to double in the future (Housefield, G. 2011 pers. comm., 4 March).

Currently, Queensland, the Northern Territory and New South Wales are the only states / territories which do not yet accommodate farms. The temperature regimes of the Northern Territory and Queensland generally prohibit the culture of valuable temperate species of Abalone. However, research indicates that certain areas around NSW are considered potentially appropriate for Abalone aquaculture development due to their environmental and locational qualities. The subject site was identified as one of these potentially appropriate sites by the NSW Government (2009), as discussed in **Section 3.5.**

The aquaculture industry and the NSW Government have invested heavily in research, technology and management practices in recent years in order to encourage the ecologically sustainable development of aquaculture in NSW (DPI n.d.*e*). As provided in the *NSW Land Based Sustainable Aquaculture Strategy* (NSW Government 2009) industry and the Government *both recognise the environmental benefits arising from aquaculture, as well as the environmental conditions aquaculture needs to ensure the continuing high quality of its products* (pi).

## 3.5 Project Need & Justification

There are a number of reasons why there is considered to be a need for the proposed Abalone farm. In particular, there are a range of reasons why farming of the Blacklip Abalone species at the selected site is considered appropriate.

The project need and justification is discussed in **Table 2** below.

**Table 2: Key Drivers- Project Need & Justification**

| **Will help to meet an increasing demand for healthy, natural food products, specifically Abalone meat** |
|---|
| Abalone meat is a natural and highly valued food product with good nutritional value. It is substantially in demand yet undersupplied, both locally and internationally. Australia is already a major importer of seafood from around the world, with approximately 72% of all fish and shellfish consumed imported from overseas (Ruello 2011). As Australia's and the world's populations continue to increase, so too does the demand for nutritious, natural food products.<br>The farming of commercial Abalone for sale within domestic and international markets can help to meet this increasing demand. |
| **May help to reduce excessive fishing pressure on wild Abalone populations by helping meet demand** |
| It has been well-established that wild populations of Abalone are in decline, and the on-going commercial harvest of wild Abalone to supply demand has played a large part in that decline. Accordingly, there is an increasing interest in the farming of Abalone around Australia as an alternative to wild harvest. The NSW Government recognises that aquaculture must be developed in a sustainable, efficient and profitable way in order to meet increasing demand (NSW Government 2009). The Project, which strives to meet these production objectives, is therefore anticipated to play a small but important role in supplying demand and relieving pressure on wild populations. |
| **Species is suited to farming and to the environmental parameters of the site** |
| Farming of the Blacklip Abalone species is considered appropriate for the Project for the following reasons:<br>• It is indigenous to the coastal waters outside Port Stephens, and occurs naturally on nearby rocky islands and headlands;<br>• It has a history of wild capture, and has suffered a significant decline in wild populations due primarily to fishing pressures. Farming of this species may help to meet demand and reduce subsequent pressure on wild stocks;<br>• It is highly sought after as a specialty food item, and has a developed but undersupplied market in Australia and overseas, making the venture commercially feasible;<br>• The species has been the focus of intensive research in recent decades, particularly into aspects of its nutrition and optimising cultivation husbandry. In particular, the proponent (Housefield) has been involved in research into Abalone rearing techniques. The Project will apply the outcomes of this best-practice research;<br>• It is suited to the particular marine environment of the Port Stephens area (particularly the water quality), which matches the species' optimum requirements to maximise growth;<br>• It is subject to very few parasites or diseases, simplifying management techniques and therefore reducing the chance of catastrophic disease outbreak within the farm (and subsequently, the escape of any diseases into the Port); and |

- It is an herbivorous animal, meaning that feed requirements are relatively low in protein and therefore Nitrogen. This results in a lower potential for water quality impacts (from waste) and lower economic costs.

**Site is suitable with regard to logistical, strategic and environmental concerns**

Significant research has been invested into the identification of appropriate aquaculture sites around NSW in recent years. In particular, two Government studies identified the subject site as potentially suitable for the Project, as follows:

- The *NSW Land Based Aquaculture Strategy* (NSW Government 2009) maps the subject site as being 'potentially suitable for aquaculture' subject to detailed assessment (i.e. this EA). This suitability was determined based on site variables such as elevation, avoidance of conservation exclusion zones and spatial salinity.
- A site assessment survey, undertaken by NSW Fisheries (Glendenning & Read 2003), identified the subject site's potential for aquaculture, despite its location outside the scope of the study area (i.e. coastal estuaries within 2km of the coast). It noted that the site *has a number of attributes suited to aquaculture development, such as available flat land in close proximity to the water, access to power and sealed road access* (p89).

As discussed in **Section 3.6** below, a number of alternatives to the subject site have been explored and disregarded over the years, for various reasons.

However, the subject site was identified as appropriate through a rigorous site selection process. In particular, it was found to meet the site selection criteria outlined within the Project Profile Analysis (prepared by the NSW Government as part of its *Land Based Aquaculture Strategy*- see **Section 4.2.3.4**). The key reasons for the site's appropriateness are summarised below:

- Its zoning, which permits the development of aquaculture with consent / approval (see **Section 4.3**);
- Its separation from nearby sensitive landuses. For example, at least 200m of heavily vegetated bushland separates the site boundary from the nearest dwelling-house. This assists in avoiding land use conflicts;
- Its access to an abundant supply of good quality, well-flushed marine water (see **Section 5.4**);
- The appropriateness of the climate for the farming of Blacklip Abalone. For example, the temperature regime is highly suited to the year-round nursery production of Abalone (Heasman & Saava 2007);
- The large size of the site which allows for acoustic separation from nearby landuses;
- Its visual isolation (i.e. the proposed farm area is not visible from public areas), due to the site's large size and the presence of extensive mature forest along all boundaries;
- Its proximity to essential infrastructure, including electricity, telecommunications and an established road network;
- Its proximity to the arterial road network and subsequent access to regional and export markets (i.e. approximately 2.5 hours driving time to Sydney);
- The suitable topographical slope, allowing for the natural cascade of waters within the farm (reducing the need for artificial pumping);
- Its proximity to nearby industrial / commercial services and resources to support construction and operation, such as the Tea Gardens industrial estate;
- Its proximity to residential areas as a source of labour (e.g. Pindimar, Tea Gardens);
- Its proximity to technical expertise, researchers and regulatory authorities (e.g. Port Stephens Fisheries Institute at Taylor's Beach).

- The availability of land above flood planning levels, including increased flooding impacts arising from climate change (see **Section 5.16**).
- Its location outside of conservation exclusion zones; and
- Its capacity to accommodate development without significant impacts to Aboriginal heritage values, or threatened flora or fauna species (see **Section 5**).

**Project has been refined for over a decade in order to achieve best possible outcomes**

An application for the proposed development was originally submitted in 2003 (refer to **Section 1.2** of this EA). In 2006, the proposal was granted development consent, and was supported by the provision of General Terms of Approval from all relevant Government agencies. Due to a legal challenge, the proposal was subsequently discontinued. Nevertheless, the proponent's ongoing research has indicated that the proposal still has substantial merit.

It has been refined over a number of years via on-going research, assessment, and liaison with Government agencies and independent experts to ensure the Project demonstrates industry best practice.

**Will result in the creation of employment and training opportunities**

A number of permanent full-time, casual and part time jobs are anticipated to arise from the Project (up to 35 construction and 15 full-time equivalent operational jobs), encompassing broad areas such as administration, electrical, mechanical and hydraulic engineering, and biotechnology. In addition, trainee positions will be created in order to introduce people to aquaculture and to facilitate and encourage further education. Equal opportunity employment will be strongly promoted, with applications invited from all demographics, including those currently under-represented in the workforce (e.g. Aboriginal people, young people). Refer to **Section 5.20** for further details.

**Will result in local economic benefits**

In addition to employment and education, there are likely to be flow-on benefits to the local economy through the purchase of construction and operational supplies and services throughout the farm's lifetime.

## 3.6 Alternatives Considered

A number of alternatives to the Project have been considered during the design and site selection process. These alternatives, and the reasons for not pursuing them, are discussed in **Table 3** below.

**Table 3: Alternatives to the Proposal Considered**

| Alternative | Comment |
|---|---|
| Site locations | Various locations around NSW have been considered by the proponent since the mid-1990s, including sites at Crowdy Head, Catherine Hill Bay and Bass Point. However, as Abalone farming has very specific environmental requirements (e.g. high water quality, direct access to marine water etc.) no other site was found to adequately satisfy all criteria.<br>Further, all other potential sites were considered likely to result in greater environmental impacts than the subject site. For example, the seagrass meadow adjacent to the subject site is relatively narrow compared to other areas within the northern part of Port Stephens, and the area does not accommodate a large population of mangroves. Accordingly, the potential |

| Alternative | Comment |
|---|---|
| | impacts of the placement of pipes within these communities are reduced. |
| Species, stocking densities | Blacklip Abalone is indigenous to coastal waters outside Port Stephens, and its suitability to the Project is described in **Section 3.5**. The selection of any other Abalone species could result in an increased risk of competition with the local species; increased risk of exotic disease introduction; and increased difficulties associated with the collection of broodstock.<br>The proposed stocking densities were selected for the optimal health and growth of the species, derived through research into results at similar facilities. Higher densities could result in stress to the Abalone and an increased disease risk, and lower densities would require a larger building footprint and associated clearing impacts. |
| Cultivation/ post-cultivation procedures | Cultivation procedures, as outlined in **Section 3.7**, were selected on the basis of current best practice. While the feeding / cultivation/ harvesting procedures are labour-intensive, they are more easily adaptable to changing conditions. Alternative post-cultivation measures, such as slaughtering and processing on site, would involve increased waste production and disposal issues, and most likely a larger building footprint. |
| Alternative pipeline designs/ installation methodologies | The proposed Inlet and Outlet pipeline design and installation methodology is described in **Section 3.7.3.4** and **Table 4** in this EA. This approach was selected primarily as:<br>• Trenching pipes through the intertidal area minimises impacts on beach access and visual amenity, without significant disturbance to seagrass beds. Further, all pipelines are able to share a common trench throughout the intertidal area (minimising overall disturbance);<br>• The pipeline route minimises the width of seagrasses (within the subtidal meadow) which must be crossed;<br>• It allows for the continued growth of the majority of seagrasses along the route underneath the elevated pipelines, without significant disturbance; and<br>• The route leads directly to a required drop-off (deep point) for water access.<br>The proposal to raise pipelines over the seagrass beds rather than being positioned directly over the top of beds has been generally supported by Department of Primary Industries (Fisheries) officers (email- Carter, 6 June 2013).<br>Alternatives to the selected approach were considered and are discussed briefly below, particularly with regard to the elevation of the pipelines over the seagrass beds:<br>***Trenching through the sea grass bed***<br>Trenching of the pipes under the (sub-tidal) seagrass beds could be carried out within temporary sheet pile shoring and within silt curtains (or similar), to limit the area of disturbance and the impact of silt plumes on adjacent seagrasses. The dredged material would be returned to the trench as backfill. Attempts could be made to replant displaced seagrasses over the top of the trench. However, historical attempts to transplant *Posidonia* seagrasses to date have met with only limited success. Accordingly, this option was considered likely to have a more significant impact on seagrasses than the proposed methodology, and was disregarded. |

| Alternative | Comment |
|---|---|
| | ***Micro tunnelling (pipe jacking)***<br>Micro tunnelling involves pushing a small tunnelling machine between 2 excavated pits (the launching pit and the receival pit). Pipes are placed into the launching pit behind the tunnelling machine and both are then pushed forward by a set of hydraulic jacks. Additional sections of pipe are progressively added until the tunnel machine reaches the receival pit. While there is the potential to reduce disturbance to seagrass beds utilising this technique, there are also significant risks and constraints, including:<br>• The complexity and impacts of sealing the launch pit, and boring through soft sand material;<br>• The potential for lubricant dispersal into the Port from the soft ground bores;<br>• The risk of leaking at the point of connection of the tunnelled section of pipe to the pipe above substrate;<br>• The environmental and safety risks associated with the need for a coffer dam (dry enclosure), estimated to be at a depth of over 5 metres;<br>• The difficulty of applying ballast to the pipes (to prevent their gradual movement up through saturated sediment) using this technique; and<br>• Unanticipated risks (as use of such a technique in a similar situation has not been known to occur).<br>Accordingly, this option was considered likely to involve more significant risks for impacts on the Port than the proposed methodology, and was disregarded.<br>***Horizontal direct drilling (HDD)***<br>HDD involves an initial bore that is then back-reamed to a larger diameter. The reaming process is continued until the desired bore diameter is reached. A linear pipe is then pulled into the reamed hole. Similar to micro tunnelling, there are significant risks associated with this approach including the need for a deep coffer dam; the risk of lubricant dispersal; the risk of leaking at the connection point; and the difficulty of applying ballast to the pipes. In addition, use of the technique would require a work compound to be established on the beach large enough to lay out 4 x 400m long sections of linear pipe to enable it to be pulled into the bored hole. Space restrictions on the beach would prohibit this approach.<br>Accordingly, this option was considered likely to involve more significant constraints and risks for impacts on the Port than the proposed methodology, and was disregarded. |
| Transport options | Alternatives to the use of public roads for site access have been considered, including the construction of a jetty to allow boat access; the use of fire trails across private land; and the construction of new access roads. All of these alternatives are likely to have more pronounced environmental impacts than the use of Challis Avenue, Como Street and Cambage Street. |
| The 'do nothing' approach | The 'do nothing' approach involves the on-going management of the site as it currently operates (i.e. a small agricultural consideration). This option was considered undesirable for the following reasons:<br>• The economic benefits to the local community, including the opportunity for job creation and flow-on financial benefits, would be lost. Export income would also be lost;<br>• Aquaculture research and development opportunities would be lost, in addition to the loss of training opportunities for young workers; and |

| Alternative | Comment |
|---|---|
| | • The modest boost to the local and international supply of Abalone, from a sustainable farm operation, would be lost. |

## 3.7 Description of the Proposal

### 3.7.1 PHYSICAL FARM LAYOUT & DESIGN

The Project (also referred to as the 'farm') will comprise a network of land-based buildings, tanks and ponds, which will be supplied with a constant flow of marine water sourced from nearby Port Stephens.

The farm will be located within the central-southern portion of the site, adjacent to existing roads. This area was selected due to the following key factors:

- Small areas have been previously cleared, reducing vegetation clearing requirements;
- The existing road network may be utilised, further reducing the need for clearing for access;
- Close proximity to egress routes, in case of emergency such as bushfire; and
- Favourable topography, allowing for some gravitational water flow, reducing the need for artificial pumping.

The structures that comprise the main farm precinct will be positioned over about 5 hectares (ha), and will have a total building footprint of approximately 1.2ha (i.e. approximately 2.3% of the total site area). Approximately 65 trees, over about 1ha, will be cleared to accommodate these structures. An additional 1ha of vegetation in this precinct will be modified to meet bushfire asset protection zone requirements (see **Section 5.13** of this EA). The conservation of certain high-quality land within the site is proposed to compensate for this disturbance/ clearing, as outlined in **Section 3.7.2** below.

Four pipelines will extend from the main farm precinct to the waters of Port Stephens for the intake and outlet of marine water. From the farm precinct to the Pumphouse (see Sheet 3 of the plans at **Appendix 2**), they will be elevated above the ground on low supports (around 20cm high). However, south of the Pumphouse, the pipelines will be buried underground through the foreshore and intertidal area before emerging underwater. For the remainder of their length, they will be slightly elevated on supports over the seabed (around 50cm high).

Apart from some vegetation understorey disturbance, no trees are likely to be cleared to accommodate the pipes, as the selected route contains few trees and the pipes will be manoeuvred around trees where necessary (see **Section 5.8**). Disturbance to limited

areas of seagrasses and the trimming of several mangroves is anticipated, as discussed in **Section 5.9.2**. It is proposed to install 3 navigational buoys in association with the pipelines to minimise the risk of boating conflict (see **Section 5.19**).

A pedestrian boardwalk will connect the site to the Cambage Street track for emergency evacuation purposes only. The pipelines and boardwalk will be partially located within the 'additional areas' outside the subject site, as described in **Section 2.3.2** of this EA.

The proposal includes the upgrading (i.e. grading, minor widening) of selected existing roads within the site to ensure suitability for Rural Fire Service (RFS) vehicles. The site will continue to be accessible from Challis Avenue.

Full development plans for the Project are provided at **Appendix 2**. **Figure 10**, following, illustrates the position of farm structures within the subject site and the local context (aerial view). A plan showing an overview of proposed development within the subject site is provided at **Figure 11** following. Larger versions of these figures are provided at **Appendix 3**.

Note that pipelines will not normally be visible from south of the proposed Pumphouse, as they will be buried underground or positioned underwater. The illustrated roads and tracks already exist.

Details about the key components of the proposal are provided in **Table 4** below, and should be read in conjunction with the development plans at **Appendix 2**.

### 3.7.2 CONSERVATION LAND

An area of approximately 5.14ha (around 10% of the subject site), is proposed to be conserved in perpetuity for ecological purposes, to compensate for the small area of vegetation required to be cleared or disturbed in association with the farm. This land, positioned in the northern portion of the site, includes the following features:

- Four vegetation communities, including an Endangered Ecological Community;
- Two ephemeral drainage lines and associated riparian vegetation; and
- The maintenance of a valuable habitat corridor from the west of the site to the east.

Further discussion on this land is provided at **Section 5.8.2**, including a map of the land's extent.


**Figure 10: Subject Site & Proposed Development - Local Context**

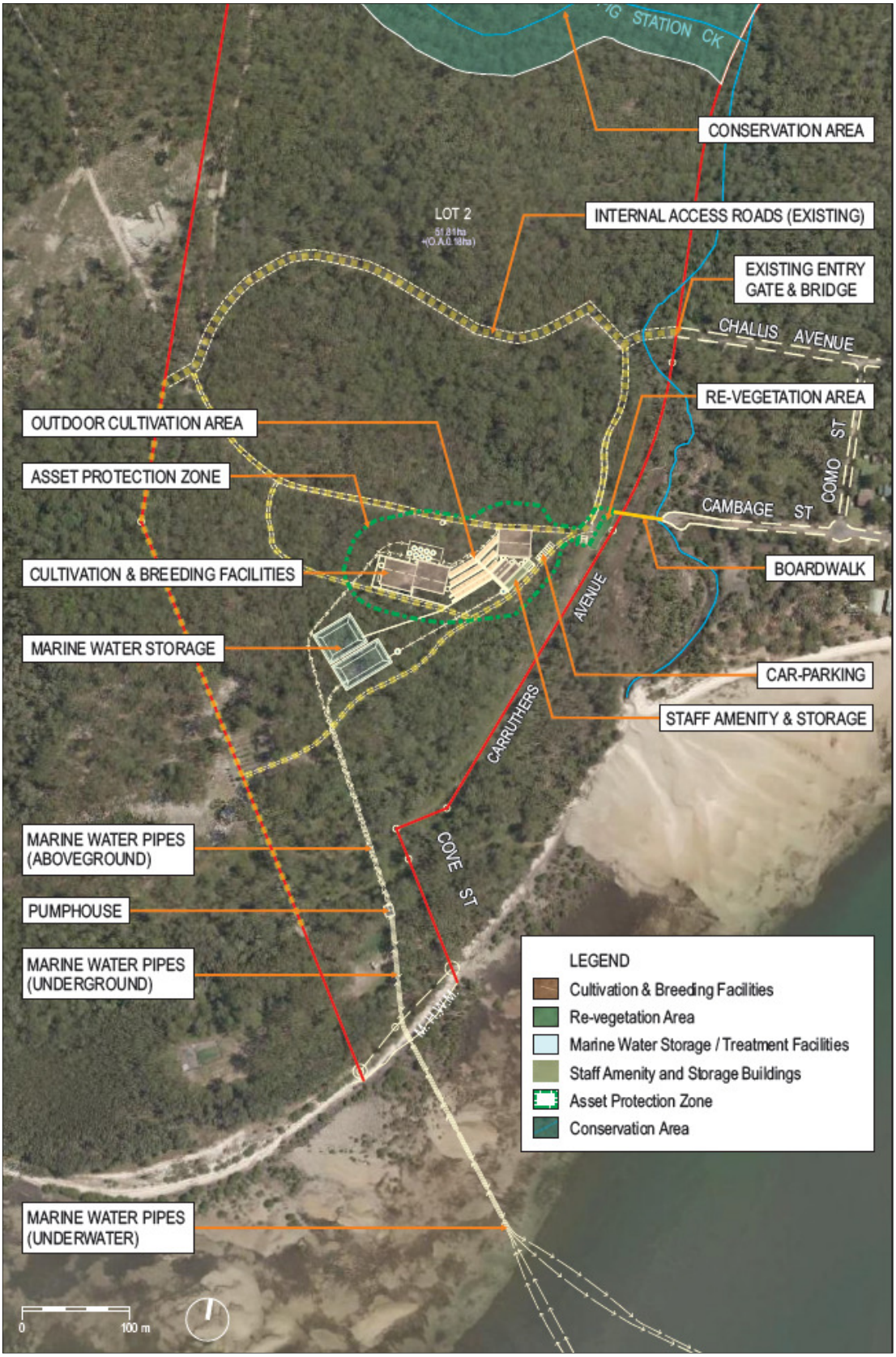



**Figure 11: Proposed Terrestrial Development – Overview**

**Table 4: Schedule of Key Physical Project Components**

| Component | General Description & Key Features |
|---|---|
| Broodstock Shed | • **Purpose:** secure building for Abalone quarantine, breeding and conditioning activities.<br>• **Structure:** single-storey building (around 4.3m high), elevated on low piers to avoid cutting/ filling. Total floor area: approximately 135m$^2$.<br>• **Contains**: 5 insulated shipping containers designated for specified uses:<br>- Quarantine Room: tanks for the isolation and quarantine of Abalone. Room accessible via a separate vestibule and 2 lockable security doors;<br>- Spawning/ Hatchery Area: tanks and shelves of spawning containers; and<br>- Broodstock Conditioning Rooms (1-3): each will contain tanks to accommodate broodstock.<br>• **Access**: disability - accessible ramp and steps. |
| Juvenile Shed | • **Purpose:** to accommodate very young Abalone on algal culture systems until ready for adult diets.<br>• **Structure:** single-storey building (around 3m high) comprising poly-propylene walls, elevated on low piers to avoid cutting/ filling. Total area: approximately 135m$^2$.<br>• **Contains:** a series of tanks to accommodate juvenile Abalone.<br>• **Access:** disability - accessible ramp. |
| External Juvenile Area | • **Purpose:** to accommodate juvenile Abalone during the transition period between algal feeding and adult diets.<br>• **Structure:** outdoor cultivation area comprising a levelled, gravelled space.<br>• **Contains:** a series of low density, shade-cloth covered plastic tanks.<br>• **Access:** gravelled pedestrian paths between rows of tanks. |
| Grow Out Sheds | • **Purpose:** to accommodate the growth and maturation of Abalone until ready for harvest.<br>• **Structure:** 3 x single-storey buildings (around 3.6m high). Grow Out Shed 3 will be partially positioned on low piers to minimise cut and fill. Remaining buildings will be set partially into the ground. Each building has a total area of approximately 750m$^2$.<br>• **Contains:** a series of stacked shallow raceway tanks (creating artificial channels for the flow-through of water) to accommodate mature Abalone.<br>• **Access:** ground-level doorways and disability - accessible ramps (for Grow Out Shed 3). |
| Facility Shed & Office | • **Purpose:** to accommodate the depuration and packing of live Abalone (after harvest), workspaces, amenities for staff use, general office space and storage areas.<br>• **Structure:** single-storey building (around 3.6m high), elevated on low piers to avoid cutting/ filling. Total area of approximately 225m$^2$.<br>• **Contains:**<br>- Facility shed/ Packing Room: containing depuration tanks and packing area;<br>- Store room: space for storage and workshop uses; |

| Component | General Description & Key Features |
|---|---|
| | - Refrigeration room: including shelving; and<br>- Office areas: will include a kitchen, amenities (including shower), office space, reception area, first aid room and screened-in porch.<br>• **Access:** disability - accessible ramps. |
| Header Tank Area | • **Purpose:** to receive and store marine water from the Intake Pipes, before distribution to selected farm facilities (e.g. Broodstock Shed).<br>• **Structure:** 8 x standalone, cylindrical concrete tanks with removable manhole covers, situated on a levelled rock surface. Combined volume approximately 5ML.<br>• **Contains:** as above.<br>• **Access:** informal. |
| Settlement Ponds | • **Purpose:** the collection, storage and settlement of marine water after use within the farm facilities, and before release into Port Stephens.<br>• **Structure:** 2 x rectangular ponds excavated into the ground and lined with high-strength pond plastic. Each pond will have a volume of approximately 2.1ML; and an average depth of 2m.<br>• **Contains:** as above.<br>• **Access:** informal. |
| Pumphouse | • **Purpose:** to accommodate pumps and other equipment related to the intake/ outlet of marine water via the Intake/ Outlet Pipes.<br>• **Structure:** secure, concrete building set predominantly below ground to a floor depth corresponding with the level of 'Indian Spring Low Tide' (approximately 2m deep). Walls will be constructed of impermeable material. Part of the roof will be covered with earth and revegetated.<br>• **Contains:** principal electric pumps, bilge pumps, diesel-powered backup pump, battery backup and alarm systems. Batteries will be stored in a separate battery room on the upper floor.<br>• **Access:** ramp and stairs down to Pumphouse floor. |
| Intake Pipes | • **Purpose:** to facilitate the intake and transport of marine water from Port Stephens to the farm. Water will be pumped from the Port via pumps within the Pumphouse to the farm facilities.<br>• **Structure:** 2 x polypropylene pipes with an internal diameter of approximately 500mm and external diameter of approximately 630mm. Pipes will generally be positioned adjacent to eachother and have a total length of approximately 540m (from the Mean High Water Mark).<br>- Within the main farm precinct, pipes laid directly onto the ground's surface.<br>- At road intersections, pipes buried underground within culverts.<br>- Between the farm precinct and the Pumphouse, pipes placed on low concrete supports (approximately 20cm high) positioned on the ground's surface.<br>- South of the Pumphouse, pipes buried underground, through the foreshore of Port Stephens, to the southern edge of the intertidal area (i.e. just south of Indian Spring Low Tide).<br>- South of Indian Spring Low Tide pipes emerge from underground and will sit on low concrete supports/ footings (approximately 50cm high) |

| Component | General Description & Key Features |
|---|---|
| | positioned on the seabed.<br>- Pipe terminals (water inlets) will be positioned at a depth of 15-20m. Each inlet will be fitted with 'passive fish screens'.<br>• **Contains:** as above.<br>• **Access:** informal. |
| Outflow Pipes | • **Purpose:** to facilitate the release of marine water from the farm to Port Stephens. Water will be released from the Settlement Ponds and will generally flow via gravity, occasionally supported by pumps within the Pumphouse.<br>• **Structure:** (As for Intake Pipes). Pipe terminals (water outlets) will be positioned at a depth of approximately 6m. The total length of the pipes is approximately 450m (from the Mean High Water Mark).<br>• **Contains:** as above.<br>• **Access:** informal. |
| Parking area & loading bay | • **Purpose:** visitor and staff parking, loading & unloading of goods.<br>• **Structure:** cleared, levelled area (levelled rock). Loading bay along existing road, adjacent to Facility Shed.<br>• **Contains:** 8 car parking spaces, including 1 space accessible for people with disabilities<br>• **Access:** informal. |
| Bin Storage | A level, gravelled area for the temporary storage of recyclable and non-recyclable waste. Dumpsters will be screened via a low fence. |
| RFS Tank & Equipment | 50,000L concrete water tank equipped with a diesel powered pump and fire hose reel. To be filled with freshwater (from onsite rainwater collection systems) and utilised for firefighting purposes only. |
| Access Road Network | Upgrading of existing dirt roads and access tracks within site to meet RFS requirements, predominantly via grading of roads to provide a level, trafficable surface. Roads will remain a single-lane width with occasional passing bays. No new roads are proposed. |
| Boardwalk | A wooden boardwalk to provide emergency pedestrian egress from the site onto an existing access track at the western end of Cambage Street. Will provide access over previously disturbed areas of wetland and Pig Station Creek. Main features:<br>- Timber deck boardwalk with a length of approximately 45m, and a width of approximately 2m;<br>- raised on wooden piles to a height sufficient to provide clearance over the Indian Spring High Tide mark;<br>- appropriate safety railings (if required);<br>- lockable gate to be positioned within subject site boundary, to restrict unauthorised access into the farm. |
| Ancillary Development & Site Works | Additional site works to support the farm include:<br>• Limited excavation works associated with pipe burial, building construction etc.;<br>• Rainwater tanks and other stormwater management controls; |

| Component | General Description & Key Features |
|---|---|
| | • Pump-out septic system for sewage management;<br>• Revegetation/ landscaping with native vegetation in key areas;<br>• Minimal outdoor site lighting around farm facilities, predominantly limited to solar powered path-lighting;<br>• Marine water piping and open channel/drain system within the farm precinct, including connections to the 2 x Settlement Tanks; and<br>• 3 x navigational buoys associated with marine pipelines in Port Stephens. |

## 3.7.3 CONSTRUCTION

### 3.7.3.1 *Construction Program*

The construction of the farm is anticipated to be staged over approximately 3 years, although timing will be dependent on stock production and demand requirements (i.e. as the first Abalone cohort reaches maturity milestones). Abalone cultivation operations are expected to begin at the conclusion of Stage 1.

- **Stage 1:** Undertaking of all road upgrade works, relevant site works and installation of servicing infrastructure. Construction of the Broodstock Shed, Facility Shed, Office, Header Tank Area, Settlement Ponds, Pumphouse and Intake / Outlet Pipes;
- **Stage 2:** Construction of the Juvenile Shed and External Juvenile Area (constructed as demand requires); and
- **Stage 3:** Construction of Grow Out Sheds 1, 2 and 3, as demand requires.

### 3.7.3.2 *Hours of Construction*

The proposed hours of construction are anticipated to be determined by the NSW Office of Environment & Heritage and Great Lakes Council guidelines. These hours are likely to be as follows:

- Monday to Friday 7am - 6pm;
- Saturday 8am - 1pm;
- No work on Sundays or public holidays.

### 3.7.3.3 *Construction Workforce*

It is estimated that the farm will require a workforce of up to 35 people over the construction period.

### 3.7.3.4 *Construction Methodology*

The details of each farm component are provided in **Table 4**, above.

Before the undertaking of any works, appropriate sedimentation and erosion control works will be completed. Conceptual Sediment and Erosion Control Plans are included within the development plans at **Appendix 2** (Sheet 5) and the *Acid Sulphate Soil Preliminary Assessment* (i.e. for pipeline construction) at **Appendix 4**.

The building footprints which contain vegetation will be cleared of trees and stumps, with roots grubbed to approximately 100mm below the ground surface. Vegetative material will be mulched and re-used within the site in revegetation areas. Topsoil will be left in-situ wherever possible. In areas requiring excavation, topsoil will be stripped to a minimum depth of approximately 100mm, with the stripped material to be stockpiled for use in revegetation areas after the completion of construction.

In some locations, such as the car parking area, small areas of rock may need to be cut. Any rock required to be relocated will be moved by a small bulldozer. Rocks will be re-used within the site wherever possible (e.g. landscaping).

Most of the buildings / sheds will be pre-fabricated and situated on piers to minimise the requirement for earthworks. Accordingly, they will require few site preparation works. Construction materials and equipment will be temporarily stockpiled in the area designated for Grow Out Shed 3, as this building will not be constructed until late in Stage 3 (see **Section 3.7.3.1**).

Excavation works will be undertaken utilising self-loading scrapers, which will move material to temporary stockpile areas. Any excess fill will be disposed of at an appropriately licensed landfill, however it is anticipated that the cut/ fill works required will not result in a net excess of fill. Such scrapers will also undertake the levelling of relevant areas (e.g. External Juvenile Area, Header Tank Area).

To achieve the required access road widths (see **Section 5.13**), the minimum understorey vegetation necessary will be cleared. No trees are anticipated to be removed for these works. Roads will be improved with the use of graders, scrapers, water trucks and rollers, as required. Should any additional fill be required to fill potholes, this will be sourced from excess fill resulting from earthworks elsewhere within the site wherever possible.

The proposed boardwalk will be constructed as follows:

- Mangrove branches will be trimmed as required along boardwalk route;

- Holes will be drilled within the sediment using an auger to allow for pylon placement. Holes will be about the same size as pylons to reduce sediment disturbance. All excess spoil will be disposed of at an appropriately licensed landfill. Pylons will be placed immediately into holes to reduce the potential for the creation of Acid Sulphate Soils (see **Section 5.5**); and
- The remainder of the boardwalk will be constructed (i.e. decking, guard rails) without the use of heavy machinery or plant.

Detailed specifications and methodologies for the construction of the boardwalk can be provided before the undertaking of construction works. It is noted that a similar and much larger boardwalk was successfully constructed between North and South Pindimar villages in recent years, and acceptable construction methods are therefore available for the currently proposed boardwalk.

The construction methodology for the proposed Intake and Outlet Pipes is discussed below.

### *PLACEMENT OF PIPELINES*

The four Intake / Outlet Pipes will be buried in some locations and raised on supports in others, as discussed in **Table 5** in this EA.

The pipelines will generally be constructed in-situ via the sequential connection of high-density polypropylene pipe 'spools' (segments). It is anticipated that a small rubber-tracked excavator will be used to move pipe spools around the site and into position. Pipes are relatively flexible and will be manoeuvred around trees and other obstacles. Spools will be stockpiled in appropriate locations (i.e. clear areas in close proximity to pipeline route) prior to the construction of each segment.

For required excavations, the top layer (approximately 150mm) of vegetative groundcover and soil / sediment will be removed. No trees are anticipated to be removed for pipeline construction. The potential for root damage is addressed at **Section 5.8**.

Excavated topsoil / sediment will be stockpiled adjacent to the pipes for later reinstatement, and any vegetative matter mulched for use within terrestrial revegetation areas. A single trench will be created to accommodate the 4 pipes, approximately 0.9m deep and approximately 2.6m wide, in terrestrial areas. In intertidal areas, the trench will be of a variable depth in order to maintain the consistent grade of the pipe. Excavated spoil will be stockpiled for regular backfilling into the trench upon the completion of each segment. Any excess fill will be utilised within the site where possible (e.g. filling in of road potholes) or disposed of at an appropriately licensed landfill. The width of the 'disturbance corridor' for buried pipes, including stockpile areas, will be approximately

4.6m. Disturbed areas will be revegetated with endemic species upon completion of works.

The management of Acid Sulphate Soils is addressed at **Section 5.5** of this EA.

Additional details on the construction of each segment are provided in **Table 5** below.

**Table 5: General Construction Methodology- Placement of Intake / Outlet Pipes**

| Pipe Location/ Segment | Proposed Pipe Treatment | General Placement Methodology |
|---|---|---|
| Within farm precinct | Laid on ground surface (*to minimise excavation*) | Pipes will be positioned directly on the ground, adjacent to each other, except where they will be partially buried between the Settlement Ponds and the lower access road (see below). |
| Intersection with internal access roads | Buried under roads, placed within culverts | A trench leading to and beneath the roads will be excavated (generally as outlined above this Table), and a culvert put in position. Pipe spools will be connected through the culverts. |
| Lower access road to Pumphouse | Raised above ground on low supports (*to avoid impeding fauna access - see **Section 5.8***) | Pipes will be placed directly on raised concrete supports (at least 20cm high), positioned at regular intervals. Pipes will be positioned around trees and other obstacles. A shallow trench will be excavated (generally as outlined above this Table) adjacent to the Pumphouse to allow a partially-below ground connection to the Pumphouse. |
| Pumphouse to just below Indian Spring Low Tide mark | Buried underground (*to avoid access & amenity impacts - see **Section 5.14***) | Excavations within terrestrial areas will be generally as outlined above this Table. Pipes will be positioned directly adjacent to eachother within the trench.<br>Excavations within intertidal areas will begin at the low tide mark and progress towards the shoreline. Concrete weights will be attached to the bottom of each pipe spool (for ballast) via 'Band-It' straps and buckles. Pipe spools will be prepared prior to the commencement of trenching in order to minimise trenching time. All works will occur at low tide. As the placement of pipes within the intertidal area is likely to take more than 1 tide cycle, emplaced pipe spools will be sealed and fitted with inlets to allow the pipes to fill with water as the tide rises (to avoid the floatation of the pipes). Highly visible hardwood marker posts will be driven into the sediment to temporarily mark the position of the next excavation. Note that appropriate Acid Sulphate Soil management procedures will be implemented (see **Section 5.5**), as well as the transplantation of mangrove seedlings and appropriate seagrasses (see **Section 5.9**). |
| Indian Spring Low Tide mark to pipe terminus (inlet/ outlet) | Raised above seabed on low supports (*to minimise* | All required pipe spools will be joined by butt fusion (on land) before placement. Each end of the pipeline will be capped to create a floating pontoon, allowing the floating of pipes into position with the aid of a work boat. Once in position, low concrete supports will be attached |

| Pipe Location/ Segment | Proposed Pipe Treatment | General Placement Methodology |
|---|---|---|
| | *seagrass impacts - see **Section 5.9**)* | sequentially to each spool via Band-It straps. The pipes will then be strategically flooded and allowed to gently sink to the seabed, maintaining anchorage at both ends. SCUBA divers will be in position to ensure pipe footings are positioned without undue impacts on seagrasses adjacent to the pipeline route. Once pipelines are fixed in position, underwater technicians will fix appropriate inlet structures with screens to the inlets. Note additional measures to reduce impacts on seahorses and other aquatic species are outlined in **Section 5.9**. |

A detailed *Construction Management Plan* (see **Section 7** of this EA) will be prepared before the undertaking of works. This Plan will include details of appropriate construction methodologies, including but not limited to the following:

- Identification and marking of works-corridor and placement of appropriate temporary barricading;
- Identification of appropriate plant access routes and spool stockpile areas;
- Documentation of tidal movements and identification of pipe placement sequences and timeframes;
- Development of safe work procedures;
- Installation of construction signage;
- Emergency retrieval procedures for plant and equipment; and
- Detailed re-vegetation methods for trench locations.

#### 3.7.3.5 *Construction Traffic Access Arrangements*

The anticipated key construction vehicles and equipment required for the farm are indicated below. Note that precise requirements will be dependent on detailed engineering design, and will be outlined within the proposed *Construction Management Plan*.

- Concrete delivery trucks;
- Standard trucks for materials deliveries;
- Excavators;
- Front end loaders; and
- Bobcats.

All construction traffic associated with the farm will enter the site via the existing road network i.e. via Challis Avenue, Como Street and into Cambage Street. This is the only

feasible vehicular access, which will not require the clearing of additional vegetation. Traffic and access is discussed further at **Section 5.11**.

#### 3.7.3.6 *Construction Waste Management*

Construction waste will predominantly comprise the following:

- Vegetation from clearing activities;
- Packaging and other general construction waste; and
- Potential excess fill from excavation works.

Vegetation waste will be mulched on-site and reused within the revegetation areas of the farm. Any packaging or other general waste that is recyclable will be collected by a licensed contractor and disposed of at a recycling facility. Any remaining solid waste will be disposed of at an appropriately licensed landfill by licensed contractors.

Any excess fill generated from excavation works (e.g. excavation of the Settlement Ponds) will be utilised within the site wherever possible. For example, fill can be utilised during road upgrade works to fill potholes. Any excess fill will be disposed of at a licensed landfill.

#### 3.7.3.7 *Construction Environmental Management & Monitoring*

Appropriate environmental management and monitoring of the construction works is proposed to occur. The proposed site preparation and construction works will not commence until a detailed *Construction Management Plan*, including environmental management provisions and occupational health and safety provisions, has been prepared. Further, all relevant licenses, permits and approvals will be sought and obtained before any works are undertaken.

The *Construction Management Plan* will aim to ensure that the workers, the environment and the surrounding community are protected from unreasonable impacts arising from the construction works. It will provide information on appropriate methods for the undertaking of works, including relevant safeguards and monitoring techniques. The Plan will provide reporting protocols and will nominate procedures to be followed should an issue be identified, so that appropriate management measures may be implemented.

The *Construction Management Plan* will form part of an overall *Environmental Management Plan* proposed for the site, as outlined in **Section 7.2**.

## 3.7.4 PROVISION OF SERVICE INFRASTRUCTURE

### 3.7.4.1 *Water*

The subject site does not have connections to a reticulated freshwater supply. Freshwater will be provided via the proposed rainwater collection tanks positioned throughout the site (refer to **Section 5.6**). This water will be used for all freshwater needs (e.g. hand washing, landscaping irrigation, toilet flushing, hosing down of equipment etc.) with the exception of drinking. Drinking water will be supplied via a filtered-water delivery system.

Note that a separate, dedicated freshwater supply will be maintained for the purposes of fire fighting (i.e. RFS Tank).

Should water levels become low due to drought, freshwater will be purchased on an as-required basis.

### 3.7.4.2 *Electricity*

Three-phase electrical power is currently available to the subject site, via the transmission lines running along the site's eastern and southern boundaries. This system is anticipated to be extended to the farm facilities, including the Pumphouse, preferably via underground lines.

A back-up generator will be positioned in a structure adjacent to Grow Out Shed 2. The generator will be capable of powering all facilities within the farm, with the exception of the pumps utilised for the Intake / Outflow Pipes, until electricity is restored. Back-up, diesel-powered pumps (located within the Pumphouse) will be utilised to temporarily maintain water flows within the Intake / Outflow pipes until electricity is restored.

Heat pump hot water systems (which absorb and utilise heat from the ambient air to heat water) will be installed on the outside of each building and supplied with freshwater from the rainwater tanks. The hot water will be utilised for purposes such as the washing down of equipment and staff amenities (shower/ kitchen sink etc.).

### 3.7.4.3 *Sewage Treatment*

A single toilet facility is proposed to service the farm, located within the Office.

Due to the proximity of the site to sensitive ecological values, it is proposed to utilise a pump-out septic system to manage sewage. This system will receive all blackwater (toilet waste) and greywater (wastewater from sinks, showers etc.). This system is proposed to

have a capacity of approximately 7,770 litres and is anticipated to be pumped out every 2 weeks. Appropriate licenses for the installation of the system will be obtained as required.

No irrigation, discharge trenches or exfiltration associated with sewage treatment is proposed on site.

#### 3.7.4.4 *Communications*

A telephone line is already connected to the subject site. Internet connections will be provided via wireless internet services.

An electronic monitoring system will constantly monitor water quality, water pressure and other parameters throughout the farm. Should any key parameters reach prescribed limits, or the security system be breached, silent alarms and alerts will be sent directly to the farm manager via SMS or email.

#### 3.7.4.5 *Gas*

Gas is not available to the site, and is not intended to be connected as part of this Project.

### 3.7.5 ABALONE QUARANTINE, PRODUCTION & CULTIVATION PROCESS

Essentially, farming of the Abalone will involve the following key steps and processes:

- collection of broodstock (approximately 120 initially and then approximately 24 annually), including appropriate quarantine treatments;
- breeding of production stock from broodstock;
- rearing of production stock through a number of life stages;
- harvesting of mature stock; and
- live transport to market for commercial sale or export.

These steps and phases are discussed in detail in the following sections.

#### 3.7.5.1 *Broodstock Collection & Quarantine*

A number of Abalone individuals must first be sourced to act as 'broodstock' (meaning *sexually mature individuals kept separately for breeding purposes*). These broodstock will provide a production base for the farm, and will assist in the on-going maintenance of

genetic diversity throughout its operating life. The number of individuals anticipated to be required is provided below:

- **At farm establishment**: approximately 120 broodstock (ratio - 2 male:3 female); and
- **Each subsequent year of production**: approximately 24 replacement broodstock, in order to maintain genetic diversity.

### *BROODSTOCK SOURCE*

There are currently significant restrictions on the translocation and importation of Blacklip Abalone from interstate into NSW, which assist in reducing the risk of disease translocation from other parts of Australia (refer to **Section 5.3** for discussion on disease issues). Accordingly, stock can only be reasonably sourced from NSW licensed hatcheries, authorised distributors / re-sellers, or via collection from NSW wild populations.

There are currently no hatcheries in NSW. Therefore purchase from a licensed distributor/ re-seller or collection from the wild are the only viable options.

As a first preference, it is proposed to purchase broodstock from appropriately licensed re-sellers in NSW (in order to maximise collection efficiency). However, the method of broodstock collection will ultimately be determined by the availability and appropriateness of stock at the time of collection, as discussed below. Should stock not be available for purchase, it is proposed to collect broodstock from wild NSW populations, after the obtainment of appropriate licenses and in accordance with all relevant guidelines and license conditions. These two sourcing options are discussed in more detail in the following sections.

### *PREFERRED LOCATION*

The waters of the NSW coast are divided into six geographical Abalone Assessment Regions for the purposes of stock assessment for the wild fishery, as shown in **Figure 12** below (The Ecology Lab 2005).

The taking of wild Abalone is limited by legislation within a number of areas, such as aquatic reserves and marine parks. In addition, a partial recreational fishing closure is currently in place from Wreck Bay (Jervis Bay) north to a point adjacent to Tomaree Head (eastern boundary of Port Stephens). The closure means that Abalone can only be harvested on weekends and public holidays.

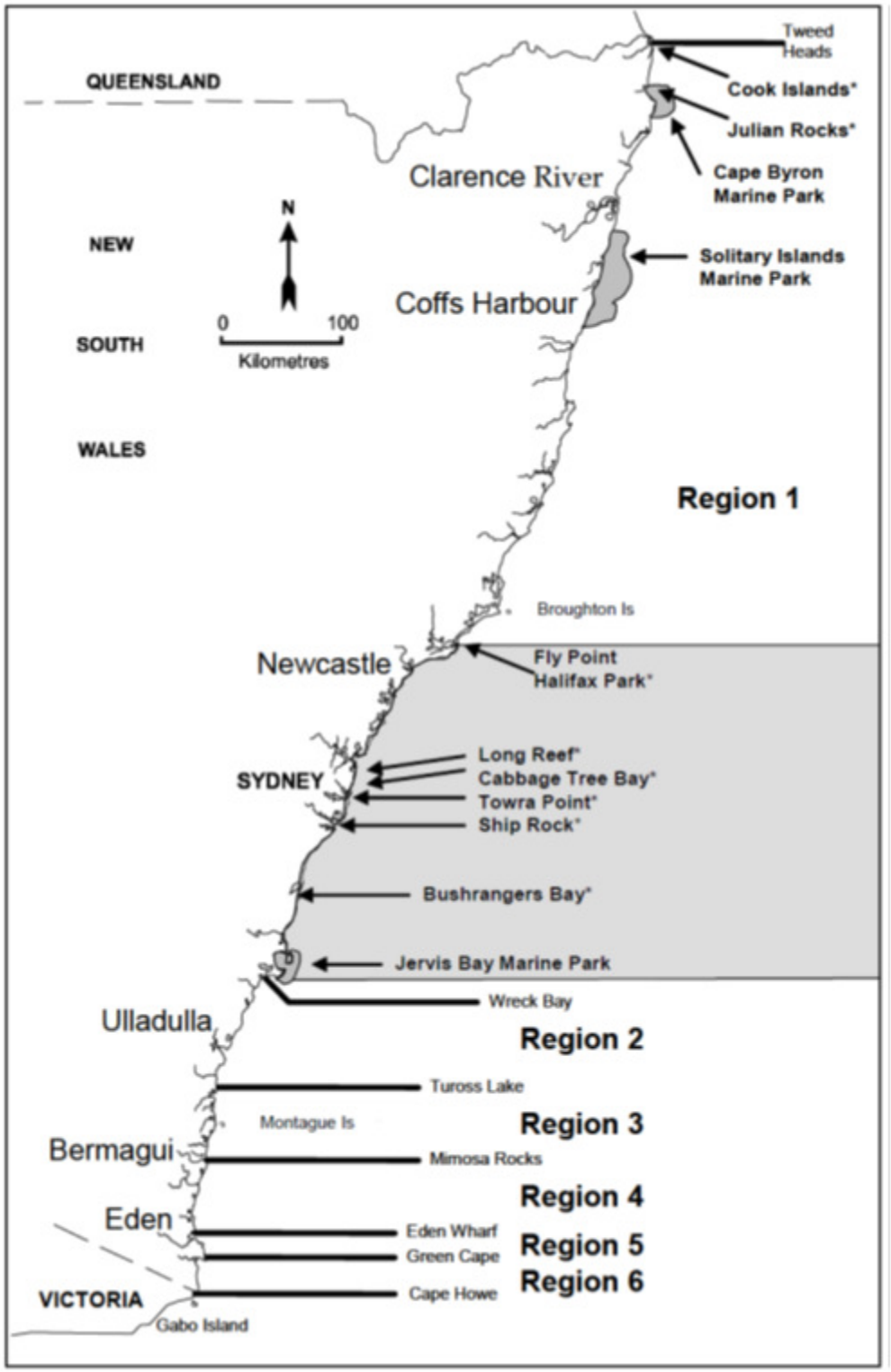



**Figure 12: Abalone Assessment Regions of the NSW Coast**

**Marine parks are shown in dark grey; aquatic reserves are indicated with (*) and the light grey area shows where a current recreational closure to the taking of Abalone is in effect**

***(Source: The Ecology Lab 2007)***

Restrictions are also in place with regard to the methods of taking Abalone for commercial purposes for all waters north of Wreck Bay to Tweed Heads (Department of Premier & Cabinet NSW 2012). This closure was implemented to assist in increasing wild stock, and is expected to be in effect until 30 June 2014. It is noted that, to date, Abalone have not been identified within the waters of Port Stephens inside Tomaree Head.

The closures affect recreational and commercial fishing activities; however the licensed collection of broodstock is not affected by the same restrictions. For the farm's purposes, broodstock Abalone will preferably be sourced from the northern-most Abalone Assessment Region (i.e. Region 1), if available at the appropriate time. This is because Abalone sourced from the north will be more adapted to warmer water temperatures, which may be expected within the farm into the future. Should Abalone from Region 1 be unavailable at the time of sourcing, Abalone from the next-most northern Region will be selected.

Whether purchased or collected from the wild, it is noted that all broodstock will undergo rigorous quarantine screening, as discussed below.

### *1. Purchase Option*

Abalone will preferably be purchased from NSW licensed sellers at locations such as the Sydney Fish Markets. The feasibility of purchasing stock will be influenced by the following factors at the time of collection:

- Availability of stock;
- Source location (i.e. stock sourced from Region 1 will be selected preferentially, as discussed above); and
- Health of the individuals.

No licenses are required to purchase 'live seafood' in this manner.

The National Docketing System for the tracking of commercially-caught Abalone is in place in NSW. This system ensures that all Abalone batches are accompanied by catch records (accessible by officers from NSW Fisheries), from capture until final retail sale. This system will make it possible for farm representatives (with the assistance of NSW Fisheries) to identify the location from which the Abalone was sourced, such as the Abalone Assessment Region and catch subzone.

### *2. Wild Collection Option*

For wild collection, Abalone will again be preferentially sourced from the northern-most Abalone Assessment Region that permits wild collection at the time required. All

appropriate licenses and approvals will be obtained from regulatory authorities in order to permit broodstock collection (e.g. a Broodstock Collection Permit pursuant to the *Fisheries Management [Aquaculture] Regulation 2007*). Individual Abalone will then be hand selected and removed from the wild by licensed divers, in accordance with regulatory requirements.

Abalone collection protocols for the management of disease risk are proposed in the *Biosecurity & Disease Management Plan* at **Appendix 5**, including the requirement for disinfection of equipment and clothing between dives.

#### *QUARANTINE PROCEDURES*

The farm design includes the provision of a dedicated broodstock quarantine facility within the Broodstock Shed (see plans at **Appendix 2**).

All 'new' Abalone selected for introduction into the farm will undergo rigorous quarantine procedures to assess the health of individuals and to minimise the risk of introducing disease. The general purpose of quarantine is to isolate individuals whilst undergoing testing and monitoring for indications of disease. If indications of disease are identified, stock may be culled and/ or appropriately managed before introduction to the farm.

Details of quarantine procedures are provided at **Section 5.3** and **Appendix 5** of this EA (*Biosecurity & Disease Management Plan*).

### 3.7.5.2 *Breeding of Production Stock*

After broodstock have successfully passed through the quarantine process, broodstock must be 'conditioned' and managed in such a way as to maximise fecundity (*reproductive rate*). Broodstock management and conditioning, through the manipulation of environmental factors, can assist in increasing the number and quality of gametes (*sex cells*) produced, and can control the timing of maturation and spawning (*the process by which Abalone reproduce, involving the release of gametes into the water*).

Within the farm, broodstock will be held in conditioning facilities, where conditions such as light, noise and handling disturbances are carefully controlled. After approximately 5 months, the Abalone will be conditioned and ready for spawning.

At the appropriate time, Abalone will be moved into individual spawning containers where water conditions will be monitored and adjusted in order to promote spawning. Once individuals have spawned (see **Plate 20**), the male and female gametes from individual containers will be combined so that eggs may be fertilised.

The embryos will then be transferred into hatchery tanks. After approximately 24 hours, the eggs will hatch and free-swimming larvae (known as *trochophores*) will emerge.

All of the above processes will be undertaken within the Broodstock Shed.

### 3.7.5.3 *Rearing through Larval Stage*

Abalone larvae will be kept within hatchery tanks for approximately 1 week. To prevent the escape of larvae into the marine water reticulation system, sieves of an appropriate size will be fitted to water outlets, in addition to other water treatment systems (see **Section 5.4** of this EA). A discussion on the risk of larvae escaping the farm is provided at **Section 5.21.2.**

Abalone larvae are relatively simple to rear as the planktonic larval stage (i.e. *living in the water column*) is brief and larvae do not require feeding. Larvae survive on their eggyolk and through the direct absorption of nutrients in seawater through the skin (Heasman & Saava 2007).

**Plate 20: Photograph of spawning female Abalone in individual spawning container. The eggs are visible on the floor of the container**

***(Source: Heasman & Saava 2007)***

### 3.7.5.4 *Rearing through Juvenile Stage*

After being raised through the free-swimming larval stage, juveniles develop into shelled 'veliger' larvae and then metamorphose (*transform*) into reef-dwelling 'post-larvae' (see **Plate 21** and **22** below).

At this metamorphosis stage, Abalone will be moved to the Juvenile Shed and allowed to settle on plastic plates within tanks (note- in the wild, Abalone must settle on rocky substrate). Juvenile Abalone will feed on algae that grow on the plates. The production and management of this food source is discussed in **Section 3.7.7.3**.

After approximately 4-8 weeks, individuals will be transferred to the External Juvenile Area where they will continue to grow in low density transition tanks for approximately 8-12 months.

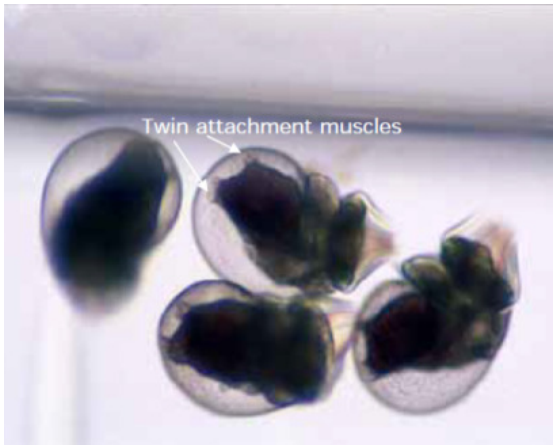



**Plate 21: Image of veliger larvae**
***(Source: Heasman & Saava 2007)***

**Plate 22: Photomicrograph of post-larvae**
***(Source: Heasman & Saava 2007)***

### 3.7.5.5 *Grow-out*

After the juvenile growth stage, individuals will be transferred to 1 of the 3 Grow-Out Sheds. Individuals will continue to grow in shallow, stacked 'raceways' (also known as 'flow-through systems'). These comprise artificial channels (in this case, formed of tanks) equipped with a water inlet and an outlet, which allows for a continuous flow of water through the system.

Disturbance to the Abalone will be kept to a minimum, with the exception of regular cleaning, feeding and occasional sorting activities. Abalone will continue to be fed until

individuals reach market size (i.e. a shell length of approximately 80-90mm) and are ready for harvest. This process is expected to take approximately 78 weeks.

#### 3.7.5.6 *Harvest*

When Abalone are of market size and ready for harvest, they will be held within the raceways for several days without feeding. Individuals will then be manually removed from raceways, and placed on transport plates within crates. The crates will be kept within depuration tanks, where individuals will be checked for recovery from any handling wounds and allowed to 'depurate' (meaning *to eliminate waste products*). As a constant flow of marine water cannot be maintained during transportation, Abalone may be marked or damaged from the deposition of its own waste products on gills and other parts. 'Depurating' before transport will ensure that no waste can be produced to damage the stock during this time.

It is noted that, as Abalone are not filter feeders, they do not require a 'purging' process as with edible oysters (i.e. *involving the expulsion of potentially hazardous impurities, such as faecal bacterial contaminants, from the intestinal contents of bivalves* [Lee *et. al* 2008]).

#### 3.7.5.7 *Transport & Sale*

Once Abalone are ready for transport, crates of individuals will be placed into bags along with gaseous oxygen and wet sponges to maintain humidity. Bags will be placed into foam boxes ready for final transport.

Abalone will be transported from the farm to on-sale destinations within small refrigerated vehicles. Each vehicle is expected to accommodate 1-2 tonnes of Abalone, with an average of 1-2 trips per week anticipated (to a total annual production weight of approximately 60 tonnes per year). Abalone are expected to be in transit for a maximum of 48 hours.

Abalone will be sold as a live product, with some stock to be sold within domestic markets (i.e. most likely within Sydney) and a large proportion to be exported directly overseas.

Food production safety measures are discussed at **Section 5.22** of this EA.

#### 3.7.5.8 *Anticipated Stocking Rates & Annual Production*

At full capacity the farm is anticipated to produce approximately 60 tonnes per year of live marketable Abalone. It is likely to take approximately 3.5 years to achieve full production rates.

This production rate assumes 2 successful spawning runs per year, resulting in up to 31.6 tonnes of Abalone being available for market every 6 months (i.e. with a typical shell length of 80-90mm, weighing approximately 80-113 grams each). Note that Abalone are usually sold by weight, rather than per piece (i.e. individual animal).

The farm's production rate is a factor of farm size, the expected survival rates of each Abalone growth stage, the fertilisation rate of eggs and the number of eggs likely to be produced by female Abalone. A discussion on the proposed breeding process, Abalone breeding success rates and survivorship has been provided by the proponent (refer to **Appendix 6** in this EA). This document provides calculations of expected survival rates for each Abalone cohort (age group), which led to the annual production estimate.

Farm size has been determined based on cost-effectiveness and a desire by the proponent to minimise vegetation clearing and maintain reasonable working distances. As Abalone are bottom (benthic) dwelling animals, stocking density is usually based upon percentage of available surface area. It has been found that the best yield will occur when Abalone are stocked at around 45% coverage.

### 3.7.6 MARINE WATER SOURCE & MANAGEMENT

Abalone require a constant flow of high quality marine water for maximum health and growth. At full capacity it is anticipated that approximately 50ML of marine water will pass through the farm's systems daily. This volume is comparable (in relation to Abalone biomass production) to existing farms of similar scale in Tasmania, Victoria, Western Australia and South Australia (Housefield, G 2012 pers. comm. 3 March).

The following sections provide a brief description of the intake source, outlet location and management techniques for the farm's marine water. Note that no licenses are required specifically for the extraction and/ or treatment of marine water as proposed (other licensing requirements are discussed at **Section 7.1**).

Further details on the farm's water quality management systems are provided at **Section 5.4** of this EA.

#### 3.7.6.1 *Marine Water Source, Reticulation & Treatment Systems*

The general flow of marine water within the farm system will be as follows:

These steps are discussed in more detail below.

### *PORT INTAKE*

Marine water will be pumped continuously (at a very low velocity i.e. 0.1m/sec) from Port Stephens via the 2 proposed Intake Pipes. Pumps will be located within the Pumphouse (refer to **Table 4** and Sheets 3 and 4 of the plans at **Appendix 2** for further details). The Pipes will access water:

- approximately 540m from the shoreline,
- at a depth of 15m to 20m,
- adjacent to a 'drop off' into a channel that is approximately 30m deep.

The water intake structures will be designed and positioned to minimise any potential entrainment or impingement impacts on marine organisms (see **Section 5.9** for further details).

The Intake Pipelines will be:

- **Buried** from the Pumphouse south to the Indian Spring Low Tide Mark, to reduce amenity impacts (see **Section 5.14**), and
- **Suspended** over the seabed (approximately 50cm) from the Indian Spring Low Tide Mark to the pipe terminals, to reduce impacts on seagrasses (see **Section 5.9**).

Available data indicates that the water in the vicinity of the intakes is of reliably high quality, and its characteristics make it suitable for the farming of Abalone. Additional information on existing water quality is provided at **Section 5.4.1**.

### *FARM FACILITIES*

Once extracted from the Port, water will be pumped to the main farm precinct. From the Pumphouse north to the farm, the pipelines will be raised over the land on low supports (approximately 20cm) to minimise impacts on terrestrial fauna movement (see **Section 5.8**).

Within the farm precinct, water will be directed to the various facilities via a system of pipes laid directly on the ground, except where they are buried under roads. Water will typically flow directly between facilities via gravity, although pumping between some areas may be required.

Water will be pre-treated before supply to Abalone in various ways, depending on the nature of the facility, as outlined in **Table 6** below.

**Table 6: Pre-Treatment of Farm Marine Water**

| Farm Facilities | Pre-Treatment Measures |
|---|---|
| Growout Sheds, Juvenile Sheds and External Juvenile Area | Water from Intake Pipes will flow directly to Growout Sheds and Juvenile areas, where it will be filtered before being directed into Abalone raceways or tanks. |
| Broodstock Shed & Facility Shed | Due to the more sensitive nature of Abalone in this area (e.g. quarantine specimens, broodstock, etc.) water will receive further treatment before addition to Abalone tanks.<br>Water from the Intake Pipes will flow directly into a series of Header Tanks. There will be 8 Header Tanks in total, with a combined volume of approximately 5ML.<br>The lowest 5% volume of each tank will be released directly to the Settlement Ponds in order to remove dead organisms or other detritus (which sink to the bottom) from the water supply. Water will be aged for a minimum of 5 days before transfer to the Broodstock Shed, so that large numbers of parasites or other disease-causing organisms can complete their life cycles and die, with a consequent reduction in infective force.<br>As well as water ageing and the associated reduction in water pathogen load, the storage of water in Header Tanks in this way will provide a buffer against external pollution events which may restrict water intake from the Port temporarily, ensuring a continuity of water supply to these critical farm components.<br>Water will be further treated before transfer to Abalone tanks, generally comprising the following steps:<br>• Temperature control (i.e. water chiller);<br>• Filtering; and<br>• Ultraviolet light (UV) treatment, to kill residual micro-organisms. Further discussion on UV treatment is provided at **Section 5.3** of this EA. |

Immediately *after* passing through the farm's tanks and raceways, marine water quality will be somewhat reduced due to its interaction with large populations of Abalone. Accordingly, various methods are proposed to treat water before release to the Settlement Ponds. This treatment will ameliorate water quality impacts and minimise the risk of parasite or disease transmission originating from the farm.

Water treatment methods utilised within each farm facility will depend on the source (e.g. growout raceways, quarantine tanks etc.). Generally, treatment will include some or all of the following measures:

- Filtering;
- Ozone treatment; and
- UV treatment.

A detailed discussion on water treatment is provided at **Section 5.4**.

#### *SETTLEMENT PONDS*

After use and treatment within the farm facilities, all marine water will be directed to the Settlement Ponds. Water will be transported to the Ponds via a network of pipes (laid on the ground) and in-ground open channels (constructed of lengths of half-pipe). Depending on the facility, water may also pass through the Primary and/or Secondary Settlement Tanks (e.g. from the Broodstock Shed).

Whilst not a critical part of the water treatment train, the Settlement Ponds will allow for additional water treatment (i.e. a 'polishing system') via:

- Settlement; and
- Biological treatment.

Further details are provided at **Section 5.4**.

#### *PORT OUTLET*

From the Settlement Ponds, marine water will flow continuously downhill to the pipe outlets and will be released into the Port (approximately 50ML per day). The 2 Outlet Pipes will be positioned directly adjacent to the Intake Pipes, except where they diverge below the Indian Spring Low Tide Mark.

Water will be released approximately 450m from the high-tide shoreline, directly into the tidal stream at a depth of approximately 6m. Outlets will be directed at an angle slightly above horizontal (away from the seabed) to minimise the risk of scouring. Following release, this treated water will be rapidly diluted, minimising any remaining concentration-based water quality impacts. As discussed in **Section 5.4**, no significant impacts on the existing water quality of the Port (or on marine flora or fauna, such as seagrasses) are anticipated as a result of farm activities.

Appropriate navigational buoys are proposed to be installed near the Intake and Outlet Pipes to minimise the risk of boat traffic conflict (see **Section 5.19**).

### 3.7.6.2 *Marine Water Recirculation Capabilities*

The farm will incorporate the ability to recirculate water throughout facilities for limited periods, if required. Recirculation is achieved within individual units / facilities by temporarily ceasing the inlet and outlet of water; and continuously cycling the existing water between treatment systems (e.g. filters) and tanks/ raceways. On a larger scale, water from the Settlement Ponds could also be recirculated back through the farm for a limited time if required.

The advantages of recirculation include:

- the ability to temporarily control overall water usage if required;
- provides a buffer against external pollution events, algal blooms or other events which may restrict water intake from the Port for periods of time;
- enhances re-oxygenation of water;
- allows for increased flow rates within facilities (which stimulate Abalone growth); and
- enhances water temperature and oxygen control abilities.

It is noted that Abalone, more so than many other marine organisms, are sensitive to water quality changes such as pH, unionised ammonia or available dissolved oxygen content. For example, even a small drop in pH will result in Abalone stress and a reduction in shell growth.

The quality of recirculating water can be maintained for limited periods through the use of filters and other measures, such as the closely monitored addition of buffer solutions. However if the same water is recirculated for an extended time without additional treatment (such as dilution effects or the addition of salts such as Calcium to maintain correct concentrations / ratios), pH, dissolved salts and other water quality parameters will decline and can have a detrimental impact on Abalone health (Housefield, G. 2012 pers. comm. 2 February).

For this reason, recirculation will only be implemented in 'emergency' situations such as pollution events or algal blooms in the Port.

#### 3.7.6.3 *Marine Water Monitoring*

Monitoring of key marine water quality parameters will occur on a regular basis, for both water intake (*into the farm*) and release (*from the farm to Port Stephens*). Parameters monitored will include salinity, dissolved oxygen, pH and Total Nitrogen.

Details of the proposed monitoring regime are provided in **Section 5.4.3.2** of this EA.

### 3.7.7 GENERAL FARM MANAGEMENT PRACTICES

#### 3.7.7.1 *Hours of Operation*

Staff will generally be in attendance at the farm from 8am - 6pm Monday - Saturday, with the exception of public holidays.

The farm's pumping and water reticulation system will operate 24 hours a day. Note that potential noise impacts from pumping are addressed at **Section 5.12**.

### 3.7.7.2 *Operational Workforce Requirements*

The farm is expected to employ approximately 15 full-time equivalent staff. Staff roles are likely to include farm managers, biologists, hatchery managers, maintenance staff and technical assistants. It is also envisaged that students and other researchers may utilise the farm on occasion, for research purposes.

### 3.7.7.3 *Feeding Practices*

The feeding methods of Abalone will depend on their life stage. The various stages are discussed below.

#### *PLANKTONIC LARVAL STAGE*

Larvae at this stage do not require feeding, as they depend upon eggyolk and the uptake of nutrients from seawater only.

#### *JUVENILE STAGE*

After metamorphosis, juvenile Abalone are fed on algae grown on 'nursery plates'. Generally, the growth and management of algae encompasses the following key components:

- Plastic nursery plates are inoculated with the alga *Ulvella lens* (Heasman & Saava 2007), before larvae settle. This alga species occurs naturally along the Australian coast, including within Port Stephens. Algae spores can be collected from local surface marine water, and induced to attach to and colonise plates, creating a 'bio-film' of microscopic algae. This is used to encourage larvae to settle, and provides grazing for juvenile Abalone.
- The growth of naturally occurring diatoms (i.e. *microscopic algae with silica cell walls*) is encouraged on plates, through similar processes as those above. This bio-film of diatoms and other microscopic algae will support the growth of older juvenile Abalone.
- The growth of algae can be managed through Abalone density (i.e. to reduce grazing pressure) and the controlled provision of light.

The growth and management practices for the feeding of juvenile Abalone will be guided by best practice research, including the *Manual for Intensive Hatchery Production of Abalone* (Heasman & Saava 2007) and the *Abalone Nursery Manual: Algal Culture Methods for Commercial Abalone Nurseries* (Daume 2004).

#### *GROW-OUT STAGE*

Mature Abalone will be fed commercially available dry feed, which has been specially designed to support the growth of Abalone. A powder, crumb or biscuit form of the feed will be utilised, depending upon the age of the Abalone. Feed will be purchased from a producer within Australia (e.g. Adam & Amos brand), negating the need for any quarantine procedures. These types of feed are the products of on-going research and development, and typically comprise milk proteins and wheat as the main components, reducing the emphasis on fishmeal (which is typically sourced from fishery by-catch).

Feed is designed to rapidly sink to the bottom of tanks and raceways so it may be accessed by Abalone and waste can be more easily managed.

Abalone feed will be stored in dark, dry, airtight, and vermin-proof containers within the farm, separated from chemicals, waste or other potentially contaminating substances.

The main grow-out Abalone feeding processes are discussed below:

- Abalone will be hand-fed a measured volume of feed. Feeding will generally occur in the afternoons or at night.
- The appropriate volumes of feed will be calculated based on the number of individuals and their stage of life. Feed efficiency will be monitored via the sample weighing of stock before and after feeding, and monitoring of the amount of uneaten feed.
- Strict feeding records will be kept, and on-going adjustments and refinements will be made to feeding volumes/ processes in response to this monitoring regime. The main objective of this process is to optimise Abalone growth whilst minimising waste, thereby reducing costs and demand upon the farm's waste management system.

### 3.7.7.4 *Stock Security*

The stock which may be at greatest risk of theft is likely to be broodstock and mature Abalone almost ready for harvest. This stock will be protected through the secure locking of Grow-out Sheds and the Broodstock Shed, and via remotely controlled surveillance technology.

Access into the farm will be controlled through lockable access gates along internal roads, and a lockable pedestrian gate at the terminus of the emergency egress boardwalk.

### 3.7.7.5 *Disease Management*

Disease and biological security is addressed in **Section 5.3** and **Appendix 5** of this EA (*Biosecurity & Disease Management Plan*).

### 3.7.7.6 *Acid Sulphate Soils Management*

The management of potential Acid Sulphate Soils during construction is addressed at **Section 5.5** of this EA.

### 3.7.7.7 *Maintenance Procedures*

Generally, the on-going maintenance of the farm will involve the following key tasks:

- Checking and maintenance of the integrity of pipes, pumps, tanks, ponds and other infrastructure;
- Removal of excess algal growth within ponds and tanks;
- Emplacement of appropriate mesh over ponds should waterbird fouling become problematic;
- Cleaning of tanks and other infrastructure (additional detail on pond cleaning activities is provided at **Section 5.23.1**);
- Cleaning of pipes, including the Intake and Outflow Pipes, via 'pigging'. 'Pigs' are bullet or spherically shaped, flexible and contractible devices which are pushed through pipes under pressure, cleaning the pipes by friction as they proceed;
- Monitoring of water quality (see **Section 5.4**) and other parameters;
- Maintaining the store within the Facility Shed (e.g. ensuring the provision of spare pumps, etc.);
- Management and enhancement of ecological values within the proposed conservation area (see **Section 5.8**) and
- Weed management around the farm precinct.

### 3.7.7.8 *Waste Management*

The management of general solid waste and Abalone mortalities (and associated waste) within the farm is discussed in the following sections.

Note that:

- the management, treatment and release of the farm's *marine water* is addressed within **Section 5.4**;
- the management of *sewage* from the farm is discussed in **Section 3.7.4**, and
- the management of *construction waste* is discussed in **Section 3.7.3.6**.

### *SOLID WASTE*

Only small amounts of solid waste material are expected to be produced within the farm, and are likely to comprise the following:

- **Solid marine waste** - resulting from the marine water treatment processes (e.g. recoverable sediment, waste Abalone food etc.);
- **Vegetative waste -** resulting from (occasional) cleaning of tanks and ponds (e.g. excess algal growth);
- **General waste** - arising from the general operation of the farm (e.g. office waste, empty feed packaging, etc.).

Recyclable waste will be collected and stored on-site within appropriate receptacles for regular pick-up by contractors. The Bin Storage area is indicated on the plans at **Appendix 2**.

All other solid wastes will be collected and stored on-site within appropriate garbage receptacles (also in the Bin Storage area) until pick-up by a licensed waste removal contractor. Receptacles containing biological waste (e.g. excess algae) will be fitted with tightly sealing lids to minimise the escape of odours during storage. Disposal of waste is anticipated to occur at the Bedminster Advanced Resource Recovery Facility (ARRF) at Raymond Terrace. It is anticipated that the vast majority of the farm's solid waste will be suitable for composting within this facility, with only a very small proportion destined for ultimate landfill.

It is noted that the salinity of most of the anticipated waste products (e.g. marine water sediment) precludes the potential for any direct on-farm land application and beneficial re-use.

Throughout the life of the farm, the proponent intends to research innovative ways to reduce waste to landfill, including the potential for re-use of various wastes within the farm's processes. It is noted that these future processes will only be undertaken in compliance with relevant license conditions.

***ABALONE MORTALITIES***

Any Abalone stock mortalities will be assessed for disease in accordance with the *Biosecurity & Disease Management Plan*. If safe to do so, stock will then be disposed of at the Bedminster ARRF, along with other solid waste. Note that stock will be kept chilled or frozen until garbage collection days, to minimise odour production.

Should any stock be deemed unfit for disposal to the ARRF, appropriate disposal methods will be determined in accordance with the protocols within the *Biosecurity & Disease Management Plan* (see **Appendix 5**).

### 3.7.7.9 *Fuels, Chemicals & Pharmaceuticals*

As a general rule, the proponent intends to minimise the use of chemicals and pharmaceuticals within the farm wherever possible. This is driven by the proponent's desire *to produce a product that has acceptance in markets where people are well informed and desirous of a natural, 'healthy' product as free of chemicals or other additives as possible*.

However, like all aquaculture operations, the use of some substances will be required for water disinfection, water buffering and other uses. The key chemicals / pharmaceuticals listed at **Appendix 7** are anticipated to be necessary to the operation of the farm from time to time. Their expected volumes and frequency of use is also provided at **Appendix 7**.

Management of the risks associated with the use and storage of these substances is discussed at **Section 5.24** of this EA.

### 3.7.7.10 *Site Decommissioning & Rehabilitation*

Should the operation of the farm cease at any time after its construction, a number of options are available for the decommissioning and potential re-use of the site. These options include:

- Investigating and implementing adaptive re-uses for farm infrastructure. Infrastructure would be most appropriate for the culture of other marketable benthic species, such as sea urchins, turban shells, bait or crabs *(subject to obtaining appropriate development approvals*);
- Investigating the reuse of the site for alternative uses unrelated to aquaculture. This could involve the partial decommissioning and removal of some or all

infrastructure. An example of such an alternate use is intensive horticulture/ fungiculture within the sheds and buildings (*subject to obtaining appropriate development approvals*); or

- Complete decommissioning of the farm and rehabilitation of the site. This could include earthworks to restore the site to its natural landform (e.g. removal of the Settlement Ponds) and revegetation using seedstock of local plant species. The farm is not anticipated to result in any contaminating activities and therefore no additional rehabilitation is likely to be required.

These, and any other appropriate options that may arise, should be assessed at the time of decommissioning and the most appropriate option selected. The obtaining of appropriate consents and licenses will also be required.

### 3.7.8 TRAFFIC & ACCESS ARRANGEMENTS

The vehicular routes proposed to be utilised to and within the farm are as follows:

- Access to the site will be directly from Challis Avenue (*comprising compacted gravel*) only. Note- only the section of Challis Avenue between Como Street and the subject site is fully cleared and useable. This road connects to Como Street (*compacted gravel*), then Cambage Street (*sealed*) then Clarke Street (*sealed*), as shown in **Figure 13** below;
- Internally, the farm will be accessed via the existing road network within the site as outlined in **Section 2.3** and shown in **Figure 13**. The creation of new roads is not proposed.

The construction of a wooden pedestrian boardwalk is proposed to provide a connection from the farm to Cambage Street, as shown in **Figure 13** below.

Carruthers Avenue is undeveloped, and Cambage Street (between Carruthers Avenue and Como Street) comprises an established dirt footpath. The boardwalk is proposed to be used for emergency egress from the farm only and is not suitable for vehicles.

The following road upgrade works are proposed as part of the Project:

- Upgrading of the internal road network via levelling / grading where required. This upgrading will render the roads suitable to accommodate the largest vehicles anticipated to visit the site (e.g. RFS vehicles, garbage collection trucks). No clearing of trees is anticipated to be required;
- The designation of approximately 5 passing areas along the road network, as required to satisfy recommendations for bushfire hazard management (see

**Section 5.13** of this EA). The areas proposed for passing bays comprise existing, wide areas of the road and no clearing or additional works are likely to be required;

- The construction of an 8-space car parking area, comprising levelled rock and graded dirt, to facilitate staff and visitor parking; and
- The designation of a loading bay area adjacent to the proposed Office.

Traffic and transport issues are discussed further in **Section 5.11** of this EA.

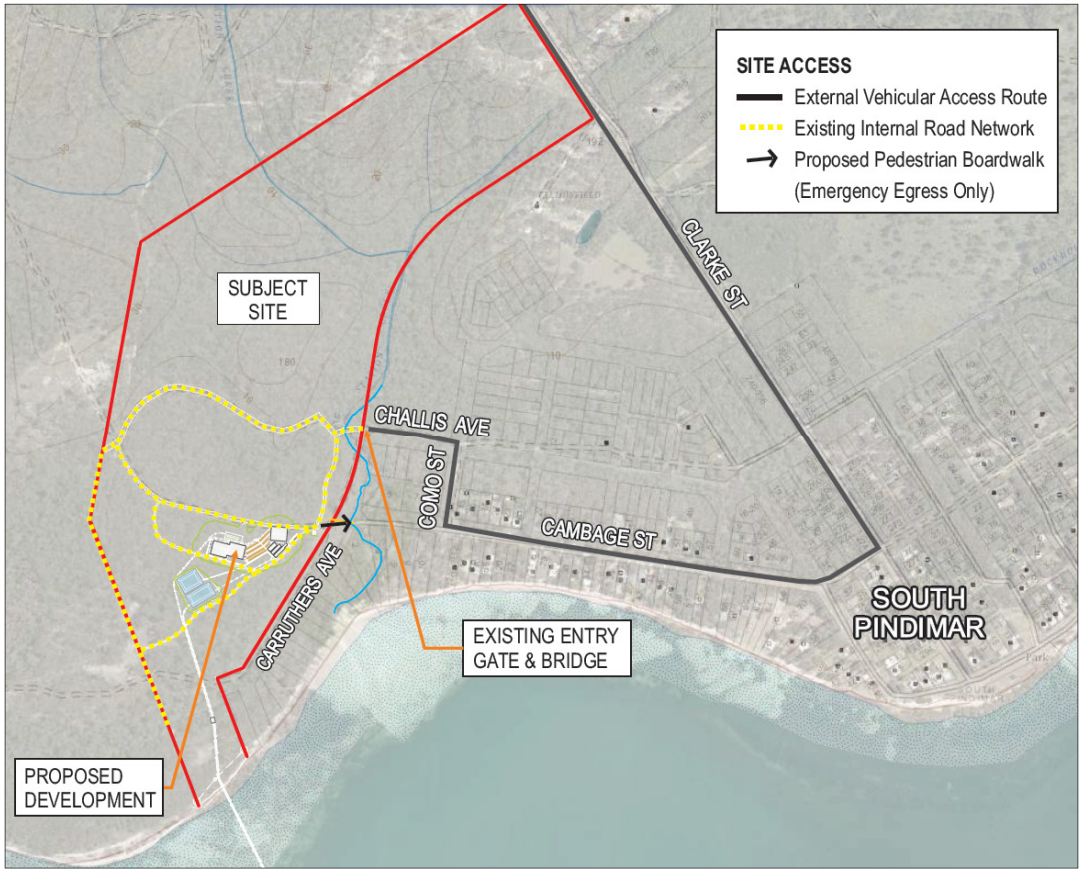



**Figure 13: Proposed Vehicular & Pedestrian Access Routes**

### 3.7.8.1 *Emergency Egress Boardwalk*

In order to address bushfire hazard risk, an elevated wooden boardwalk is proposed to connect the subject site to the Cambage Street road reserve, in the location generally described in **Section 2.3.2.2** of this EA. An aerial view of the proposed route of the board-walk is shown in **Figure 14** below, and a photograph of the approximate area of the proposed route is shown in **Plate 23**.

It is proposed to be utilised for emergency egress from the farm only. The key features of the boardwalk are outlined within **Table 4** of this EA.


**Figure 14: Proposed Emergency Egress Boardwalk Route- Approximate**

**Plate 23: Location of Proposed Boardwalk- Approximate**

***Looking west towards the subject site from the terminus of Cambage Street***

**Plate 24: Existing North-South Pindimar Boardwalk**

***The proposed boardwalk will be of a similar design, but a smaller scale***

The boardwalk will be of a similar design to other boardwalks constructed in the local area, such as the much larger boardwalk which connects the villages of North and South Pindimar (i.e. with a length of approximately 200m). A photograph of part of this existing boardwalk is shown in **Plate 24** above.

Plans of the existing North-South Pindimar boardwalk are attached at **Appendix 8** of this EA (reproduced with the permission of Great Lakes Council). These plans provide an indication of the technical specifications and construction methodology which can be used for the boardwalk. Detailed engineering and material specifications, as well as a detailed construction methodology, can be provided should the Project gain approval.

### 3.7.9 OPERATIONAL ENVIRONMENTAL MANAGEMENT & REPORTING

A detailed *Environmental Management Plan* (EMP) will be prepared to manage the construction and operation of the farm, to ensure the protection of key environmental and social values. The EMP will be finalised in accordance with any conditions associated with a Project approval or other licensing or regulatory requirements, and will encompass monitoring and reporting regimes where appropriate.

Details of the EMP are provided at **Section 7.2** of this EA.

# 4 PLANNING FRAMEWORK

The legislation, planning instruments and strategic matters with some application to the site and proposal are addressed in the following sections.

## 4.1 Commonwealth Matters

### 4.1.1 ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), is the main Federal legislation which aims to protect the environment. The EPBC Act contains provisions for the protection of Matters of National Environmental Significance (MNES), which include wetlands of international importance and listed threatened species. If a development has the potential to significantly impact upon a MNES, the EPBC Act is 'triggered' and the development must be assessed in accordance with this Act (and may also require consent from the Federal Government).

The original DA for the farm (see **Section 1.2** of this EA) was referred to the (former) Department of the Environment and Heritage in November 2006 to determine if approval was required under this Act. At that time, the Department determined that the Project *is not a controlled action…approval is therefore not needed under Part 9 of the Act before the action can proceed*.

However, since that time the proposal has been amended, predominantly with reference to the proposed annual production rate (i.e. now approximately 60 tonnes). Accordingly, a new referral to the Federal Department of Sustainability, Environment, Water, Population & Communities (DSEWPC) was recommended, to ensure that the Project adequately considers potential impacts upon MNES.

Consideration of the Project with regard to the MNES is provided at **Section 5.8.2.4** of this EA (*Flora & Fauna- Terrestrial)*. In addition, potential impacts on aquatic / marine threatened species are addressed within **Appendix 16** of this EA (*Aquatic Ecology Assessment*). The results of these assessments conclude that there is not likely to be any significant impact on any MNES as a result of the proposal.

Regardless, at the time of writing, a referral was being prepared and was anticipated to be made to the DSEWPC imminently. Additional assessment requirements issued by the DSEWPC, if any, will be addressed once received.

It is noted that approval of the Project under Part 3A of the EP&A Act is not dependent on the completion of an assessment pursuant to the EPBC Act.

Part 13A of the EPBC Act deals with the international movement of wildlife specimens, and requires a permit for export of native species (such as wild-caught Abalone broodstock or their progeny). Such a permit will be sought should the Project be granted approval.

## 4.2 State Matters

### 4.2.1 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

The *Environmental Planning & Assessment Act 1979* (EP&A Act) is the main piece of legislation governing development assessment in NSW.

In summary, the Project will be assessed as a 'major project' under Part 3A of the EP&A Act despite this Part now being repealed. Details of the relevant sections of this Act and their application to this Project are discussed in more detail below.

#### 4.2.1.1 *Part 3A of the EP&A Act- The Application Process*

Since the time a DA for the Project was originally lodged in 2003 (refer to **Section 1.2**), Part 3A of the EP&A Act was introduced to allow for the more 'streamlined' assessment of major infrastructure and other large-scale or environmentally sensitive projects in NSW. Relevant to this proposal, Part 3A applied to the carrying out of development *that is declared under this section to be a project to which this Part applies…by a State environmental planning policy* (section 75B[1][[a]].

On 17 October 2007, the Minister for Planning formed the opinion that the proposed development of an Abalone farm is a project to which Part 3A of the Act applied, as it is *development for the purposes of aquaculture located in environmentally sensitive areas of State Significance* (refer to **Appendix 9** for a copy of this opinion). This class of development was listed in Schedule 1 of *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP), as discussed in **Section 4.2.3.6** of this EA.

As required by Section 75E of the EP&A Act, a Major Project Application for the current proposal (accompanied by a Preliminary Environmental Assessment Report) was lodged with the former NSW Department of Planning (now DP&I) in December 2009. Subsequently, Director-General's Environmental Assessment Requirements (DGRs) were issued to the proponent on 26 May 2010, in satisfaction of Section 75F. A copy of

the DGRs is attached at **Appendix 1** and each DGR is addressed at **Appendix 10**. The formulation of these DGRs by DP&I included consultation with relevant government agencies in order to identify any key issues that needed to be addressed as part of the EA for the Project.

This EA addresses the issues raised within the DGRs, amongst other issues considered to be of relevance (such as matters raised by the community during consultation). The EA has been prepared pursuant to Section 75H of the Act, and will assist the Director-General in assessing and determining whether the Project should be granted approval under Section 75E. It includes a Statement of Commitments that the proponent is prepared to make for environmental management and mitigation measures on the site, as outlined in **Section 7** of this EA.

It is noted that, pursuant to section 75H(2), the Director-General may require the proponent to submit a revised EA to address specific matters. After the submission of a draft EA to DP&I in March 2013, DP&I requested that additional matters be addressed. The current version of the EA includes consideration of these additional matters and has been prepared in consultation with DP&I and relevant government agencies (where relevant). A summary of the additional matters raised, and a response to each, is provided at **Appendix 11**.

Section 75H also requires the public exhibition of the EA after the submission of a revised EA (where relevant) for a period of at least 30 days. Accordingly, this EA is anticipated to be exhibited, and any submissions made will be taken into consideration by the Director-General and the proponent.

The Director-General may request the proponent respond to issues raised in any submissions received during the exhibition period. If such submissions result in any proposed changes to the Project, Section 75H(6)(b) provides for the lodging of a Preferred Project Report outlining these changes to minimise the Project's environmental impacts. This Preferred Project Report may be required to be exhibited to the public, and may include a Revised Statement of Commitments.

#### 4.2.1.2 *Repeal of Part 3A- Transitional Arrangements*

On 1 October 2011, the *Environmental Planning & Assessment Amendment (Part 3A Repeal) Act 2011* commenced, resulting in the repeal of Part 3A and the implementation of an alternative assessment process for major projects. However, Schedule 6A of the EP&A Act provides transitional arrangements for existing Part 3A projects that have not yet been determined.

Section 2(1)(c) of the Schedule identifies the following types of development as a *transitional Part 3A project*:

> *a project for which environmental assessment requirements for approval to carry out the project… were last notified or adopted within 2 years before the relevant Part 3A repeal date (unless the environmental assessment is not duly submitted on or before 30 November 2012 or on or before such later day as the Director-General may allow by notice in writing to the proponent).*

The Project meets these criteria as the DGRs were issued on 26 May 2010, which is within 2 years of the Part 3A repeal date of 1 October 2011. Further, in November 2012 the (Acting) Director-General provided written advice to the proponent, granting an extension of time for the lodgement of the (draft) EA until 30 March 2013 (see **Appendix 12**). The draft EA was submitted by the required time.

Accordingly, *Part 3A of this Act (as in force immediately before the repeal of that Part and as modified under this Schedule after that repeal) continues to apply to and in respect of a transitional Part 3A project.*

For the sake of clarity, it is noted that the historical version of the EP&A Act dated 16 September 2011 - 30 September 2011 is therefore the version applicable to this Project in relation to Part 3A matters, as confirmed by officers from DP&I (Galloff, C 2012, pers. comm., 23 January).

Importantly, any SEPP or other instrument made under or for the purposes of Part 3A, as in force on the repeal of Part 3A, continues to apply to and in respect of a transitional Part 3A project (Section 3[2] of Schedule 6A). Therefore a historical version of the Major Development SEPP also applies to this Project (refer to **Section 4.2.3.6** of this EA).

#### 4.2.1.3 *Application of other Provisions of the EP&A Act & other Legislation*

It is noted that, under Section 75R of the Act and with the exception of State Environmental Planning Policies (SEPPs), environmental planning instruments (EPIs) such as Local Environmental Plans (LEPs) do not apply in respect of an approved project. However, as the Minister *may* take into account the provisions of any EPI that will not apply once approved (because of the application of Section 75R), the relevant provisions of applicable LEPs have been addressed within this EA (refer to **Section 4.3**).

Division 4 of the Act also identifies other legislation and approvals that do not apply in respect of an approved project, and those that must be applied consistently. Accordingly, the following is relevant with regard to this Project:

- the concurrence under Part 3 of the *Coastal Protection Act 1979* of the Minister administering that part of the Act is not required;
- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994* is not required;
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* is not required;
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* is not required;
- an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act to be repealed by that Act) to clear native vegetation is not required;
- a permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948* is not required;
- a bush fire safety authority under section 100B of the *Rural Fires Act 1997* is not required;
- a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the *Water Management Act 2000* is not required;
- an aquaculture permit under section 144 of the *Fisheries Management Act 1994* cannot be refused if it is necessary for carrying out an approved project and is to be substantially consistent with the Project Approval;
- an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997 (*for any of the purposes referred to in section 43 of that Act) cannot be refused if it is necessary for carrying out an approved project and is to be substantially consistent with the Project Approval; and
- a licence under the *Pipelines Act 1967* cannot be refused if it is necessary for carrying out an approved project and is to be substantially consistent with the Project Approval.

It is noted that an assessment of whether there is likely to be a *significant effect on threatened species, populations or ecological communities, or their habitats* is still required, pursuant to Section 5A of the EP&A Act. This issue is addressed in **Section 5.8** of this EA.

### 4.2.2 ENVIRONMENTAL PLANNING & ASSESSMENT REGULATION 2000

Part 1A of the *Environmental Planning & Assessment Regulation 2000* (the Regulation) contains provisions relevant to 'Transitional' Part 3A Projects.

Relevant to this proposal, Clause 8F provides that consent for the lodgement of this Project Application must be provided by the owners of the subject site at any time before the Application is determined. As discussed in **Section 2.2** of this EA, the subject site (i.e. land) is owned by private individuals. The water component of the site (i.e. waters of Port Stephens into which the proposed pipeline will extend) is owned by the Crown, and the area proposed to accommodate the boardwalk is vested in Great Lakes Council.

Written consent for the lodging of this application by the private owners of the land, the Crown, and the Council is submitted separately with this EA.

Clause 8N of the Regulation provides that certain proposals within sensitive coastal locations (including the subject site) and which are prohibited under an EPI cannot be approved under Part 3A of the Act. For the avoidance of doubt, it is noted that even though the subject site is located within a *sensitive coastal location*, the proposed development is not prohibited under any applicable EPI (refer to **Section 4.3** of this EA) and can therefore be approved under Part 3A.

### 4.2.3 STATE ENVIRONMENTAL PLANNING POLICIES

#### 4.2.3.1 *State Environmental Planning Policy No 14 - Coastal Wetlands*

SEPP 14 aims to ensure that coastal wetlands are preserved and protected in the environmental interests of the State. Clause 4 of the SEPP provides that the policy applies to land outlined in maps associated with the SEPP.

The subject site is located near two areas identified as coastal wetlands, located to the east (wetland No. 757a) and west (wetland 757b) of the subject site, separated from the site boundaries by approximately 55m and 110m respectively. These areas are shown in **Figure 15** below.

As outlined in **Section 3.7** of this EA, a 2m-wide wooden pedestrian boardwalk is proposed to extend through the unformed road reserve of Carruthers Avenue and into Cambage Street. It is designed to allow emergency egress from the farm to the public

road network (Cambage Street) across Pig Station Creek and associated wetlands in the case of an emergency such as a bushfire.

It is noted that the boardwalk will be located just outside of the area mapped as wetland 757a, as indicated in **Figure 15** below. Accordingly, the provisions of the SEPP do not apply to this proposal. However, due to the proximity of the boardwalk to the wetland, the relevant provisions of the SEPP are considered below in order to provide a thorough assessment of the proposal.

Clause 7 of the SEPP provides that a person must not *clear, drain, fill*, or *construct a levee* within SEPP 14 wetlands except with the consent of the Council and the concurrence of the Director-General. The proposal does not involve any of these works within the wetland area. However, even if it should, Clause 6(2) states that, if development that requires consent under SEPP 14 is declared to be a project to which Part 3A of the EP&A applies, the concurrence of the Director-General is not required. As outlined in **4.2.1** of this EA, the proposal is subject to Part 3A.

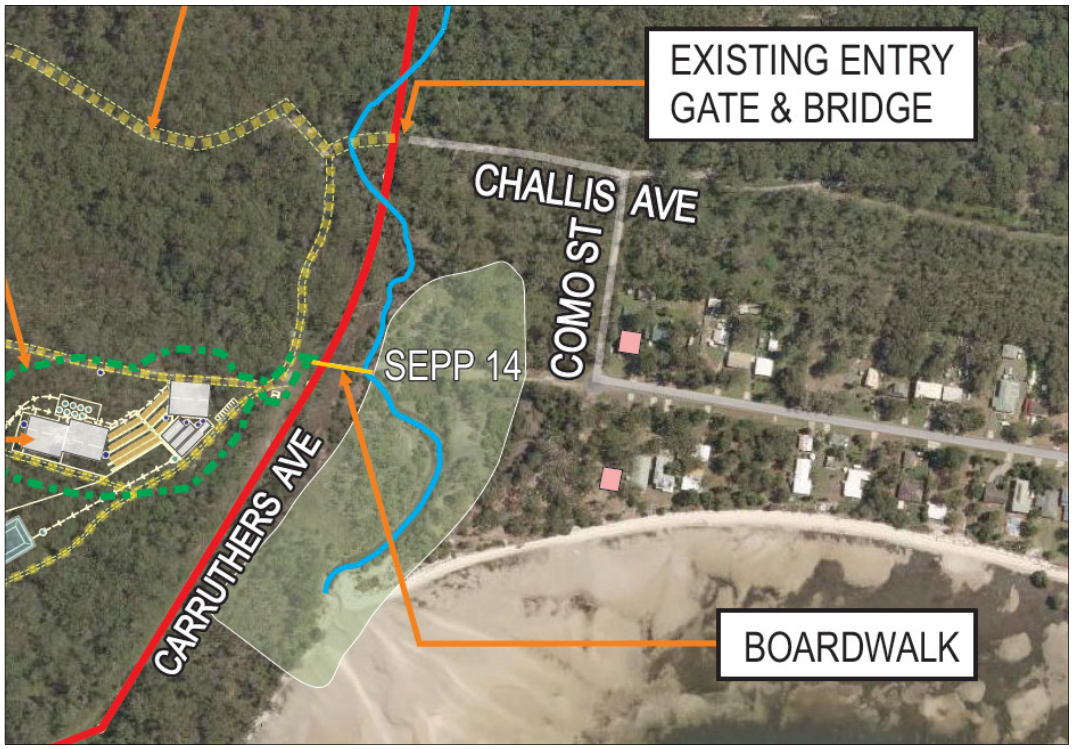



**Figure 15: SEPP 14 Coastal Wetlands Closest to Development (Wetland 757a)**

***(Source: extract from Appendix 3)***

Clause 7(2) provides heads of consideration for the Director-General which should be considered before granting consent to works within SEPP 14 wetlands. The *Statement of*

*Effect on Threatened Flora & Fauna* at **Appendix 13** of this EA provides the following information (pp9-10):

> *…the boardwalk will require only minimal removal of vegetation to allow for holes for the pylons. Some disturbance from illegal vehicle crossings has created an opening enabling the boardwalk to be constructed without the removal of any Mangrove Trees. However a small number of branches may be required to be removed. The boardwalk is to be raised so as to allow the vegetation to grow out from underneath and to allow continued movement through the area by terrestrial and aquatic fauna. The site is likely to overlie Potential Acid Sulphate Soils. However, considering the minimal amount of digging it would not be considered significant. It is recommended that auger holes only be the same diameter as the pylons to minimise the amount of sediment to be removed and the spoil from the holes is to be removed from the site. To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic should not be used. A vegetation management plan recommended for the proposal* (refer **Section 5.8.3** of this EA) *will help ensure the long-term viability of this wetland during and post construction. The egress may also prevent illegal vehicle access to the site.*

The Statement concluded that *given the recommendations the proposal is unlikely to significantly impact this nearby SEPP 14 Wetland* (p91). The recommendations provided are included in the Statement of Commitments at **Section 7** of this EA and will be implemented should the Project be granted approval.

Accordingly, the proposal is considered to be consistent with the aims and objectives of SEPP 14.

#### 4.2.3.2 *State Environmental Planning Policy No. 44 - Koala Habitat Protection*

SEPP 44 aims to promote the conservation and management of areas that provide habitat for koalas, in order to ensure the maintenance of free-living populations.

This SEPP applies to land within the Great Lakes LGA that has an area of over 1 hectare and to which a DA has been made (note that this application comprises a *Part 3A Project Application* rather than a DA). Nevertheless, in order to provide a comprehensive assessment, the provisions of the SEPP are addressed in relation to the Project below.

Clauses 7 and 8 require the consent authority to consider whether the land is 'Potential Koala Habitat' or 'Core Koala Habitat'. These types of habitat are defined below:

> ***potential koala habitat*** *means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.*

> ***core koala habitat*** *means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*

The *Statement of Effect on Threatened Flora & Fauna* (F&F Report) (Wildthing 2013), attached at **Appendix 13** of this EA, addresses these questions as discussed below.

#### *IS THE LAND POTENTIAL KOALA HABITAT?*

The F&F Report notes that 2 species of 'koala feed trees' listed within Schedule 2 were present, largely within the southern portion of the subject site (i.e. *Eucalyptus robusta* [Swamp Mahogany] and *Eucalyptus microrys* [Tallowwood]). These were found to comprise over 15% of the total trees present in some locations, particularly in the southern half of the study area where the proposal is situated. Therefore the subject site was considered to constitute 'Potential Koala Habitat'.

#### *IS THE LAND CORE KOALA HABITAT?*

The F&F Report notes that no koalas were directly observed during fieldwork, either during the current survey or as part of recent surveys. There was evidence of koala activities within the site, in the form of characteristic scratches on tree trunks and a small number of scats. The level of activity appeared to be low, and associated with *E. robusta* specimens in the area of Swamp Sclerophyll Forest within the southern portion of the site (i.e. outside the main farm footprint). The only record of a koala within the site dates back to 1995 (i.e. OEH Wildlife Atlas).

Due to the lack of recent koala sightings and historical records of a population, and the low level of koala activity that appears to occur on the site, it cannot be considered to meet the definition of Core Koala Habitat outlined above. Accordingly, no further provisions of this SEPP apply to the Project, and the preparation of an individual Koala Plan of Management is not required.

Regardless, further discussion on measures to mitigate impacts on koalas is provided in **Section 5.8** of this EA.

### 4.2.3.3 *State Environmental Planning Policy No. 55 - Remediation of Land*

This SEPP aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or the environment.

For the avoidance of doubt, it is noted that this SEPP will only apply in relation to the determination of a *development application* (pursuant to Part 4 of the EP&A Act). As this

Project is a *Major Project Application* (pursuant to Part 3A of the EP&A Act) the SEPP does not apply in this case.

However, it is noted that contamination is not likely to be a significant concern in relation to this Project as the site comprises predominantly undeveloped land. No potentially contaminating activities are known to have occurred within the proposed development footprint, and only minimal excavation works are proposed. Accordingly, the Project will not be inconsistent with the provisions of this SEPP.

#### 4.2.3.4 *State Environmental Planning Policy No. 62 - Sustainable Aquaculture*

SEPP 62 aims to encourage sustainable aquaculture within NSW by permitting it in certain zones, and through the provision of site location and operational requirements for aquaculture development.

##### *CLAUSE 7 - PERMISSIBILITY*

Pursuant to this SEPP, the Project comprises *tank-based aquaculture*, defined as:

> *aquaculture undertaken exclusively in tanks, but not including natural water-based aquaculture*.

Relevant to the Project, clause 7(2) provides that the development of tank-based aquaculture is permissible with consent in:

- zones equivalent to RU1 Primary Production, W1 Natural Waterways and W2 Recreational Waterways;
- only so long as, in the opinion of the consent authority, the development complies with the site location and operational requirements set out in Schedule 1 (i.e. the minimum performance criteria); and
- development is only permissible in the W1 and W2 zones if the development will utilise waterways to source water (as provided within a 'note' within the SEPP).

The Project will be located within the 1(a) Rural zone and W2 Recreational Waterways zone under current local planning legislation. It will also be positioned within the 7(w) Environmental Protection: Waterways zone under the PSLEP 2000 (see **Section 2.3**). The 1(a) and 7(w) zones are 'equivalent zones' to those mentioned above. Water will be sourced from waterways within the W2 zone. Further, the Project complies with the

minimum performance criteria, as outlined in **Table 7** below. Accordingly, the Project is permissible with development consent.

Note that, as outlined in **Section 4.2.3.6**, approval for this Project is sought pursuant to Part 3A of the EP&A Act.

**Table 7: Compliance with Schedule 1 - Minimum Performance Criteria (SEPP 62)**

| Criteria | Compliance |
|---|---|
| **1 Conservation exclusion zones** | |
| *(1) Must not be carried out on land dedicated or reserved under the* National Parks and Wildlife Act 1974. | The land is not so reserved or dedicated. |
| *(2) Must not be carried out on the following land, except to the extent necessary to gain access to water:*<br>*(a) land declared as critical habitat under the* Threatened Species Conservation Act 1995*,*<br>*(b) vacant Crown land,*<br>*(c) land within a wetland of international significance declared under the Ramsar Convention on Wetlands.* | The only 'vacant' Crown land that will accommodate development is the waterbody of Port Stephens. This will be used solely *to the extent necessary to gain water* (i.e. land is proposed to accommodate water pipes). The Project will not be carried out on critical habitat or within a Ramsar wetland. Accordingly, the Project complies. |
| *(3) Must not be carried out on the following land, except for the purposes of minimal infrastructure to support the extraction of water from, and discharge of water to, the land concerned:*<br>*(a) land declared as an aquatic reserve under the* Fisheries Management Act 1994*,*<br>*(b) land declared as a marine park under the* Marine Parks Act 1997. | The site is not located within an 'aquatic reserve', however it is located within the *Port Stephens - Great Lakes Marine Park* (refer to **Section 4.2.4.6**). Regardless, the only components of the Project to be located within the Marine Park are the water pipes. These pipes comprise *minimal infrastructure to support the extraction of water from, and discharge of water to* the farm. Accordingly, the Project complies. |
| **2 Species selection** | |
| *Species of fish or marine vegetation cultivated or kept must be consistent with the relevant aquaculture industry development plan.*<br>*Note- the Aquaculture Industry Development Plan (AIDP) is contained within the *NSW Land Based Sustainable Aquaculture Strategy 2009* | The farming of Blacklip Abalone as proposed complies with the *Key Translocation Principles* outlined in the AIDP (Table 2). The proposed 'tank' based culture method for this species is permissible according to *Table 3 - Species culture methods and constraints.* Accordingly, the Project complies. |
| **3 Intensive pond-based aquaculture - pond design** | |
| *Ponds must be capable of being drained or pumped and then completely dried.* | Although all Abalone will be kept in tanks (i.e. 'tank-based' aquaculture), Settlement Ponds will be utilised to collect marine water before release to the Port. These ponds are able to be completely drained and dried if required. |

| Criteria | Compliance |
|---|---|
| **4 Intensive pond and tank aquaculture freshwater discharges** | |
| *No discharge of freshwater used to intensively cultivate or keep fish to natural waterbodies or wetlands is permitted, except freshwater discharge from open flow through systems.* | No freshwater is proposed to be used for the purposes of Abalone aquaculture (i.e. only marine water will be used). |
| **5 Outlets from culture ponds etc.** | |
| *All outlets from culture ponds, tanks and other culture facilities must be screened to avoid the escape of fish.* | All outlets within the farm facilities will be appropriately screened (i.e. subject to filtration). See **Section 5.4** of this EA. |

### *CLAUSE 10 - AQUACULTURE INDUSTRY DEVELOPMENT PLAN*

Clause 10 of the SEPP provides that the consent authority is to take into consideration the relevant provisions of an aquaculture industry development plan. The *Aquaculture Industry Development Plan* (AIDP) is contained within the *NSW Land Based Sustainable Aquaculture Strategy* published by the NSW Government in 2009 (the 'LBSAS'). The LBSAS is an overarching State-wide aquaculture strategy that encompasses the former *Hunter & Central Coast Sustainable Aquaculture Strategy*.

The purpose of the LBSAS (and therefore the AIDP) is to *detail best practice guidelines which promote ecologically sustainable development (ESD) of the land based aquaculture industry in NSW* (p1).

The project profile analysis chapter of the LBSAS provides a *systematic and rigorous 'sieve' approach to site selection. Government agencies will use this approach when formally assessing a proposed aquaculture venture* (p23). The section **below** addresses this process in detail.

The results of the assessment confirm that the site meets minimum mandatory performance criteria and the proposal is classified as having a 'medium level' risk. This risk is addressed, and mitigation measures outlined, throughout this EA. Accordingly, the provisions of the AIDP have been appropriately considered.

### *PART 3 - DETERMINATION OF ASSESSMENT CATEGORY OF AQUACULTURE DEVELOPMENT*

Part 3 of the SEPP deals with the determination of aquaculture assessment categories. Clause 13 requires that, for the purposes of determining the level of assessment for applications for development consent under this SEPP, the proposed aquaculture development is to be categorised with regard to the *project profile analysis*.

Pursuant to the SEPP, a 'project profile analysis' is:

*a matrix of environmental and operational criteria for ranking the level of environmental risk in relation to site location and operational attributes of aquaculture development. There are to be 3 levels of risk for each attribute (Level 1, 2 or 3 in ascending order of risk).*

A project profile analysis for aquaculture has been reviewed by the Director-General and is contained within the AIDP (i.e. within the LBSAS). The project profile analysis provides the following categories and classes:

*(1) (a) Class 1 - Non-designated development (low-level risk),*

*(b) Class 2 - Non-designated development (medium-level risk),*

*(c) Class 3 - Designated development.*

*(2) The relevant class is to be determined as follows:*

*(a) Class 1 - if all the risk levels in relation to each attribute are Level 1,*

*(b) Class 2 - if all the risk levels in relation to each attribute are Level 2 or Levels 1 and 2,*

*(c) Class 3 - if any risk level in relation to an attribute is Level 3.*

The proposed farm will not be assessed as a *development application (*pursuant to Part 4 of the EP&A Act). Rather, it will be assessed as a *Major Project Application* under Part 3A of the EP&A Act. Accordingly, the level of environmental assessment required is high and will be generally equivalent to or higher than that of designated development. Accordingly, assessment against the project profile analysis to determine a level of assessment is not considered necessary.

Regardless, for the avoidance of doubt, an assessment of the proposal against the project profile analysis for pond and tank aquaculture has been undertaken. Further assessment with regard to *additional criteria for pond aquaculture* has also been undertaken, as the farm will involve the construction of Settlement Ponds. However, these ponds will only be utilised for the holding of water before discharge to the Port, and will not accommodate Abalone at any time.

The assessment is divided into the following categories:

- **Minimum Performance Criteria:** this is the same as the criteria addressed in Schedule 1 of SEPP 62. See **Table 7**, above.
- **Tier 1** (Site Selection Criteria);
- **Tier 2** (Site Selection Criteria);
- **Tier 3** (Operational Selection Criteria);
- **Additional criteria for pond aquaculture**; and;

- **Additional criteria for tank aquaculture**.

Each assessment category, with the exception of the Minimum Performance Criteria, is addressed in detail at **Appendix 14** of this EA.

The results of the assessments indicate that the proposal would predominantly comprise Risk Level 1, with some issues ranked Level 2. Accordingly, the proposal will be considered ***Class 2*** and ***non-designated development (medium level risk)*** pursuant to subclause 13(1) of the SEPP.

### *PART 3A - CONSIDERATION OF EFFECTS ON OYSTER AQUACULTURE*

Clause 15B requires the consent authority to consider any potential impacts of aquaculture on the oyster industry before granting development consent. Clause 15D requires that the provisions of the *NSW Oyster Industry Sustainable Aquaculture Strategy* (OISAS) should be taken into account.

The main aim of the OISAS is to achieve and maintain the sustainable production of premium NSW oyster products into the future. It provides best practice guidelines for the oyster industry and, relevant to this Project, provides for the identification and use of 'priority oyster aquaculture areas' and *the protection of water quality in these areas* (p2).

Port Stephens is a major oyster-producing estuary. According to the OISAS, it contains 861.8ha mapped as 'priority oyster aquaculture areas'. These priority areas include actual / potential leases located within the waters to the east of the subject site, directly south of the village of South Pindimar (see **Figure 16** below). The proposed pipelines cross through an area which formerly accommodated oyster leases, however no infrastructure remains. It is noted that the pipes are separated from the 'priority' oyster areas by at least 335m (approximately 360m from the pipe outlets).

Section 8.4 of the OISAS provides matters for consideration that the consent authority must take into account when considering a development application for development that *because of its proposed location, may affect a priority oyster aquaculture area or oyster aquaculture outside such an area*. The farm adequately addresses these matters, as outlined in **Table 8** below.

### *KEY PROVISIONS OF THE OISAS*

It is considered that the key potential impacts from the farm on oysters relate to water quality impacts, and therefore on health issues. The OISAS notes that, because oysters filter such large volumes of water, they are particularly sensitive to changes in water chemistry. Key sources that may pose a risk to oyster food safety are listed and addressed as follows (p20):

*Sewerage system and septic tank overflows and leaks;*

- *Sewage discharge from vessels;*
- *Re-suspension of contamination sediments;*
- *Stormwater run-off; and*
- *Discharges from industrial premises or agriculture.*

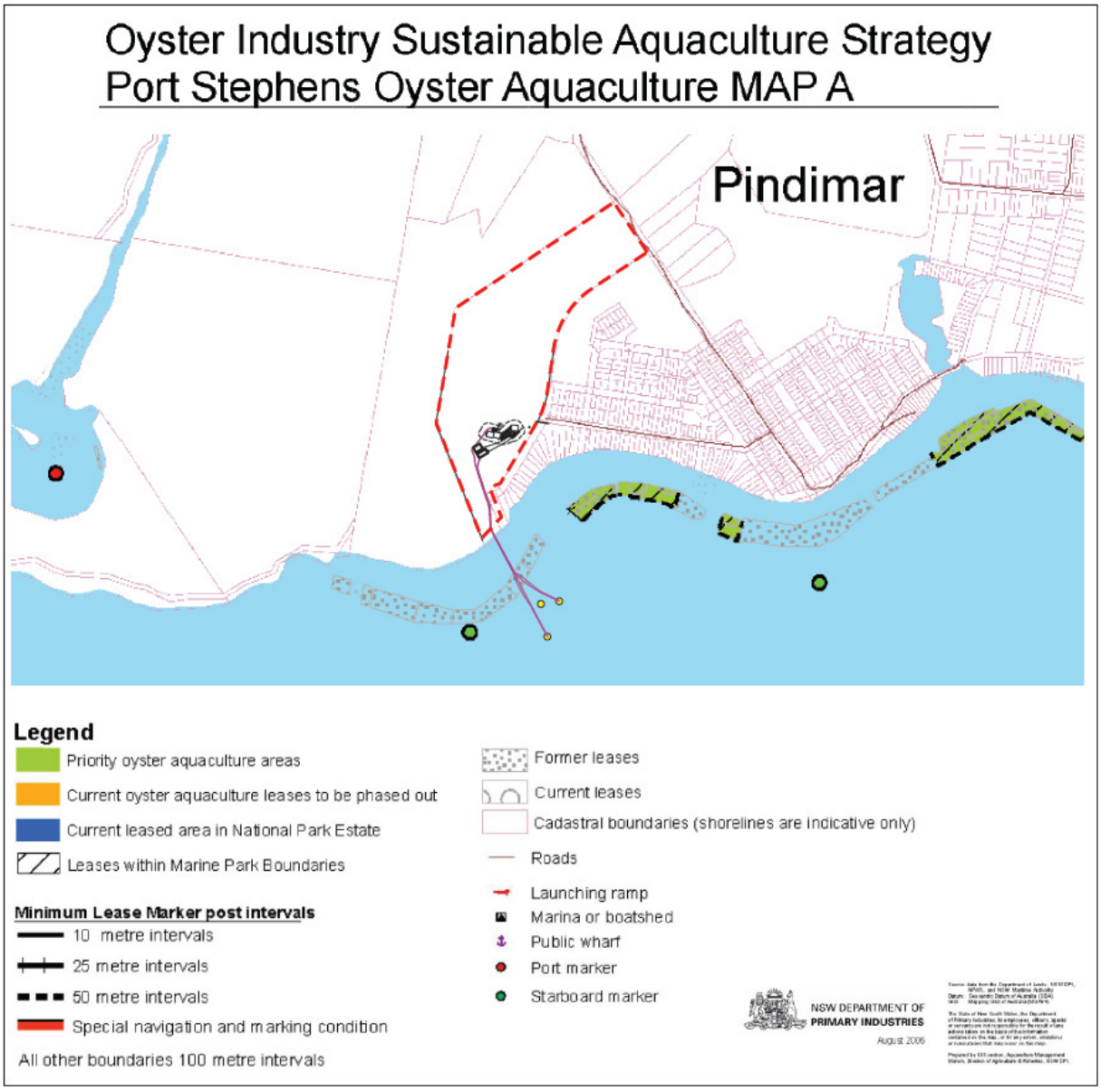



**Figure 16: Port Stephens Oyster Aquaculture Map (OISAS) - Extract**

The farm proposes an on-site pump-out sewerage system to manage the small amount of human waste generated on the farm. This system will be regularly emptied, inspected and maintained. Appropriate stormwater management measures are proposed (see

**Section 5.6**) to ensure there are minimal water quality impacts resulting from stormwater runoff.

There is no known contamination of the seabed in the location of the proposed marine pipes, and so the temporary disturbance associated with pipe placement / construction is not anticipated to result in the re-suspension of contaminated sediments. Details of how marine water releases from the farm will be managed and monitored are addressed at **Section 5.4**. The farm is not likely to result in the release of any disease pathogens which could impact upon oyster health (see **Section 5.3**).

**Table 8: Compliance with DA Matters for Consideration (NSW OISAS)**

| Matter | Comment |
|---|---|
| 1- *Give the Director- General of the Department of Primary Industries written notice of the development application and take into consideration any written submissions made in response to the notice within 14 days after notice was given.* | The DP&I consulted with the NSW Department of Industry & Investment (now Department of Primary Industries) during the formulation of the DGRs and after lodgement of the draft EA. It is anticipated that further consultation will occur during the public exhibition period, as outlined in **Section 6** of this EA. |
| 2- *Take into consideration the provisions of the OISAS.* | The key provisions relevant to this Project are addressed in the following section of this EA. |
| 3- *Consider any issues that are likely to make the development incompatible with oyster aquaculture and evaluate any measures that the applicant has proposed to address those issues. Examples of potential land use incompatibility issues include access to oyster leases being limited by the development or the risk of adverse impacts of the development on water quality and, consequently, on the health of the oysters and on the health of consumers of those oysters.* | The potential impacts of the proposal on water quality and therefore health are addressed throughout this EA. It is not likely that the farm will result in any detrimental effects to oyster leases.<br>The proposed placement of the Intake and Outflow Pipes will not physically interfere with access to the nearby oyster leases.<br>There are not considered to be any other issues that could make the farm incompatible with the viability of healthy oyster leases in close proximity. |

Overall, the farm's operation is not likely to have any detrimental impacts upon water quality.

The OISAS lists 'healthy growth' water quality parameters most likely to be affected by human activity (p21):

- *Suspended solids* i.e. increased turbidity. *Suspended solids levels can be raised by any catchment land use that exposes and leaves soil bare to erosion or by excessive wave wash arising from activities such as power boating within the estuary;*

- *pH- the optimal pH range for oysters appears to be between 6.75 to 8.75…large areas of acid sulphate soils occur in coastal floodplains in NSW and the drainage of acid waters from these areas is a major concern to the oyster industry;*

- *toxic elements and substances,* for example *elevated concentrations of Iron and Aluminium at low pH could cause significant mortality in oysters.*

The farm will not involve the creation of bare, cleared land areas prone to erosion. Appropriate sediment and erosion controls are proposed during both the construction and operational phases of development. The water released from the farm is not likely to contain a significant concentration of suspended solids, due to the rigorous water treatment measures proposed (see **Section 5.4**). Nor is the discharge of water likely to disturb seabed sediment, due to the slightly upward direction of the water outlets and their position above the seabed. Further, the water is not likely to contain any significant concentrations of toxic elements or substances. Acid sulphate soil management is addressed at **Section 5.5**.

In order to ensure the protection of water quality and health for oysters, Section 4.2 of the OISAS provides guidelines for the protection of harvest areas, which should be considered in determining development applications. These key guidelines are addressed in **Table 9** below.

In summary, the potential impacts of the proposal on the environment, including the receiving waters of Port Stephens, have been assessed throughout this EA. Provided recommended mitigation measures are implemented, it is not anticipated that there will be any impacts upon the water quality of Port Stephens, nor on the health or viability of associated oyster leases.

**Table 9: Compliance with Guidelines for Harvest Area Protection (NSW OISAS)**

| Guidelines | Comment |
|---|---|
| **Non Point Sources** | |
| *Riparian zones in agricultural areas fenced to prevent access of livestock to estuary* | No development is proposed in close proximity to riparian areas. No terrestrial livestock, such as cattle, are proposed to be accommodated within the farm site. |
| *Encourage establishment of riparian filters and settlement areas for run-off drainage in landscape with potential high animal faecal/fertiliser/chemical contamination (e.g. livestock, golf link, turf farm)* | The farm does not propose activities that will result in a high potential for fertiliser or faecal contamination. The small volumes of chemicals proposed to be used within the farm will be managed carefully to avoid contamination, as outlined in **Section 3.7.7.9**. The main farm precinct will be separated from Port Stephens |

| Guidelines | Comment |
|---|---|
| | by a distance of at least 200m. Appropriate stormwater management controls are provided at **Section 5.6**. |
| *Elevated monitoring and awareness of septic safe programs in areas adjacent to harvest zones* | An on-site sewage management system is proposed for the farm- sewage will be pumped out and appropriately disposed off-site. This facility will be carefully maintained and regularly inspected, as outlined in **Section 3.7.4.3**. |
| *Marinas and vessel pump out facilities carefully regulated* | N/A |
| *Educational and advisory signs for recreational boating warning of the need to protect sanitary water quality* | N/A |
| *Avoid artificially attracting large numbers of birds into harvest zone* | All Abalone tanks will be located indoors or covered with shadecloth or other material to deter predatory birds. Accordingly, the farm will not behave as a bird attractant. |
| *Investigate the need for exclusion of recreational/ private boating in specific oyster harvest area to protect sanitary water quality if required* | N/A |
| *Inclusion of buffer zones between foreshore sub-divisions and the shoreline* | The farm does not comprise a subdivision. However note there is a separation of at least 200m from the farm and the waters of Port Stephens. |
| **Point Sources** | |
| *Sewer systems improved, maintained and operated so that overflows do not occur as a result of maintenance or operational failure, overflows in dry weather are eliminated or occur only under exceptional circumstances and wet weather overflows are minimised* | The proposed sewerage system will be regularly emptied, maintained and inspected to avoid overflows. |
| *Identification of priority urban storm water drains and installation of suitable treatment systems* | N/A |
| *Priority treatment drains would include those with a catchment from large hard stand car parks and roadway car parks, caravan parks, golf links, subdivision, commercial/ business and shopping centres and industrial areas* | Appropriate stormwater management controls are discussed at **Section 5.6** of this EA. |
| *At source control of stormwater for new developments to reduce stormwater impacts* | Appropriate stormwater management controls are discussed at **Section 5.6** of this EA. |

#### 4.2.3.5 *State Environmental Planning Policy No. 71 - Coastal Protection*

This policy aims to protect, preserve and manage the coastline of NSW. It applies to land within the coastal zone of NSW, within which the subject site is located.

Clause 8 of the SEPP sets out matters which should be taken into account by a consent authority when determining a DA. While the proposal does not comprise a *development application*, these matters have nevertheless been addressed in **Table 10**, following.

Other relevant clauses of the SEPP are addressed below.

In summary, the Project is considered to comply with the provisions of SEPP 71.

- **Clause 14 – Public access:** The bulk of the farm's built components will be set significantly back from the foreshore. The only development within the foreshore will be the Intake and Outflow pipes, which will be buried within the intertidal area and so will not impede public access during operation. Any access restrictions which may occur during construction of the pipeline will be temporary and short-term, and will be managed via an appropriate *Construction Management Plan* (see **Section 7** of this EA).
- **Clause 15 – Effluent disposal**: The farm will produce negligible sewage effluent. Wastewater from the single toilet and sinks will be disposed of via an appropriately licensed pump-out sewage system located several hundred metres from the foreshore, which is not likely to have any impact upon the water quality of Port Stephens. The marine water discharged from the farm will be appropriately treated to ensure there is no significant impact upon water quality. See **Section 5.4** for further discussion.
- **Clause 16 – Stormwater:** Appropriate stormwater management controls are proposed to manage surface water runoff from the site. Refer to **Section 5.6** of this EA.

**Table 10: Compliance with Clause 8- Matters for Consideration (SEPP 71)**

| Clause | Comment |
|---|---|
| *(a) the aims of this Policy set out in clause 2,* | The Project will not interfere with public access along the coastal foreshore, nor impact upon visual amenity, as the proposed pipes connecting to Port Stephens will be buried within the intertidal area. Accordingly, no part of the farm is likely to be readily visible from the public foreshore. See **Section 5.14** of this EA for further discussion.<br>The proposal is not likely to significantly impact upon |

| Clause | Comment |
|---|---|
| | marine or terrestrial native vegetation, as outlined in **Section 5.8** and **Section 5.9** of this EA. Nor will it significantly impact upon the marine environment or water quality of Port Stephens and therefore its recreational, cultural or economic attributes.<br>The design of the Project ensures that there will be no impacts upon identified Aboriginal heritage values, including a shell midden along the foreshore (refer to **Section 5.10**).<br>Accordingly, the Project is considered to be compliant with the SEPP's objectives. |
| *(b) existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved,* | The bulk of the farm's built components will be set significantly back from the foreshore. The only development within the foreshore will be the Intake and Outflow pipes, which will be buried within the intertidal area and so will not impede public access during operation. No formalised access paths currently exist along the foreshore. It is not considered appropriate for the farm to propose the development of new or improved public access paths through the farm or along the beach. |
| *(c) opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability,* | No formalised access paths currently exist along the foreshore. It is not considered appropriate for the farm to propose the development of new or improved public access paths through the farm or along the beach. |
| *(d) the suitability of development given its type, location and design and its relationship with the surrounding area,* | The Project is considered suitable for the reasons outlined **Section 3.5** of this EA. It is noted that no part of the farm is likely to be readily visible from a public place. |
| *(e) any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore,* | The only development within the foreshore will be the Intake and Outflow pipes, which will be buried within the intertidal area and will not generally be visible. Due to the retention of the existing vegetation, no part of the farm is likely to be readily visible from a public place. No overshadowing of the foreshore will occur. |
| *(f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities,* | As the development is not likely to be readily visible from any public place, it will not have any impacts upon the scenic quality of the coast |
| *(g) measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats,* | The farm will result in the removal of only a small area of vegetation, due to careful design. The *Statement of Effect on Threatened Flora and Fauna* (**Appendix 13**) concludes that the proposal will not have a significant detrimental impact on threatened species or their habitats. Regardless, the permanent conservation of an area of over 5ha in the northern part of the site is proposed to compensate for vegetation clearing, as outlined in **Section 5.8.** |

| Clause | Comment |
|---|---|
| *(h) measures to conserve fish (within the meaning of Part 7A of the Fisheries Management Act 1994) and marine vegetation (within the meaning of that Part), and their habitats* | A range of measures are proposed to minimise and mitigate any impacts on aquatic habitats and marine vegetation- see **Section 5.9**. |
| *(i) existing wildlife corridors and the impact of development on these corridors,* | There are not likely to be any significant impacts on wildlife corridors, as outlined in **Section 5.8.2**. |
| *(j) the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards,* | There are not likely to be any significant impacts from coastal processes on farm operations - see **Section 5.17**. |
| *(k) measures to reduce the potential for conflict between land-based and water-based coastal activities,* | The proposed pipes will be buried within the intertidal area and so will not impede any land-based activities. Measures to minimise risk of boating conflict (e.g. anchor entanglement) are outlined in **Section 5.19**. |
| *(l) measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals,* | A probable Aboriginal shell midden has been identified adjacent to the coastline. The proposed pipelines will be placed to ensure that the midden will not be impacted upon or disturbed. Further discussion on Aboriginal heritage is provided at **Section 5.10** of this EA. |
| *(m) likely impacts of development on the water quality of coastal waterbodies,* | There is not likely to be any significant impact on the water quality of Port Stephens from farm operations, as outlined in **Section 5.4**. |
| *(n) the conservation and preservation of items of heritage, archaeological or historic significance,* | As discussed above, the Aboriginal midden located along the foreshore will be protected from impacts associated with the proposal. |
| *(o) only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities,* | Not applicable. |

#### 4.2.3.6 *State Environmental Planning Policy (Major Development) 2005*

The Major Development SEPP facilitates the protection and development of sites of special significance to the State.

In summary, the SEPP provides for the assessment of the Project under Part 3A of the EP&A Act, despite the repeal of Part 3A. The relevant provisions of this SEPP are discussed further below.

#### *IDENTIFICATION AS A MAJOR PROJECT*

Relevant to this proposal, Clause 6 of the Major Development SEPP provides that *development that, in the opinion of the Minister, is development of a kind…that is described in Schedule 1…is declared to be a project to which Part 3A of the Act applies.*

The Project comprises aquaculture development located partially within *environmentally sensitive areas of State significance,* relevantly defined as being within *coastal waters of the State* and *a marine park under the* Marine Park Act 1997. Accordingly, pursuant to Section 2(2) of Schedule 1, the Project is considered to be subject to Part 3A of the EP&A Act.

This view was confirmed by the Minister for Planning, who provided an opinion confirming the applicability of Part 3A of the Act to the Project on 17 October 2007. A copy of this opinion is attached at **Appendix 9** of this EA.

#### *RELATIONSHIP TO PART 3A OF THE EP&A ACT*

Clause 2A of the Major Development SEPP provides that *on the repeal of Part 3A of the Act, this policy is subject to Schedule 6A to the Act*. As discussed in **Section 4.2.1**, Part 3A of the EP&A Act has been repealed. Schedule 6A generally provides for the continuation of the assessment of Transitional Part 3A projects- see **Section 4.2.1** for further discussion.

This Clause also provides that the repeal of certain clauses of the Major Development SEPP (which occurred from the commencement of *State Environmental Planning Policy [State and Regional Development] 2011*) do not affect the declaration of a Part 3A project if it is a Transitional Part 3A project.

Accordingly, the historical version of this SEPP dated 5 August 2011- 30 September 2011 is the relevant version for matters related to Part 3A of the EP&A Act, and is the version referred to within this EA.

### 4.2.3.7 *State Environmental Planning Policy (State & Regional Development) 2011*

This SEPP was introduced in September 2011 to allow for the assessment and determination of major projects upon the repeal of Part 3A of the EP&A Act.

Under Clause 8(a), this Project would be declared to be *State significant development*, as it is not permissible without development consent and is listed under Schedule 1 of the SEPP (i.e. *development for the purpose of aquaculture located in an environmentally sensitive area of State significance*).

However, as this Project is already considered to be a 'Transitional Part 3A' project (as discussed in **Section 4.2.1** of this EA), it will continue to be assessed under Part 3A of the EP&A Act. Therefore the provisions of this SEPP do not apply in this case.

### 4.2.4 ADDITIONAL STATE LEGISLATION

#### 4.2.4.1 *Crown Lands Act 1989*

The *Crown Lands Act 1989* aims to ensure that Crown Land is managed for the benefit of the people of NSW.

As outlined in **Section 2.3.2** of this EA, marine pipes are proposed to extend into Port Stephens, which is owned by the Crown. Pursuant to Section 34 of the *Crown Lands Act*, a license to occupy this land will be sought should the Project be granted approval.

#### 4.2.4.2 *National Parks & Wildlife Act 1974*

The *National Parks & Wildlife Act 1974* (NPW Act) governs the establishment, preservation and management of national parks, historic sites and certain other areas, and the protection of certain fauna, native plants and Aboriginal relics.

With regard to this Project, the NPW Act provides for the protection of Aboriginal relics. Under section 86 of the Act, it is an offence to 'harm' an Aboriginal object. As outlined in **Section 5.10** of this EA, a likely Aboriginal midden has been identified within the subject site. However, the farm has been designed to avoid this location and therefore avoid any harm to the object. An assessment prepared for the site (**Appendix 15**) concluded that there are unlikely to be any impacts on Aboriginal heritage.

Accordingly, no permits or further consideration under the Act is required in this regard.

#### 4.2.4.3 *Native Vegetation Act 2003*

The *Native Vegetation Act 2003* (NV Act) provides for the management of native vegetation in NSW, and requires approval for most broadscale clearing undertaken within the State.

However, as the proposal is to be assessed under Part 3A of the EP&A Act (and pursuant to Section 75U[1][e] of the EP&A Act), an approval to clear native vegetation under the NV Act is not applicable to approved Part 3A projects. Therefore no provisions of this Act apply to this Project, as approval for proposed clearing is being sought as part of the overall Part 3A Project.

It is noted that vegetation clearing is addressed in **Section 5.8** of this EA.

#### 4.2.4.4 *Coastal Protection Act 1979*

The *Coastal Protection Act 1979* (CP Act) aims to provide for the protection of the coastal environment of NSW for the benefit of present and future generations. The subject site is identified as being within the 'coastal zone'.

Part 3 of the CP Act deals with the use of the coastal zone, and provides that concurrence from the Minister should be sought with regard to certain development in this area. However, as the Project is a Part 3A project, such concurrence is not required, pursuant to Division 4 of Part 3A of the EP&A Act.

#### 4.2.4.5 *Protection of the Environment Operations Act 1997*

The *Protection of the Environmental Operations Act 1997* (POEO Act) provides for environmental protection within NSW, in particular with regard to the regulation of 'polluting' activities. The implementation of the Act is overseen by the NSW Environmental Protection Authority (EPA).

The POEO Act provides a regulatory framework for the licensing of all activities listed in Schedule 1 to the Act; that have the potential to impact on the environment. Such scheduled activities require that an Environment Protection License (EPL) is sought and obtained. Section 3 relates to *Aquaculture and Mariculture* and provides the following:

> *(1) This clause applies to aquaculture and mariculture, each meaning the commercial production of marine, estuarine or freshwater organisms, including aquatic animals and plants but excluding oysters, being an activity that involves:*
>
> *(a) supplemental feeding in tanks or artificial waterbodies, and*
>
> *(b) the discharge of effluent, liquid sludge or other waste water into natural waterbodies, including discharge by means of a pipe, drain, drainage depression, canal or other form of conveyance.*
>
> *(2) Each activity to which this clause applies is declared to be a scheduled activity.*
>
> *(3) In this clause, natural waterbody includes any river, stream, lake, lagoon, swamp, wetland or watercourse (including any natural watercourse that has been artificially modified) or tidal waters (including the sea).*

As the Abalone within the farm will require supplemental feeding and water from the farm (albeit treated) will be released into the natural waterbody of Port Stephens, an EPL is required to be obtained. The EPL will be sought should the Project be approved. These

licences are required to be reviewed every 5 years, and are subject to the completion of an Annual Return Report.

It is noted that, pursuant to Division 4 of Part 3A of the EP&A Act, the issuing of an EPL cannot be refused if it is necessary for the carrying out of an approved project and it is to be substantially consistent with the conditions of the project approval.

#### 4.2.4.6 *Marine Parks Act 1997*

The *Marine Parks Act 1997* (MP Act) provides a regulatory framework for the declaration and management of marine parks in NSW. As outlined within **Section 2.4.2** of this EA, the area of Port Stephens into which the farm will extend forms part of the Port Stephens – Great Lakes Marine Park.

Section 19 of the MP Act contains provisions for development in or affecting marine parks, however these provisions only apply to development pursuant to Part 4 of the EP&A Act and activities under Part 5 of the EP&A Act. As the Project is a Part 3A project, these provisions do not appear to apply. Regardless, the objectives of the MP Act are addressed, as required under the *Marine Parks Regulation 1999*, in **Section 4.2.4.7** of this EA, below.

#### 4.2.4.7 *Marine Parks Regulation 1999 & Marine Parks (Zoning Plans) Regulation 1999*

The *Marine Parks Regulation 1999* supports the *Marine Parks Act 1997*.

Clause 9 of the MP Regulation sets out the assessment criteria which are to be considered before granting consent to the carrying out of any activity in a marine park.

The location of the subject site and proposed development in relation to the Marine Park zones is illustrated in **Figure 17** below. The proposed pipes will be separated from the Sanctuary Zone by a minimum distance of approximately 135m, and at least 415m separates the boundary from the pipe outlets.

It is noted that consent for the undertaking of activities within the Marine Park is not required under the *Marine Parks Act 1997*, as the Project is subject to Part 3A of the EP&A Act (see **Section 4.2.4.6** above). Nevertheless, in order to provide a thorough assessment, the 'assessment criteria' under Clause 9 are addressed in **Table 11** below.

Note that the zoning provisions of the Port Stephens-Great Lakes Marine Park are set out in the *Marine Parks (Zoning Plans) Regulation 1999*.

In summary, the Project is consistent with the provisions of both of the Marine Parks Regulation instruments.

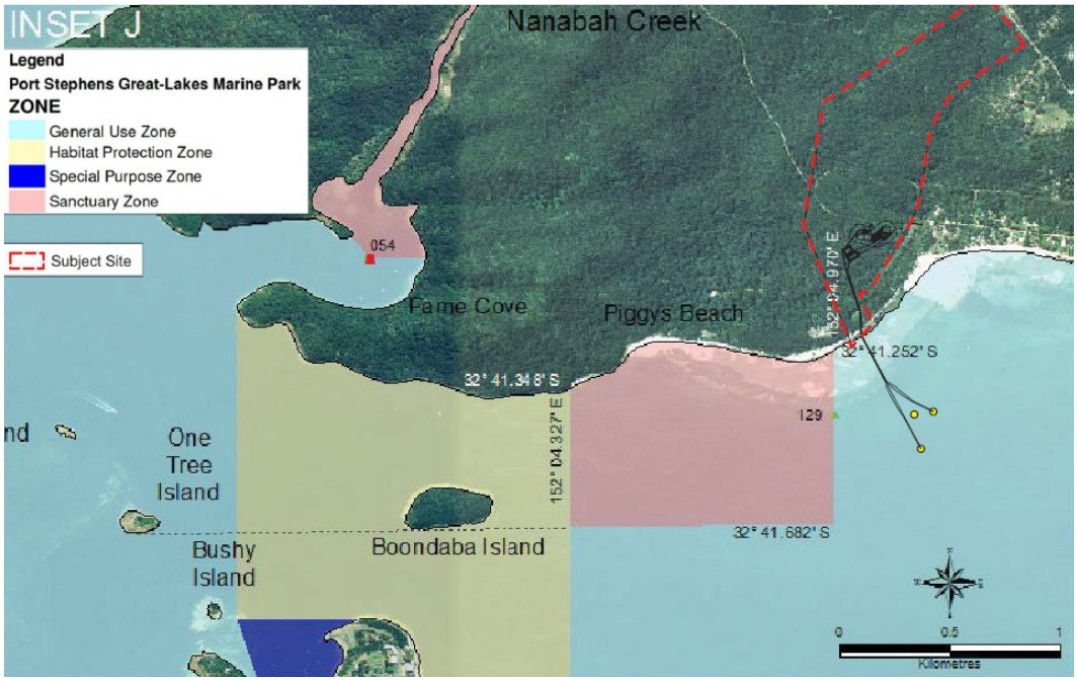



**Figure 17: Port Stephens- Great Lakes Marine Park- Subject Site & Proposed Development**

**Table 11: Compliance with Assessment Criteria (Marine Parks Regulation 2009)**

| Clause | Comment |
|---|---|
| *(a) the objects of the Act* | The Act aims to conserve biological diversity, marine habitats and ecological processes in marine parks, whilst providing for the ecologically sustainable use of fish and vegetation and the use/ appreciation of the park by the public.<br>The potential impacts of the farm have been addressed throughout this EA. Providing that the mitigation measures recommended within the EA are implemented, the farm is not likely to have any detrimental impacts upon the sustainability or use of the marine park. Accordingly, the proposal is considered to be consistent with the objectives of the MP Act. |
| *b) the objects of the zone in which the activity is proposed to be carried out* | As outlined in **Section 2.4.2** of this EA, the farm proposes the placement of pipes within Port Stephens, and therefore the marine park. The area in which this will occur is within the 'General Use Zone' of the Marine Park (see **Figure 17**). The objects of the General Use Zone are provided in the *Marine Parks (Zoning Plans) Regulation 1999*, and are as follows :<br>*(a) to provide protection for biological diversity, habitat, ecological processes, natural features and cultural features (both Aboriginal and non-Aboriginal) in the zone, and*<br>*(b) where consistent with paragraph (a), to provide opportunities for recreational and commercial activities (including fishing), scientific research, educational activities and other activities so long as they are ecologically* |

| Clause | Comment |
|---|---|
| | *sustainable.*<br>Again, the potential impacts of the farm have been addressed throughout this EA. Providing that the mitigation measures recommended within the EA are implemented, the farm is not likely to have any detrimental impacts upon the sustainability or use of the marine park. Accordingly, the proposal is considered to be consistent with the objectives of the General Use Zone. |
| *(c) the activities that are permissible in the zone in which the activity is proposed to be carried out (as specified in the relevant zoning plan)* | Clause 1.21 of the *Marine Parks (Zoning Plans) Regulation 1999* provides that 'aquaculture' is permissible in the General Use Zone of a marine park. |
| *(d) any operational plan for the marine park adopted by the Authority pursuant to section 25 (4) of the Act* | The *Port Stephens – Great Lakes Marine Park Operational Plan 2010* is the adopted operational plan for the area. Generally, it provides management actions in response to marine park legislative objectives, including the adequate assessment of development applications within marine parks and the maintenance of marine habitats and water quality.<br>The potential impacts of the farm have been addressed throughout this EA. Providing that the mitigation measures recommended within the EA are implemented, the farm is not likely to have any detrimental impacts upon the sustainability or use of the marine park. Accordingly, the farm is not inconsistent with the provisions of the Operational Plan. |
| *(e) any threatened species or other protected flora or fauna under the* Fisheries Management Act 1994, the National Parks and Wildlife Act 1974 or the Threatened Species Conservation Act 1995 *that may be affected by the proposed activity* | A detailed *Statement of Effect on Threatened Flora and Fauna* has been prepared (**Appendix 13**), relating primarily to terrestrial species. This Statement concludes there are not likely to be any significant impacts upon threatened species as a result of the farm.<br>An *Aquatic Ecology Assessment* has also been prepared in relation to the farm (**Appendix 16**), which addresses potential impacts on marine and aquatic threatened species. The Assessment also concludes there are not likely to be any significant impacts upon threatened species as a result of the farm. |
| *(f) the form of transport to be used to gain access to the zone in, on or from which the activity is proposed to be carried out, having regard to the adequacy of facilities for parking, mooring and landing vehicles, vessels and aircraft, and for loading and unloading them* | Access to the subject site will be via existing public roads. The only form of development proposed within the Marine Park comprises the placement of the Intake and Outflow pipes, including their 'construction' and regular inspection and maintenance during operation. Access to the pipes will occur either via boat (which will be launched from an established public jetty) or via established trails within the subject site. |
| *(g) the type of equipment to be used in connection with the proposed activity* | The proposed construction methods associated with the pipes are outlined in **Section 3.7.3.4** of this EA. |
| *(h) the arrangements that have been made for the making good of any damage to the marine park that arises from the* | Specific arrangements with regard to the making good of any damage to the Marine Park have not yet been negotiated. Such discussions are anticipated to take place should the Project gain approval. |

| Clause | Comment |
|---|---|
| *proposed activity* | |
| *(i) such other requirements as the relevant Ministers consider appropriate to the proposed activity* | Detailed environmental assessment requirements have been provided for this Project in the DGRs attached at **Appendix 1** of this EA. |

### 4.2.4.8 *Fisheries Management Act 1994*

The objectives of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of NSW.

Section 37 of the FM Act requires that a permit is required to take and/or possess Abalone broodstock for aquaculture purposes, in excess to the legal bag limit. Such a permit will be sought and obtained as required should the Project be granted approval.

Section 144 provides that aquaculture is prohibited except in accordance with a permit. Such a permit will be sought and obtained should the Project be granted approval. It is noted that, as the Project is being considered pursuant to Part 3A of the EP&A Act, an aquaculture permit cannot be refused if it is necessary for carrying out an approved project and is to be substantially consistent with the Project Approval.

Section 201 provides that a permit is necessary for any dredging work. 'Dredging work' could include the proposed burial of pipes within the intertidal zone of Port Stephens, as proposed. Section 205 requires that a permit is also necessary to 'harm' vegetation, such as is proposed via the trimming of mangroves and transplanting of seagrasses (if necessary- see **Section 5.9**) to accommodate the pipelines. However, as the Project is subject to Part 3A of the EP&A Act, the obtaining of such a permit is not required should the Project be approved.

### 4.2.4.9 *Water Management Act 2000*

The *Water Management Act 2000* (WM Act) provides for the management of the water resources of the State for both the present and future generations.

It is noted that no surface water or groundwater extraction is proposed as part of the Project. However, a boardwalk is proposed to be constructed over Pig Station Creek and parts of the development (i.e. Pumphouse and pipes) will be located within close proximity to a watercourse (i.e. Port Stephens). Normally the obtaining of permits will be required to allow for such development.

However, as the Project is being assessed under Part 3A of the EP&A Act, a water use approval under section 89 of the WM Act, a water management work approval under section 90 or an activity approval under section 91 are not required.

It should be noted that the main farm development area is located in excess of 40m from any defined watercourses (with the exception of the works listed above). Those works within 40m of the watercourses will be undertaken in accordance with the relevant NSW Office of Water guidelines where applicable.

#### 4.2.4.10 *Rural Fires Act 1997*

The *Rural Fires Act 1997 (*RF Act) primarily aims to provide for the prevention, mitigation and suppression of bush and other fires throughout the State. It is supported by the provisions of the *Rural Fires Regulation 2008*.

No provisions of this Act are specifically relevant to the obtaining of approval for this Project. For clarification purposes it is noted that, as the Project is to be assessed under Part 3A of the EP&A Act, the obtaining of a bush fire safety authority under Section 100B of the RF Act will not be required regardless of the type of development proposed, pursuant to Section 75U(1)(g) of the EP&A Act.

#### 4.2.4.11 *Threatened Species Conservation Act 1995*

The *Threatened Species Conservation Act 1995* (TSC Act) aims to maintain ecological diversity and promote ecological sustainable development. It provides for the conservation of threatened species, populations and ecological communities of animals and plants.

Schedules 1 and 2 of the TSC Act list threatened species and ecological communities, and the TSC Act provides that consideration of such species is made in relation to proposed development.

A detailed *Statement of Effect on Threatened Flora and Fauna* and *Aquatic Ecology Assessment* has been prepared in relation to this Project (**Appendix 13** and **Appendix 16**). They conclude that, provided mitigation measures recommended within the EA are implemented, there are not likely to be any significant impacts upon threatened species, communities or their habitat.

#### 4.2.4.12 *Heritage Act 1977*

The *Heritage Act 1977* generally aims to promote and conserve the non-Aboriginal heritage of NSW. The *Heritage Act* is administered by the NSW Heritage Office, and provides for the listing and protection of items of heritage significance.

No items of non-Aboriginal heritage significance are known to occur within the subject site or additional associated areas. Accordingly, the provisions of this Act do not apply.

## 4.3 Local Matters

### 4.3.1 GREAT LAKES LOCAL ENVIRONMENTAL PLAN 1996

The subject site is located within the Great Lakes LGA, which extends to the Mean High Water Mark of Port Stephens. The principal instrument for controlling development within the Great Lakes LGA is the *Great Lakes Local Environmental Plan 1996* (GLLEP 1996).

#### *GENERAL OBJECTIVES*

The aims and objectives of the GLLEP 1996 are outlined below:

*(1) The aims of this plan are:*

*(a) to provide an updated and simplified plan for the area of Great Lakes, and*

*(b) to protect and enhance the environmental qualities of the area, and*

*(c) to facilitate the orderly and economic development of land within the area, and*

*(d) to promote the well-being of the area's population.*

*(2) The objectives of this plan are:*

*(a) to provide a land use framework to guide the future use of the land within the area of Great Lakes, and*

*(b) to provide a basis for the preparation of detailed development control plans, and*

*(c) to protect environmentally sensitive areas and the heritage of the area, and*

*(d) to improve opportunities for ecologically sustainable development, and*

*(e) to provide for the cultural needs of and the equitable provision of services and facilities for the community.*

The proposal for an Abalone farm has been carefully assessed throughout this EA in terms of its potential impacts upon the environmental, social and heritage values of the area. Anticipated benefits include the creation of jobs and flow-on economic benefits within the local economy; and assistance in meeting the increasing demand for Abalone

products, which may subsequently help to reduce fishing pressures on wild Abalone populations. Provided that the management and mitigation measures recommended within this EA are implemented, the impacts of the proposal upon the environment will be appropriately managed. Accordingly, the Project is considered to be consistent with the aims and objectives of the GLLEP 1996.

### *ZONING & PERMISSIBILITY*

The subject site is zoned 1(a) Rural, as shown in **Figure 5**. The 'boardwalk area', as described within **Section 2.3.2** of this EA, is also zoned 1(a) Rural.

The 'marine pipe area' is subject to the provisions of the *Port Stephens Local Environmental Plan 2000* and *Port Stephens Local Environmental Plan 2013* and is discussed separately in **Section 4.3.2** and **Section 4.3.3** of this EA.

Under the GLLEP 1996, the proposed Abalone farm can be described as a form of 'aquaculture', defined below:

> ***Aquaculture*** *means the cultivation (including propagating and rearing) of the living resources of the sea or inland waters, whether or not that cultivation is carried out in a farm established for that purpose using an artificially created body of water.*

Aquaculture is a form of 'agriculture' under the GLLEP 1996. As 'agriculture' is permissible with development consent in the 1(a) Rural zone, the farm is also permissible with consent. The proposed boardwalk is considered to be development ancillary to a permissible use (i.e. aquaculture) and will therefore also be permissible with consent.

The objectives of the 1(a) Rural zone are as follows:

> *To restrict development to those uses which are unlikely to:*
>
> *(a) prejudice in a significant manner the agricultural production potential of land within the zone, and*
>
> *(b) generate significant additional traffic, or create or increase a condition of ribbon development on any road, relative to the capacity and safety of the road, and*
>
> *(c) have an adverse impact on the area's water resources, and*
>
> *(d) create unreasonable or uneconomic demands for the provision or extension of public amenities or services.*

The proposed farm will result in the efficient and effective use of agricultural land on the site, which will not prejudice any other existing or likely agricultural use. The likely traffic impacts of the proposal have been investigated, and are anticipated to comprise a typical maximum of around 12 x two-way vehicle trips per day (see **Section 5.11** of this EA).

This level of traffic is not considered to be sufficient to significantly impact upon the safety, amenity or capacity of the local road network.

Provided the management measures recommended within this EA are implemented, the proposal is unlikely to have any detrimental impacts upon the freshwater resources of the area, nor on the marine water resources of Port Stephens. The extension to public amenities and services required by the proposal (e.g. electricity connection) will be at the cost of the developer and will no way create unreasonable or uneconomic demands on the local community.

Accordingly, the Project is considered consistent with the objectives of the 1(a) Rural zone.

### *ADDITIONAL RELEVANT CLAUSES*

The additional clauses outlined in **Table 12**, below, also have some relevance to the Project. Each clause is discussed and the proposal's compliance considered.

In summary, the Project is consistent with the provisions of the GLLEP 1996.

**Table 12: Compliance with Additional Relevant Clauses (GLLEP 1996)**

| Clause | Comment |
|---|---|
| 10 - Tree Preservation | This clause provides that certain trees may not be damaged without the consent of Council.<br>The farm will require the removal of approximately 65 trees. Consent for this clearing is being sought pursuant to Part 3A of the EP&A Act. |
| 11 - Land Form Modification | This clause provides that filling or excavation of land should only occur with the consent of Council, and so long as it does not significantly affect the natural and existing built environment.<br>Some excavation works are proposed (e.g. creation of Settlement Ponds). No existing built development exists close to excavation, and so none will be impacted. As outlined in **Section 5** of this EA, stormwater impacts of the farm have been carefully considered, including sedimentation and erosion impacts associated with construction/ excavation works. The potential for Acid Sulphate Soils has been considered and addressed, and there are not considered likely to be any impacts on Aboriginal heritage. Any excess fill will be appropriately re-used on site, or disposed of at an appropriately licensed landfill. Accordingly, the excavation is not likely to significantly affect the environment. |
| 12 - Services | This clause provides that all development should have adequate water and sewerage services before being granted consent.<br>The farm is proposed to use a pump-put sewerage system to manage wastewater, and rainwater tanks to provide freshwater needs. The management of stormwater runoff has been addressed through the preparation of a *Stormwater Management Plan* (**Appendix 17**). Considering the nature of the farm, these services are considered |

| Clause | Comment |
|---|---|
| | adequate. |
| 14B - Buildings associated with Agriculture | This clause provides that buildings associated with agriculture must not be erected without the consent of Council.<br>Consent for the farm development is being sought pursuant to Part 3A of the EP&A Act. |
| 21 - Heritage | This clause provides that impacts upon Aboriginal heritage significance should be appropriately considered before consent is granted to development of a known or potential archaeological site.<br>A likely Aboriginal midden has been identified on the site. A detailed assessment of the impacts of the farm on Aboriginal heritage significance is provided in **Section 5.10** of this EA. Results of assessment indicate the farm will not have any impacts upon Aboriginal heritage.<br>No other item of Aboriginal or Non-Aboriginal heritage significance has been identified on the site. |

#### 4.3.1.1 *Draft Great Lakes Local Environmental Plan 2013*

Great Lakes Council (GLC) exhibited its Draft Great Lakes Local Environmental Plan 2013 ('Draft GLLEP') from 14 June 2012 to 24 August 2012. While there is no provision within the EP&A Act for this Project to have regard to the provisions of a draft LEP, the key relevant provisions are briefly considered below:

- The subject site is proposed to be zoned RU2 Rural Landscape, as shown in **Figure 18** below. This zone is basically equivalent to the 1(a) Rural zone pursuant to the GLLEP 1996. The use of land for 'agriculture', which includes 'aquaculture', remains permissible with development consent.
- An area of Port Stephens, beyond the boundaries of the subject site, is proposed to be zoned W2 Recreational Waterways (see **Figure 18**). As the Port Stephens LGA begins at the Mean High Water Mark of the Port, it is assumed that this zoning applies to land above the Mean High Water Mark. The development of 'aquaculture' is permissible with consent in the W2 zone.
- Clause 5.5 provides heads of consideration for development within the coastal zone. It is considered that the Project has adequately considered such issues, as demonstrated in **Section 4.2.3.5** (i.e. SEPP 71) of this EA.

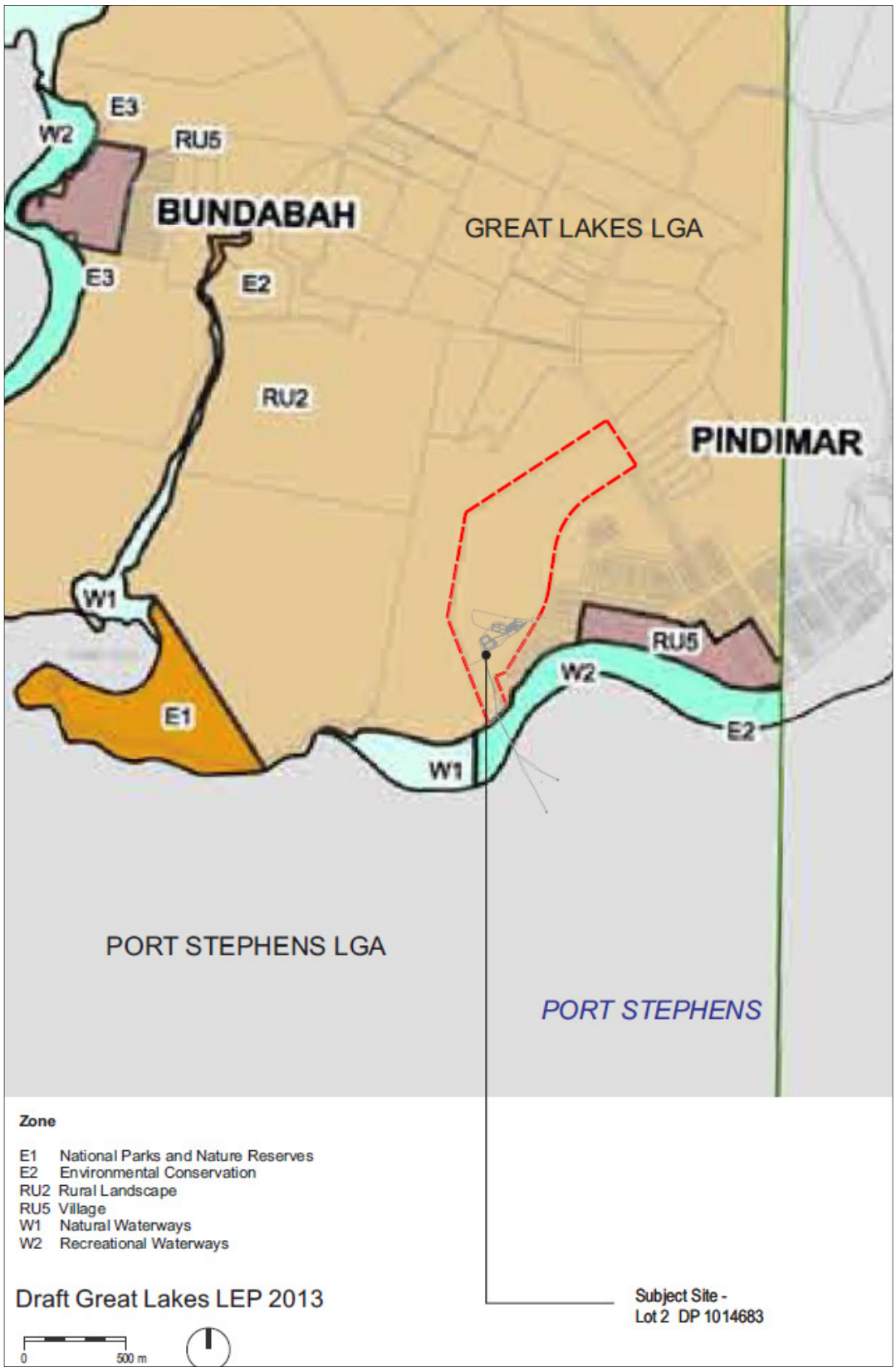



**Figure 18: Draft Great Lakes LEP 2013 Zoning - Subject Site & Proposed Pipe Extent**

- Clause 5.7 (*Development below mean high water mark*) provides that development consent is required for any development carried out on land covered by tidal waters. Approval of this Project is being sought pursuant to Part 3A of the EP&A Act.
- Clause 7.1 deals with acid sulphate soils matters. This issue is addressed in detailed at **Section 5.5** of this EA- the proposal complies.
- Watercourses have been identified adjacent to the subject site (i.e. Pig Station Creek and the foreshore of Port Stephens). Clause 7.5 provides heads of consideration for identified watercourses and associated riparian land. The proposed development of a boardwalk in association with Pig Station Creek has been considered as part of this EA. This assessment is considered adequate to address the provisions of Clause 7.5.
- Clause 7.6 provides heads of consideration with regard to stormwater and water sensitive design. It is considered that the assessment within this EA adequately addresses these issues.
- Clause 7.10 provides for the continuation of public access along the foreshore. The Project will allow for the maintenance of free access along the foreshore.
- The Draft LEP contains similar provisions to the GLLEP 1996 with regard to preservation of trees and vegetation, earthworks, essential services, flood planning, and heritage conservation. It is considered that the Project adequately addresses these issues.

In summary, it is considered that the Project is not inconsistent with the provisions of the Draft GLLEP.

### 4.3.2 PORT STEPHENS LOCAL ENVIRONMENTAL PLAN 2000

The Port Stephens LGA begins at the Mean High Water Mark of Port Stephens, and extends into the Port Stephens waterway. Parts of the proposed development (i.e. Intake and Outflow pipes) will therefore extend into the Port Stephens LGA ('marine pipes area'). The principal instrument for controlling development within the LGA was the *Port Stephens Local Environmental Plan 2000* (PSLEP 2000) at the time of lodgement of this application. Accordingly, the relevant provisions are addressed below.

#### *GENERAL OBJECTIVES*

The aims and objectives of the PSLEP 2000 are to:

*(1) (a) provide for appropriate planning and environmental control over the use and development of land within the area of Port Stephens, in order to uphold and*

*promote the objectives of the* Environmental Planning and Assessment Act 1979*, and*

*(b) provide an updated and simplified plan for the area of Port Stephens, and*

*(c) achieve the objectives of each zone referred to in clause 10, and*

*(d) promote community involvement and participation in environmental planning and development assessment, and*

*(e) ensure that existing and future residents enjoy a range of attractive living environments, have safe and secure communities and have access to a wide range of services and amenities, and*

*(f) allow flexibility in the planning framework so as to encourage orderly, economic and equitable development while safeguarding the community's interests, and*

*(g) ensure that development has regard to the principles of ecologically sustainable development.*

*(2) For the purposes of subsection (1) (g), ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. The principles of ecologically sustainable development are as follows:*

*(a) the precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation,*

*(b) inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations,*

*(c) conservation of biological diversity and ecological integrity,*

*(d) improved valuation and pricing of environmental resources.*

The proposal for an Abalone farm has been carefully assessed throughout this EA in terms of its potential impacts upon the environmental and social values of the area.

The proposal is considered to be consistent with the principles of Ecologically Sustainable Development (ESD) as:

- Detailed assessments of potential impacts have been undertaken, and comprehensive mitigation measures proposed. When impacts couldn't be adequately ascertained, the precautionary principle was applied. For example, if a threatened species was not recorded on the site but suitable habitat existed, it was conservatively assumed that the species was present (see **Appendix 13**).

- The farm strives for inter-generational equity through the sustainable cultivation of a species which faces ongoing threats in its natural habitat.
- The farm will not result in significant impacts upon threatened flora, fauna or endangered ecological communities. Only the minimal area of land required to operate the farm will be cleared of vegetation, and the remainder of the site maintained as-is. In addition, an area of high-ecological value land in the northern portion of the site will be conserved and managed in perpetuity.

The farm comprises 'orderly, economic and equitable' development, which is not likely to have any detrimental impacts upon the safety, security or amenity of the local community.

Provided that the management and mitigation measures recommended within this EA are implemented, the impacts of the proposal upon the environment will be appropriately managed. Accordingly, the Project is considered to be consistent with the aims and objectives of the PSLEP 2000.

### *ZONING & PERMISSIBILITY*

The 'marine pipe area', associated with the subject site, was zoned 7(w) Environment Protection 'W' (Waterways) under the PSLEP 2000, as shown in **Figure 6**.

Under the PSLEP 2000, the proposed Abalone farm can be described as a form of 'intensive agriculture', defined below. This definition is relevant predominantly due to the fact that the Project involves management and treatment of marine water utilised within the farm before discharge back into the Port.

> ***intensive agriculture*** *(except in relation to land in the Williams River catchment) means any form of agriculture or horticulture which:*
>
> *(a) involves the confinement in an area with watering and feeding facilities where the animals are completely hand or mechanically fed for the purpose of production, or*
>
> *(b) requires particular treatment or practices for the management of liquid or solid wastes to prevent the pollution of any part of the environment, or*
>
> *(c) requires separation from surrounding land uses to minimise the risk of land use conflict or for any other reason.*

Even though the proposed development within this zone is restricted to the placement of pipes, it is associated with an Abalone farm and is ancillary to that farm.

Use of the area for 'intensive agriculture' is permissible with development consent.

The objectives of the 7(w) Environment Protection (Waterways) zone are as follows:

*The objectives of the Environment Protection "W" (Waterways) Zone are to minimise the impacts caused by commercial operations on the marine life and ecology of the Port Stephens waterways and to provide for such activities and facilities which:*

*(a) are compatible with the existing or planned future character of the waterways and adjoining foreshores, and*

*(b) protect and maintain the viability of the oyster, prawn and fishing industries of the Port whilst enabling a balance of compatible recreational uses, and*

*(c) maintain the integrity of the waterways resource base and provide for its continued use by future generations, and*

*(d) ensure there is provision for multiple use of the waterways of Port Stephens having regard to the use and zoning of adjoining waterfront lands, and*

*(e) protect and enhance the aquatic environment and the significant marine habitats of Port Stephens, and*

*(f) protect and enhance the natural environment based on the principles of ecologically sustainable development including biological diversity and ecological integrity, and*

*(g) do not adversely affect and are not adversely affected by coastal processes, in both the short and long term.*

The proposed pipes will be buried underground on land near the foreshore and within the intertidal zone. Accordingly, the pipes will not generally be visible from any part of the Port, nor will they impede physical access along the foreshore or beach. The potential impacts of the Project on visual amenity, disease risk, water quality, marine habitat and coastal processes has been addressed carefully within this EA. Provided that the management and mitigation measures recommended within this EA are implemented, the impacts of the proposal upon the environment will be appropriately managed.

Accordingly, the Project is considered to be consistent with the objectives of the 7(w) zone.

### *ADDITIONAL RELEVANT CLAUSES*

Clause 35 (*Development within all Environment Protection Zones*) also has relevance to the proposal. Subclause 1(a) provides that the carrying out of proposed development should not harm or compromise ecological habitats. The aquatic habitat of Port Stephens in this area has been investigated, and the potential impacts of the Project have been assessed (see **Section 5.9** of this EA). Provided the mitigation measures recommended within this EA are implemented, the proposal is not likely to have significant detrimental impacts upon the ecological habitats of the Port.

No other provisions of the PSLEP 2000 have relevance to the Project.

### 4.3.3 PORT STEPHENS LOCAL ENVIRONMENTAL PLAN 2013

The Port Stephens LGA begins at the Mean High Water Mark of Port Stephens, and extends into the Port Stephens waterway. Parts of the proposed development (i.e. Intake and Outflow pipes) will therefore extend into the Port Stephens LGA ('marine pipes area'). The principal instrument for controlling development within the LGA is currently the *Port Stephens Local Environmental Plan 2013* (PSLEP 2013). Accordingly, the relevant provisions are addressed below.

#### *AIMS OF PLAN*

The particular aims of this plan are as follows:

*(a) to implement the community's* Port Stephens Futures Strategy 2009 *and* Port Stephens Planning Strategy 2011*,*

*(b) to cultivate a sense of place that promotes community well-being and quality of life,*

*(c) to provide for a diverse and compatible mix of land uses supported by sound planning policy to deliver high quality development and urban design outcomes,*

*(d) to protect and enhance the natural environmental assets of Port Stephens,*

*(e) to continue to facilitate economic growth that contributes to long-term and self-sufficient employment locally,*

*(f) to provide opportunity for housing choice and support services tailored to the needs of the community,*

*(g) to conserve and respect the heritage and cultural values of the natural and built environments,*

*(h) to promote an integrated approach for the provision of infrastructure and transport services,*

*(i) to continue to implement the legislative framework that supports openness, transparency and accountability of assessment and decision making,*

*(j) to achieve intergenerational equity by managing the integration of environmental, social and economic goals in a sustainable and accountable manner.*

The proposal for an Abalone farm has been carefully assessed throughout this EA in terms of its potential impacts upon the environmental, economic and social values of the area.

The proposal is considered to promote intergenerational equity and the achievement of sustainable environmental, social and economic goals as:

- Detailed assessments of potential impacts have been undertaken, and comprehensive mitigation measures proposed. When impacts couldn't be adequately ascertained, the precautionary principle was applied. For example, if a threatened species was not recorded on the site but suitable habitat existed, it was conservatively assumed that the species was present (see **Appendix 13**).
- The farm strives for inter-generational equity through the sustainable cultivation of a species which faces ongoing threats in its natural habitat.
- The farm will not result in significant impacts upon threatened flora, fauna or endangered ecological communities. Only the minimal area of land required to operate the farm will be cleared of vegetation, and the remainder of the site maintained as-is. In addition, an area of high-ecological value land in the northern portion of the site will be conserved and managed in perpetuity.
- The farm will provide economic benefits to the local and wider community throughout the construction and operational phases, without detrimental impacts upon the safety, security, amenity, well-being or quality of life of the local community.
- The farm will manage and protect the water quality and amenity of Port Stephens, and the cultural heritage value of the land, through appropriate design and management measures, as outlined within this EA.

Provided that the management and mitigation measures recommended within this EA are implemented, the impacts of the proposal upon the environment will be appropriately managed. Accordingly, the Project is considered to be consistent with the aims and objectives of the PSLEP 2013.

### *ZONING & PERMISSIBILITY*

The 'marine pipe area', associated with the subject site, is zoned W2 Recreational Waterways under the PSLEP 2013, as shown in **Figure 7**.

Under the PSLEP 2013, the proposed Abalone farm can be described as a form of 'aquaculture', defined below.

> ***aquaculture means:***
>
> *(a) cultivating fish or marine vegetation for the purposes of harvesting the fish or marine vegetation or their progeny with a view to sale, or*
>
> *(b) keeping fish or marine vegetation in a confined area for a commercial purpose (such as a fish-out pond),*
>
> *but does not include:*

*(c) keeping anything in a pet shop for sale or in an aquarium for exhibition (including an aquarium operated commercially), or*

*(d) anything done for the purposes of maintaining a collection of fish or marine vegetation otherwise than for a commercial purpose, or*

*(e) any other thing prescribed by the regulations.*

Use of the area for 'aquaculture' (which includes development ancillary to aquaculture, such as the proposed marine pipes) is permissible with development consent.

The objectives of the W2 Recreational Waterways zone are as follows:

- *To protect the ecological, scenic and recreation values of recreational waterways.*
- *To allow for water-based recreation and related uses.*
- *To provide for sustainable fishing industries and recreational fishing.*

The proposed pipes will be buried underground on land near the foreshore and within the intertidal zone. Accordingly, the pipes will not generally be visible from any part of the Port, nor will they impede physical access (or recreation) along the foreshore or beach. The pipes will be positioned underwater in deeper areas and will be identified via navigational buoys, and so will not interfere with water-based recreation and related uses, including recreational fishing. The potential impacts of the Project on visual amenity and ecology have been addressed carefully within this EA. Provided that the management and mitigation measures recommended within this EA are implemented, the impacts of the proposal upon the environment will be appropriately managed.

The proposed farm will involve the sustainable production of a valuable seafood resource.

Accordingly, the Project is considered to be consistent with the objectives of the W2 zone.

### *ADDITIONAL RELEVANT CLAUSES*

Clause 5.5 (*Development within the coastal zone*) also has relevance to the proposal. It provides heads of consideration for all development within the coastal zone. It is considered that the Project has adequately considered such issues, as demonstrated in **Section 4.2.3.5** (i.e. SEPP 71) of this EA.

Clause 5.7 (*Development below mean high water mark*) provides that development consent is required for any development carried out on land covered by tidal waters. Approval of this Project is being sought pursuant to Part 3A of the EP&A Act.

No other provisions of the PSLEP 2013 have relevance to the Project.

# 5 ENVIRONMENTAL ASSESSMENT

## 5.1 Introduction

The following sections of the EA address the issues identified in the Director-General's Environmental Assessment Requirements (DGRs) for this Project. The DGRs, and the section of the EA in which each issue is addressed, are listed within **Appendix 10**.

In addition, a risk assessment was undertaken (see **Section 5.2**) in order to identify and evaluate other key potential impacts of the Project which would require additional assessment and mitigation. Additional matters were also raised by members of the community and other stakeholders during community consultation exercises held by the proponent (as outlined in **Section 6.3**). These additional potential impacts are also addressed in the following sections.

Finally, a number of matters were raised by DP&I and other government agencies after submission of the draft EA to DP&I in March 2013. These matters are also addressed in the following sections, and a response to each matter is provided at **Appendix 11**.

## 5.2 Risk Assessment

In order to identify and evaluate the key potential impacts of the Project, an Environmental Risk Assessment (ERA) was undertaken. The ERA was based on the *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines* and the principles and processes outlined in *HB 203:2006 Environmental Risk Management – Principles and Process*.

The ERA process resulted in the identification of key potential impacts of the proposal, the likelihood of impacts occurring and their potential consequences. It allowed for differentiation between issues which were considered to be adequately addressed by the farm design and management (i.e. 'low risk'); and issues which required further assessment and the development and implementation of mitigation measures.

Issues identified as having a 'moderate' or higher risk were investigated more closely as part of the EA process. Mitigation and management measures were proposed, and a subsequent risk analysis was undertaken taking these measures into account.

These processes are discussed in the following sections.

### 5.2.1 RISK IDENTIFICATION

Risk identification is based on identifying the sources of risks, areas of impact, their causes and their potential consequences.

The source of risk in this instance arises from the construction and operation of the proposed Abalone farm. The potential areas of impact, their causes and potential consequences were determined through a scoping exercise undertaken by the Project team. Scoping was informed by an understanding of the site and details of the proposed development, and communication and consultation with both internal and external stakeholders.

In this instance, due to the long history of the Project (see **Section 1.2**), a wealth of consultation and background resources were available to help in scoping potential risks. These sources included:

- Previous DA documentation (including the Environmental Impact Statement and Great Lakes Council Assessment Reports);
- Consultation advice from government agencies, including general terms of approval (in relation to the previously approved DA);
- Statements of Issues (in relation to the previous Court hearing associated with the Project); and
- Ongoing research by the proponent.

In addition, stakeholder consultation was undertaken in relation to the current Project, as outlined in **Section 6**. This consultation included a public meeting and requests for feedback from government agencies, key stakeholder groups and the local community.

The ERA considered risks to the biophysical, social and economic environment. The Project was considered in the context of the locality, processes and activities which are described in **Sections 2** and **3** of this EA.

### 5.2.2 RISK ANALYSIS

Risk analysis requires developing a further understanding of the risks. It involves consideration of the positive and negative **consequences** (severity) of a particular risk and the **likelihood** that this consequence will occur. The combination of consequence and likelihood produces an estimate of the risk associated with a particular issue.

The main aim of this analysis was to determine if potential risks were significant enough to warrant additional assessment and, subsequently, the implementation of mitigation measures to manage the risk.

**Table 13**, below, outlines levels of consequence (from *negligible* to *catastrophic*).

**Table 14** defines likelihood (from *remote* to *likely*).

Using these definitions, the 'risk value' for each identified issue was determined using the risk matrix at **Table 15** (from *low* to *extreme*). The results of this initial assessment are provided at **Appendix 18** of this EA.

In assigning a likelihood level it is important to note that an assessment is being made of the likelihood of that *consequence* occurring and *not* the likelihood of that particular activity occurring.

**Table 13: Risk Consequence Definitions**

| Consequence (Severity) | Biophysical | Social | Economic |
|---|---|---|---|
| (1) Negligible | Limited damage to minimal area of low significance. | Low public concern. Restricted to local complaints. No media attention. No injury or disease. No harm to environmental credentials. | Low level legal issue. Possible on the spot fine. Technical breach with prosecution unlikely. Loss of income for proponent unlikely. Economic impact on locality unlikely. Minor scrutiny from regulator/s. |
| (2) Minor | Short term damage to small area of limited significance. | Moderate public concern. Low or local public media attention. Could cause first aid injury but no disease. Limited harm to environmental credentials. | Minor legal issues. Minor fine with prosecution possible due to breach. Minor loss of income for proponent. Possible economic impact on locality. Ongoing scrutiny from regulator/s. |
| (3) Moderate | Short to medium term damage to confined area of significance (i.e. water, air or soil) but not ecosystem function. | Ongoing public concern. Attention from regional media and potential criticism by NGOs. Could cause injury requiring medical treatment but no disease. Moderate harm to environmental credentials. | Legal issues. Fine and/or prosecution. Clear and apparent breach requiring further investigation. Loss of income for proponent. Economic impact on locality. Significant scrutiny from regulators and impact on gaining approvals. |
| (4) Major | Medium to long term damage to medium/large area of significance with some impairment of ecosystem function. | Ongoing serious public concern. Adverse attention from national media and criticism by NGOs. Could cause serious injury or disease to people. Significant impact to environmental credentials. | Major legal issues. Major fine, prosecution and further investigations. Clear and major breach. Significant loss of income for proponent. Severe economic impact on locality. Severe scrutiny from regulators and impact on gaining approvals. |
| (5) Catastrophic | Long term damage to large area of significance with long term impairment of | Widespread, serious public concern affecting local/regional community. Serious public and media | Major legal issues. Fine, prosecution and investigations that terminate feasibility of project. Gaining approvals highly |

| Consequence (Severity) | Biophysical | Social | Economic |
|---|---|---|---|
| | ecosystem function. | outcry and international coverage. Could kill or permanently disable. Severe impact to environmental credentials. | unlikely. |

*Source: Adapted from* AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines

**Table 14: Risk Likelihood Definitions**

| Level | Descriptor | Description |
|---|---|---|
| (A) | Remote | Never heard of, but not impossible |
| (B) | Rare | May occur in exceptional circumstances |
| (C) | Unlikely | Uncommon, but has been known to occur elsewhere |
| (D) | Possible | Some evidence to suggest this is possible here |
| (E) | Occasional | May occur |
| (F) | Likely | It is expected to occur |

*Source: Adapted from Fletcher* et al *2002.*

**Table 15: Risk Matrix**

| | Maximum Reasonable Consequence | | | | |
|---|---|---|---|---|---|
| Likelihood of Consequence | (1) Insignificant | (2) Minor | (3) Moderate | (4) Major | (5) Catastrophic |
| (A) Remote | Low | Low | Low | Low | Low |
| (B) Rare | Low | Low | Low | Moderate | Moderate |
| (C) Unlikely | Low | Low | Moderate | Moderate | High |
| (D) Possible | Low | Moderate | Moderate | High | Extreme |
| (E) Occasional | Low | Moderate | High | Extreme | Extreme |
| (F) Likely | Low | Moderate | High | Extreme | Extreme |

*Source: Adapted from Fletcher* et al *2002.*

### 5.2.3 RISK EVALUATION & TREATMENT

The purpose of risk evaluation is to assist in making decisions, based on the outcomes of the risk analysis, about which risks need treatment / mitigation and the priority for such treatment. It should be stressed that the prioritising of certain environmental impacts above others does not suggest that one is less or more important than another. The

process is often difficult and subjective, as there is little guidance or criterion on what constitutes an acceptable or tolerable level of risk.

The preliminary risk analysis (**Appendix 18**) resulted in the identification of issues with a 'low', 'moderate' or higher risk, based on farm design alone. Those issues with a 'low risk' were considered to be adequately addressed, and did not require further consideration (although some issues were considered further and mitigation measures proposed regardless, as outlined within this EA).

Issues allocated a 'moderate' or higher risk were investigated in more detail as part of the EA process (i.e. **Section 5** of this EA). Where appropriate, mitigation measures were then proposed to manage the risk.

Note that a separate, more detailed risk assessment was undertaken with regard to disease management issues. Refer to **Section 5.3.2.3** for further discussion.

A revised risk analysis was then undertaken, as outlined in **Table 16** below. With the application of proposed mitigation measures, as recommended throughout this EA, the risks associated with all key issues were reduced to 'low' (i.e. green shading) and were therefore considered acceptable.

**Table 16: With Mitigation - Revised Environmental Risk Analysis**

| Details of Potential Risk | IR# | Proposed Mitigation Measures | Revised Risk Assessment* (mitigated) | | |
|---|---|---|---|---|---|
| | | | C | L | R |
| **Soils** | | | | | |
| Erosion during construction works, e.g. excavation, pipeline placement. Resultant sedimentation of waterways | M | Mitigation measures outlined in **Section 5.5** of EA. | 2 | B | L |
| Exposure of Potential Acid Sulphate Soils during construction leading to the acidification of waterways | M | Mitigation measures outlined in **Section 5.5** of EA. | 2 | B | L |
| **Water & Coastal Processes** | | | | | |
| Impacts on Port water quality from farm water release (including nutrient increases) | M | Mitigation measures outlined in **Section 5.4** of EA. | 2 | B | L |
| Impacts from pipelines e.g., scouring of seabed | M | Mitigation measures outlined in **Section 5.17** of EA. | 2 | B | L |

| Details of Potential Risk | IR# | Proposed Mitigation Measures | Revised Risk Assessment* (mitigated) | | |
|---|---|---|---|---|---|
| **Flora & Fauna** | | | | | |
| Harm or disturbance from pipeline construction on aquatic fauna (including threatened sp.) | M | Mitigation measures outlined in **Section 5.9** of EA. | 2 | B | L |
| Entrainment/ impingement of marine organisms into pipe inlets | M | Mitigation measures outlined in **Section 5.9** of EA. | 1 | B | L |
| Harm or disturbance from pipeline construction on aquatic flora (including threatened sp. & seagrasses) | H | Approximately 40m$^2$ seagrass to be impacted. Not considered 'significant' in light of Port population. Mitigation measures outlined in **Section 5.9** of EA. | 2 | C | L |
| Impacts from reduced water quality on aquatic flora/ fauna arising from farm water release | M | Mitigation measures outlined in **Section 5.4** of EA. | 2 | B | L |
| Impacts on wild Abalone populations from disease/ pathogens originating from farm | M | Mitigation measures outlined in **Section 5.3** of EA. | 3 | B | L |
| Harm or disturbance from construction on terrestrial fauna (including threatened species and listed migratory species) | M | Mitigation measures outlined in **Section 5.8** of EA. | 2 | A | L |
| **Sensitive Ecosystems** | | | | | |
| Impacts on viability of Endangered Ecological Communities from clearing vegetation and construction works | M | Mitigation measures outlined in **Section 5.8** of EA. | 2 | B | L |
| Impacts from boardwalk construction and farm operation (e.g. stormwater runoff) on coastal wetlands | M | Mitigation measures outlined in **Section 5.8** and **5.6** of EA. | 2 | B | L |
| Detrimental effects from farm on nearby Sanctuary Zone (Marine Park) e.g. water quality impacts | M | Mitigation measures outlined in **Section 5.4** and **5.9** of EA. | 2 | B | L |
| **Bushfire Hazard** | | | | | |
| Threats to human safety from bushfire (within farm) | H | Mitigation measures outlined in **Section 5.13** of EA. | 4 | B | L |
| **Other Trades & Uses of the Port** | | | | | |
| Impacts on health / viability of nearby oyster leases from reduced water quality arising from farm water release | M | No nearby oyster leases, although 'priority oyster areas' nearby. Mitigation measures outlined in **Section 5.4** of EA. | 2 | B | L |
| Interference with commercial / | M | Mitigation measures outlined in | 1 | B | L |

| Details of Potential Risk | IR# | Proposed Mitigation Measures | Revised Risk Assessment* (mitigated) | | |
|---|---|---|---|---|---|
| recreational fishing activities e.g. from pipelines | | **Section 5.19** of EA. | | | |
| **Access** | | | | | |
| Navigational hazards arising from pipeline placement | M | Mitigation measures outlined in **Section 5.19** of EA. | 1 | B | L |

# Initial Risk - without mitigation measures - see **Appendix 18.**

*Risk Assessment Criteria: C=Consequence, L=Likelihood, R=Risk (according to risk matrix at **Table 15** in EA)

## 5.3 Disease & Biological Security

The management of disease is a key priority for the farm, primarily to ensure there is minimal risk of disease from the farm impacting on wild marine populations. Further, it is in the farm's commercial interest to maintain healthy, disease-free stock.

A *Biosecurity and Disease Management Plan* (BDMP) was prepared in relation to the proposal and is attached at **Appendix 5**. The BDMP was prepared by the proponent (a Fisheries Technical Officer) and peer-reviewed by Dr Matt Landos who is a Director of Future Fisheries Veterinary Service Pty Ltd and an expert on health issues related to aquatic species. Dr Landos was previously a Veterinary Officer- Aquatic Animal Health for the NSW Department of Industries.

The BDMP seeks to implement the goals and strategies of the *New South Wales Biosecurity Strategy 2013- 2021,* and is referred to within the following sections.

Note that the potential for the release of genetic material from the farm (i.e. Abalone larvae) and associated impacts on wild Abalone populations are addressed at **Section 5.21.2**.

### 5.3.1 EXISTING ENVIRONMENT

#### 5.3.1.1 *Diseases of Abalone*

There are two key diseases known to affect Abalone in Australia, both of which are reportable diseases pursuant to the Australian National List of Reportable Aquatic Animal Diseases and the World Organisation for Animal Health (OIE). These comprise:

- Abalone Viral Ganglioneuritis (AVG); and
- Perkinsosis.

**Table 17: Characteristics of Key Diseases Affecting Abalone**

| Disease Characteristics | Host Species | Known NSW Occurrence |
|---|---|---|
| **Abalone Viral Ganglioneuritis** | | |
| AVG is caused by a herpes-like virus that affects the nervous tissues of Abalone, and can progress to cause mortality. It can potentially cause large mortalities in commercial and wild stock. Affected animals exhibit a range of signs including cessation of feeding, reduced pedal movement, 'curling of the foot', swelling and protrusion of the mouth parts and excess mucus production.<br>Several strains of the virus are known to occur, and appear to have differing virulence. The susceptibility of Abalone to each strain appears to differ with their geographic origin and concurrent exposure to environmental/ husbandry stressors.<br>Transmission is known to occur through direct contact (Abalone to Abalone) and through the water column. Transmission via fomites such as people, mucus, shells and contaminated equipment is suspected to occur. | Commercial species of Australian Abalone such as *H.laevigata* and *H.rubra* are susceptible to some strains of an Abalone herpes-like virus known to be found in Australia, which can cause the disease, AVG. There are some other viral diseases of Abalone described internationally (and not within Australia at this time) which have some features in common which AVG, such as the Taiwanese herpes-like Abalone virus. Australian Abalone may be susceptible to these viruses also (Landos. M. 2013 pers. comm. 6 March).<br>AVG is not known to affect any other fish or marine species (DPI n.d.*g*). | AVG was first detected in a retail outlet in NSW in November 2011. As a result, DPI implemented an Importation Order that placed restrictions on the importation of live Abalone from Tasmania and Victoria in order to prevent the disease from infecting NSW wild Abalone populations (DPI n.d.*f*).<br>AVG is not known to be present in any wild Abalone stocks in NSW. |
| **Perkinsosis** | | |
| Perkinsus is a genus of protozoan parasites which cause 'Perkinsosis'. Infection with the species *P.olseni* causes microabscesses and abscesses to form in the flesh of affected molluscs.<br>Transmission of the parasite occurs directly through water between individual molluscs, when abscesses erupt and release prezoosporangia into seawater. After several days within the water, bi-flagellated zoospores develop which may infect Abalone / other molluscs.<br>Infections of *P. olseni* in wild Blacklip Abalone have been positively correlated with both water temperature and size of Abalone. | Perkinsosis has been previously reported in Australia, and is known to affect Greenlip and Blacklip Abalone.<br>Molecular studies indicate *P. olseni* can occur in many species of molluscs from Australia and is homologous to *P.atlanticus (=olseni)* identified infecting clams from Portugal, Japan and Korea.<br>However, Sydney Rock Oysters were shown to be refractory in experimental infections, and disease outbreaks of Perkinsosis have never been reported in Australian farmed Pacific, Flat or Sydney Rock Oysters and are not known to adversely affect any other wild populations of mussels (Landos. M. 2013 pers. comm. 6 March). | Mass mortalities of Abalone have occurred along much of the NSW coast in recent years, from (outside) Port Stephens in the north to Jervis Bay in the south, with a small area at Merimbula. Perkinsosis was diagnosed to be the cause. |

Both of these diseases have the potential to cause mortality in both farmed and wild Abalone populations. There is no evidence that AVG or *Perkinus olseni* (the parasite which causes Perkinsosis) have any effect on human health.

Key characteristics of these diseases are outlined in **Table 17** above.

#### 5.3.1.2 *Presence of Nearby Abalone Populations*

There are no known records of Abalone individuals occurring within the waters of Port Stephens inside Tomaree Head (Housefield, G. 2012 pers. comm., 25 June). Blacklip Abalone generally inhabit coastal waters between 5 and 10 metres in depth, where they adhere to rocky surfaces and inhabit crevices and caves in reefs (DPI n.d.*a*).

Accordingly, the closest known populations of Abalone are located approximately 10km from the subject site, around Tomaree and Yaccaba Heads.

The seabed adjacent to the subject site generally comprises sandy areas and other marine sediments (refer to **Section 5.9** for a full description of aquatic habitats), which are considered inhospitable to Abalone survival and movement.

### 5.3.2 IMPACTS ASSESSMENT

#### 5.3.2.1 *Potential Impacts of Disease*

Disease risk management is considered to be a key issue for the farm. As with any farm situation, there is the potential for disease outbreaks to cause significant stock losses due to the presence of dense concentrations of Abalone, resulting in significant financial repercussions. Similarly, there is the potential for diseases to be released from the farm which may potentially impact upon other populations, wild or farmed. The BDMP notes that *whilst rigorous systems are put in place to enhance disease prevention, this farm recognises the importance of disease management, given that there is always the risk of disease presenting in farming systems* (p1).

The BDMP notes the following:

> *Perkinsosis is already endemic across much of the NSW coast. Hence an outbreak on a farm does not constitute an exotic disease outbreak. It may however alter the trading status of the farm which may prevent translocation of stock to other farms…Perkinsosis has not been identified to be a problem in the oyster, pipi or mussel industries throughout the endemic area where the pathogen has impacted on the wild Abalone population (Port Stephens - Jervis Bay / Merimbula - hot spot). Hence, it is unlikely that an outbreak of this disease would have a major impact on other mollusc industries or trade…*

*AVG has been detected in a wholesale facility in NSW, but not in any farmed or wild stock at this time. AVG remains a high risk for NSW, particularly where broodstock or seedstock may be translocated outside of their biogeographic population into a new area. Strains of AVG appear to be limited to certain regions in wild stocks in Tasmania and Victoria. AVG is not known to affect other molluscs, so is unlikely to cause significant disturbance to other mollusc industries….Given Australia is already reporting to OIE as AVG positive, and it has not established zones or compartments of freedom for trading purposes at this time, it is unlikely that a further positive AVG detection would cause a major disruption to trade* (pp24 - 25).

#### 5.3.2.2 *Disease Risk Management Measures*

A number of measures are proposed to be implemented to help minimise the incidence and severity of disease outbreaks on the farm. To complement the farm design, the BDMP provides detailed management protocols which the farm will follow in order to manage disease risk. The BDMP focusses principally on Perkinsus and AVG, due to the known importance of these diseases. However, the principles of biosecurity, disease prevention, detection, containment and eradication are applicable to disease management in general.

Key measures / variables to address disease risk and management are listed below and summarised in the following sections:

- Careful selection of the abalone broodstock source location;
- Separation of the farm from nearby sensitive (Abalone) populations;
- Strict segregation of higher risk stock within the farm (quarantine);
- Implementation of general disease management standards and protocols;
- Implementation of appropriate diagnosis techniques and monitoring in the case of disease; and
- Implementation of appropriate disease control and eradication measures.

##### *ABALONE BROODSTOCK SOURCE*

As discussed in **Section 3.7.5.1** of this EA, limited numbers of Abalone broodstock will be introduced into the farm for breeding purposes. These broodstock will be sourced from wild populations along the NSW coast, in the same manner that Abalone is currently collected by commercial and recreational fishers. No translocation of specimens from interstate to the farm (particularly from Victoria or Tasmania, where AVG is known to occur) is proposed.

As outlined above, AVG is not currently known to occur in any wild NSW population, although surveillance with PCR (*Polymerase Chain Reaction*) testing has been limited.

Perkinsus is already known to occur along much of the NSW coastline, including outside Port Stephens. Accordingly, the farm will present negligible risk to nearby wild populations of Abalone in relation to Perkinsus, as it is already locally endemic and exposure is likely to have already occurred (Landos, M. 2013 pers. comm. 26 February).

The distance from the farm to the closest wild Abalone populations also reduces disease transmission risk, as outlined below.

### *SEPARATION FROM SENSITIVE POPULATIONS*

As outlined above, the nearest known populations of wild Abalone to the farm are approximately 10km east, around the heads of Port Stephens. This separation provides a reduction in disease propagation risk through the following means (Landos, M. 2013 pers. comm. 26 February):

- Any infectious disease agents within the water column will be significantly diluted prior to exposure to susceptible Abalone populations. Accordingly, the wild Abalone *may never get exposed*;
- The dilution of the disease agents also reduces infection pressure (e.g. viral load), thereby *reducing the risk of initiating an infection*; and
- The time required to transport pathogens from the farm to the wild populations may *reduce the infectivity* of the discharged pathogen (e.g. pathogens may die).

It is noted that neither AVG nor Perkinsus are known to affect the health of oysters or other mussels in Australia.

### *SEGREGATION OF HIGHER RISK STOCK (QUARANTINE)*

One of the most significant avenues for potential disease transfer into the farm is through the importation of infected broodstock. Limited numbers of broodstock will be translocated from wild NSW populations into the farm for breeding purposes on an annual basis.

A key facet of the farm's biosecurity strategy involves the segregation of new (i.e. higher risk) stock from other areas of the farm, as well as from the outside environment. The farm will employ world's best practice of including a dedicated quarantine facility on-site. This physically separated facility (i.e. located within the Broodstock Shed) will provide physical and management barriers between new stock and the balance of the farm, and will allow for the disinfection of all marine water before release back into the Port.

This segregation will allow time to complete disease testing of potential broodstock prior to their introduction into the main farm area, while preventing vertical and horizontal disease transfer between new stock and existing stock.

All new stock will be isolated in quarantine for a minimum of 8 weeks. Key facets of the quarantine system are outlined below and discussed in more detail at **Appendix 5**:

- Effective physical barriers to reduce cross contamination, including by splashing or aerosol means;
- Separate feeding and cleaning systems;
- Implementation of rigorous biosecurity and hygiene management measures (e.g. disinfection of equipment, staff induction procedures etc.);
- Regular monitoring and inspections of stock and adherence to strict record-keeping protocols;
- Use of sentinel Abalone stock with new cohorts when possible;
- Treatment of marine water before introduction to the quarantine facility to reduce the risk of disease introduction, as follows:
  - aged for 5 days (within the Header Tanks) to allow disease-causing organisms to complete their life cycle and die;
  - temperature control;
  - filtration; and
  - treatment with UV.
- Disinfection of all marine water released from quarantine, as follows:
  - Filtration < 400 microns (i.e. to remove mudworm larvae);
  - Treatment with ozone. Ozone is an effective oxidising agent / disinfectant known to reduce a range of fungal, bacterial, protozoan and viral loads in water. It is commonly used in aquaculture and other water use applications. Ozone will be generated on-site via a commercially produced unit;
  - UV disinfection, a method used to kill or inactivate microorganisms in water. This method will be used to support the ozone treatment and to deteriorate any residual ozone in the water (note - ozone residue in water can be toxic to a range of organisms, however it is readily degraded);
  - Additional settlement time within the Primary Settlement Tank (to further ensure deterioration of residual ozone); and

- Settlement within Settlement Ponds.

- Disinfection of all equipment, waste outputs or other items that come into contact with the quarantine facility; and
- Adherence to strict protocols for the diagnosis, management and treatment of any diseases that present.

### *GENERAL MANAGEMENT STANDARDS AND PROTOCOLS*

The BDMP provides detailed biosecurity standards for the general management of the farm, as well as the quarantine facility. These standards include the following:

- General disinfection and hygiene practices;
- Protocols for the control of staff and equipment movements to minimise cross contamination risks; and
- Stock monitoring and record keeping protocols.

### *DIAGNOSIS TECHNIQUES & MONITORING IN THE CASE OF DISEASE*

All stock, whether in quarantine or otherwise, will be regularly monitored for changes in behaviour (e.g. cessation of feeding) or other signs of potential disease. The BDMP outlines diagnosis techniques to determine the presence and/or form of disease, including guidance on the selection and preparation of histological samples for laboratory diagnosis. It outlines steps which can be taken to control losses while waiting for diagnostic results, including the cessation of water release from a unit (i.e. recirculation of water), isolation of tanks, and disinfection of equipment and personnel. The BDMP emphasises liaison with the farm's consulting veterinarian in order to confirm the appropriate response to a situation.

Early disease detection by farmers can allow for prompt diagnosis and the immediate implementation of management measures.

### *DISEASE CONTROL & ERADICATION MEASURES*

Should the presence of disease be confirmed, a number of measures may be implemented to minimise the impact of a disease outbreak. Disease control and eradication responses may include:

- Establishment of quarantine areas within the farm;
- Control of the movement/ release of Abalone stock, people, vehicles, equipment or water;

- Tracing investigations to determine the how the disease was spread (e.g. by Abalone, Abalone products, equipment, water etc.);
- Surveillance of given populations to detect the occurrence of disease for control purposes;
- Treatment of infected Abalone, as guided by the veterinarian, the Australian Pesticides and Veterinary Medicines Authority and other relevant authorities (e.g. medication or reduction in water temperatures);
- Destruction and disposal of affected Abalone; and
- Decontamination of affected equipment.

The most appropriate responses will be determined according to the protocols of the BDMP and through consultation with the farm veterinarian, DPI officers, the NSW Chief Veterinary Officer and other relevant authorities. Each response will depend on a range of matters including:

- The stage of the disease outbreak;
- The disease agent;
- Site specific features;
- Economic impacts;
- Effectiveness of the control measure employed;
- Implications of disease or control measures to industry/ trade relations;
- Environmental considerations; and
- Cost of control.

The BDMP provides further guidance on issues such as appropriate public communication during a disease outbreak; managing unexposed Abalone within the farm; and sentinel and restocking measures after a disease has been eradicated.

#### 5.3.2.3 *Risk Assessment*

The BDMP provides a risk identification and treatment plan in relation to disease issues. It presents an initial assessment of the likelihood and consequence of a risk occurring, and outlines specific management measures to reduce the risk. Risks include introduction of diseases from the water supply and infected broodstock or contaminated equipment.

Following the implementation of proposed risk management measures (i.e. as outlined within the BDMP) it was determined that the resultant risk rating for all disease matters was '**Negligible - an acceptable risk**'.

It is noted that a somewhat similar risk assessment in relation to disease risk in Western Australian Abalone was conducted by the Western Australia (WA) Department of Fisheries in 2011 (Jones & Fletcher 2011). Like NSW, AVG is not known to occur within WA waters. In the assessment, the risk of wild stocks being infected with AVG through the deliberate release of hatchery-farmed WA Abalone (for stock enhancement or 'sea-ranching' purposes) was examined (*it is emphasised that no release of Abalone from the farm is proposed or considered likely to occur*). Even taking into account the deliberate release of Abalone, the assessment found that the likelihood of WA wild stock being infected with AVG was 'very low / acceptable' with the application of mitigation measures similar to, and in some cases less stringent than, those proposed within the farm.

### 5.3.3 PROPOSED MITIGATION MEASURES

The farm will implement the mitigation measure outlined in **Table 18** below, in order to minimise the risk and potential impacts of disease.

**Table 18: Proposed Mitigation Measure - Disease & Biosecurity**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Disease Risk & Biosecurity | The farm shall operate in accordance with the recommendations of the *Biosecurity and Disease Management Plan.* | Operation |

## 5.4 Marine Water Quality

### 5.4.1 EXISTING ENVIRONMENT

Water quality may be defined in terms of its compliance with parameters set out in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC *et al* 2000). The 'ANZECC Guidelines' provide a framework for assessing water quality based on whether the physical, chemical and biological characteristics of a waterway support community environmental values. In effect *the guidelines help to define the water quality needed to protect these values* (DEC 2006).

Water quality issues affecting the Port Stephens estuary have been addressed and summarised in a number of documents in recent years, including:

- *Port Stephens / Myall Lakes Estuary Processes Study* (Manly Hydraulics Laboratory 1999);
- *Port Stephens - Myall Lakes Estuary Management Study (Reference Document 2: Estuary Management Issues, Themes and Options for Port Stephens and Myall Lakes* (Umwelt 2000*a*); and
- *Port Stephens - Myall Lakes Estuary Management Plan* (Umwelt 2000*b*).

These studies concluded that water quality within the estuary was generally 'good', and generally satisfies ANZECC water quality guidelines for the protection of aquatic ecosystems, secondary and primary contact recreation, and consumption of seafood. A more detailed discussion on background water quality levels within the Port (i.e. nutrient concentrations) is provided in **Section 5.4.2.1** ('*Expected Nutrient Concentration Impacts*') of this EA**.**

The water of the Port was also found to be *typical of an estuary influenced by tides and winds, with tidal forces having the greater impact* (Manly Hydraulics Laboratory 1999). The 'clear' natural water clarity in the 'Outer Port', in the vicinity of the subject site, is due to the sandy bottom and regular flushing by tidal processes (Umwelt 2000).

The key principal risks to water quality in Port Stephens have been previously identified as follows (Umwelt 2009):

- Urban stormwater runoff;
- Rural runoff;
- Run-off from on-site wastewater treatment systems;
- Drainage from oxidised acid sulphate soils; and
- Point source discharges from marinas, slipways and municipal wastewater treatment plants.

The area proposed for the farm's water intake (i.e. at 15-20m depth) is considered to be a reliable source of good quality marine water, as it is sufficiently protected from oceanic storms and is relatively isolated from catchment discharge which is often of poor water quality (p 30, **Appendix 19**). While a freshwater halocline (layer) of poorly mixed fresh water can develop on the surface waters of the Port after severe storms, the water quality below 8m depth is generally unaffected and remains 'oceanic' in quality (Housefield, G.

2013 pers. comm. 10 February). For example, water salinity concentrations at a location in close proximity to proposed inlets ('Station 21') were previously surveyed by the Manly Hydraulics Laboratory (MHL 1999). Results indicated that, even though the salinity of the surface water had declined to 32 parts per thousand (ppt) after three days of heavy rainfall, the salinity of water at depths below 2m remained at 35ppt (i.e. a marked halocline layer is formed, maintaining a separation between waters of higher and lower salinity).

Further, the local water flow patterns were considered appropriate for the intake and outlet of water as they are unlikely to result in the concentration of debris in this area (Colt & Huguenin 2002).

### 5.4.2 IMPACTS ASSESSMENT

In their natural habitat, Abalone live within marine waters on exposed coasts, and so typically experience good water quality that does not significantly vary over short time scales (Burke *et al* 2001). Accordingly, Abalone require constant access to good quality marine water for optimum growth and health.

In order to meet these requirements within the farm, a constant intake of water is required from the Port (approximately 50ML per day at full production). After use and treatment within the farm systems, water will ultimately be released back into the Port.

Changes to water quality are anticipated as the water passes through the farm, as a result of exposure to a high population of Abalone. If left untreated, there could be some potential for released water to have a detrimental impact on the water quality of the Port immediately adjacent to the outlets. These possible water quality impacts are discussed in the following sections.

#### 5.4.2.1 *Nutrients*

Nutrients (predominantly Nitrogen, as Ammonia) are produced as a waste product from Abalone feeding and as a result of respiration.

Nitrogen is usually the macro-nutrient (in its oxidised state [$No_x$] or to a much greater extent, its reduced state [Ammonia]) that most limits the growth of plants, algae and phytoplankton in Australian coastal marine and estuarine waters. Accordingly, an increased supply of mineralised Nitrogen tends to make marine systems more eutrophic (meaning *where water bodies receive excess nutrients that stimulate increased plant growth that may become excessive*). The concern is that such eutrophication might cause

changes in estuary ecology that are deemed to be undesirable. Seagrasses, in particular, can be adversely impacted if epiphyte / phytoplankton concentrations become high enough to limit light availability to seagrasses, to a point where it is below the seagrass species' minimum threshold.

There are also indications that Phosphorus may be a limiting nutrient for some marine (usually oceanic or tropical [calcareous substrate]) systems, and therefore changes in its concentration may also have an influence on Port ecology. Accordingly, the discharge of Nitrogen and Phosphorus from the farm are key considerations for this proposal and are discussed in the following sections, alongside other nutrients. Issues addressed encompass the:

- Expected nutrient loads from the farm;
- Expected nutrient concentration impacts; and
- Long-term, large-scale changes in ammonia concentrations in Port Stephens.

### *EXPECTED NUTRIENT LOADS FROM THE FARM*

**Section 5.4.3** of this EA outlines proposed treatment and mitigation measures which will minimise the nutrient loads discharged into the Port. However, regardless of any treatment measures, a residual nutrient load dissolved / suspended within marine water will still be released from the farm.

A report titled *Dilution and Transport of Discharged Material from a Proposed Abalone Farm* (the 'Dilution Report') was prepared for this proposal in 2013 by Brian G. Sanderson, an expert in fluid mechanics, physical oceanography and computational mathematics - refer to **Appendix 19**. This report calculated anticipated nutrient loads from the proposed farm based on a number of parameters, including established Abalone food conversion rates and nutrient concentrations within Abalone feed.

The Dilution Report found that the following nutrient loads are likely to be discharged into the Port from the farm (as a 'worst-case scenario', at full farm capacity, but taking into consideration proposed filtration methods outlined in **Section 5.4.3.1**):

- **Ammonia:** 1.43 tonnes per year;
- **Total Nitrogen** (*particulate-N & ammonia-N*): 2.07 tonnes per year;
- **Filterable Reactive Phosphorus (FRP)**: 0.46 tonnes per year; and
- **Total Phosphorus** (*particulate-P & FRP*): 0.55 tonnes per year.

This expected nutrient load discharge from the farm was considered to be *minor compared with that due to other human activities* (p6) in the catchment such as changes in land use from forest to grazing; the undertaking of horticulture; or the urban development of land. All of these landuses result in the addition of nutrients to the Port via stormwater runoff.

The farm will result in a more 'steady' nutrient load compared to many natural sources (which are highly intermittent) and in this regard the farm could be expected to have Total Nitrogen loads more like those from urbanised portions of the Port's catchment. However *runoff from urbanised areas will drain via the foreshore whereas the Abalone farm discharges into deeper offshore waters whereby the impact of the latter will be relatively minimised* (p7). A detailed comparison of the farm's nutrient loads in the context of other nutrient loads discharged into the Port is provided in Section 2.3 of the Dilution Report at **Appendix 19**.

As discussed in the section below ('*Long-Term, Large-Scale Change in Ammonia Concentrations in Port Stephens')*, the **overall concentration of ammonia in the Port** is expected to be elevated by an **insignificant** amount relative to the ANZECC Guidelines trigger values and background nutrient concentrations.

### *EXPECTED NUTRIENT CONCENTRATION IMPACTS*

The Dilution Report provides a discussion on background nutrient concentrations within the Port based on previous measurements, noting that even though the knowledge of concentrations generally suffers from undersampling, a fair estimate of the general magnitudes and variations of concentrations within the Port can be made. It further states that nutrient concentrations within a body of water are naturally highly variable. For example, based on EPA measurements made from 1973-1993, Manly Hydraulics Laboratory (MHL) reported in 1999 (see **Appendix 19**) that:

- 30% of Filterable Reactive Phosphorus measurements in the Port exceeded 15$\mu$g/L (the ANZECC Guidelines trigger value); and
- 70% of Total Phosphorus (TP) measurements in the Port were below 50 $\mu$/L (the ANZECC Guidelines trigger value), whereas 70% of TP measurements in the Karuah River exceeded 50 $\mu$g/L.

Various background concentration measurements taken within the Port are provided for four key relevant nutrients within **Table 19** below. These are derived from limited

sampling events undertaken by the EPA & MHL in 2007, 2008 and 2011. The ANZECC Guidelines trigger values are also provided.

In summary, the Dilution Report notes that *generally, existing concentrations are comparable to ANZECC 2000 trigger levels* (p11).

**Table 19: Background Nutrient Concentrations Recorded within the Port**

| Nutrient | Background concentration- mean[1, 2] (µg/ L) | Background concentration- max[1, 3] (µg/ L) | ANZECC 2000 Guidelines trigger (µg/ L) |
|---|---|---|---|
| Ammonia | 4.3 ± 2.3 | - | 15 |
| Total Nitrogen | 137 ± 7 | - | 100 |
| Filterable Reactive Phosphorus | 7±1 | 13 | 15 |
| Total Phosphorus | 15.6 ± 0.3 | 95 | 50 |

[1] Derived from limited sampling events in variable conditions by EPA & MHL in 2007, 2008 and 2011. See Section 2.5 of Dilution Report for details
[2] Mean and Standard Error of the Mean
[3] Highest concentration observed during sampling event. Comparable measurements were not available for all nutrients - see Section 2.5 of **Appendix 19** for further discussion.

As the maximum rate of marine water to be discharged from the farm on a daily basis is known (i.e. 50ML), the farm's nutrient loads discussed in the section above can be converted into expected concentration increases in the farm's outflow water immediately after passing through the Abalone facilities - refer to **Table 20** (i.e. the change in concentration from the *Intake water* to the *Outtake water*). As shown, the nutrient concentrations within the Outflow Pipe may exceed the ANZECC trigger values outlined in **Table 19**. However these amounts are still considered to be *within the variability of available measurements of existing concentrations* (p11) within the Port, as explained within the Dilution Report.

For comparative purposes, in the Karuah River catchment, the mean concentration of Total Nitrogen in catchment runoff derived from *grazing on modified pasture* (an unregulated activity) was found to be 6,800 µg/L (Bartley *et al* 2012 cited in **Appendix 19**). The farm is expected to increase the Total Nitrogen concentration (immediately after passing through the farm facilities) by around 113 µg/L, as shown in **Table 20**.

Regardless, particularly over the long term, mixing and dilution of the farm water subsequent to discharge is important to mitigate impacts on estuary ecology, as discussed below.

**Table 20: Expected Nutrient Concentration Change after Passing through Farm Facilities**

| Nutrient | Expected concentration change after passing through farm facilities (i.e. from Inlet Pipe to Outlet Pipe) (µg/ L) |
|---|---|
| Ammonia | +78 |
| Total Nitrogen | +113 |
| Filterable Reactive Phosphorus | +25 |
| Total Phosphorus | +30 |

The Report involved detailed assessments and calculations in order to gain an understanding of how farm water would be dispersed within the Port upon release, including:

- Drifter releases to measure likely trajectories for discharge from the farm;
- Three dimensional modelling of tidal currents within the Port; and
- Dispersion simulations as a function of the three spatial dimensions and time.

The results of the above modelling are discussed at **Appendix 19** and provided as motion pictures in the electronic files submitted with this EA and at the following web address:

**http://users.eastlink.ca/~bxs/PORT_STEPHENS/PortStephens.html**

Simulations of how the farm's water would disperse into the Port were prepared in relation to the Spring tides (*exceptionally high and low tides that occur at the time of the new moon or full moon*) and Neap tides (*the tides just after the 1st or 3rd quarters of the moon when there is the least difference between low water and high water).* The results can be seen as 'discharge plumes' originating from the pipe outlets and dispersing into the surrounding water. A 'still shot' from one of these modelled movies is shown in **Figure 19** below.

This process allowed Sanderson to calculate what the concentration of nutrients originating from the farm would be at any given distance from the pipe outlets, taking into account the mixing and dilution effects that would occur upon release (further details on this process are provided at Section 6 of the Dilution Report). The Report points out that, relative to ANZECC trigger values and relevant to the farm, the *Ammonia* increment is of greater significance by far than the increments of other nutrients. Accordingly*, if* ***dilution effects are deemed sufficient for ammonia then dilution will be sufficient for all***

***other nutrients*** (p8). For this reason, the Dilution Report assessed and modelled the dispersion and resultant concentrations of **Ammonia** from the farm (only) within the Port.

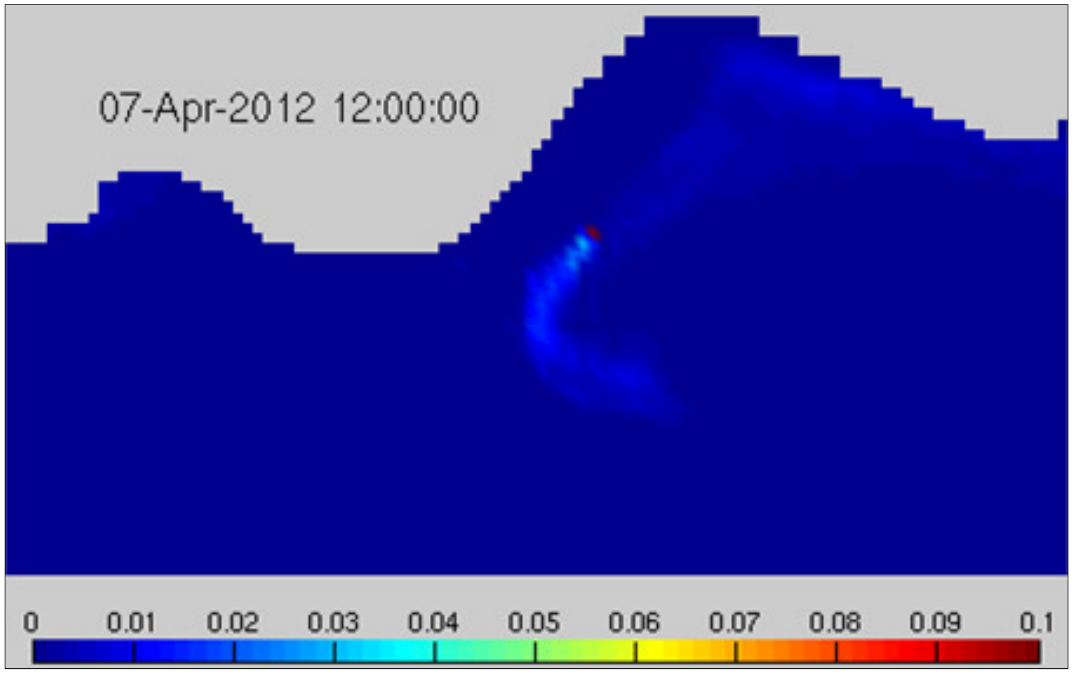



**Figure 19: 'Still Shot' from Movie showing 'Depth-Averaged' Concentration of Ammonia (Within Farm Water) being dispersed during Spring Tides.**

**Land is shown in grey, and the colours ranging from red to blue show Ammonia levels within the waters of the Port. The outlet position is indicated in red and the lighter blue colouring indicates the dispersing farm water (inclusive of Ammonia). The source concentration of Ammonia was 1 (normalised), while the colour scale is for the range 0 to 0.1 in order to resolve concentrations in most of the plume. See source (below) for further details.**

***(Source: http://users.eastlink.ca/~bxs/PORT_STEPHENS/PortStephens.html)***

**Figure 20** below shows the averaged modelled concentration of Ammonia as it disperses from the farm outlets during Spring tides, while **Figure 21** shows the same during Neap tides. This averaged representation of the spreading material appears patch-like whereas at any particular time the material tends to be distributed as a plume (similar to **Figure 19** above).

The *averaged* increments are most relevant for biological growth because such growth happens over time scales longer than the duration of tidal eddies that come and go at different phases during the tidal period. For this reason, the normalised concentrations are shown relative to the position of mapped *Posidonia australis* (seagrass) beds in close proximity to the farm, as well as Priority Oyster Lease areas (currently vacant).

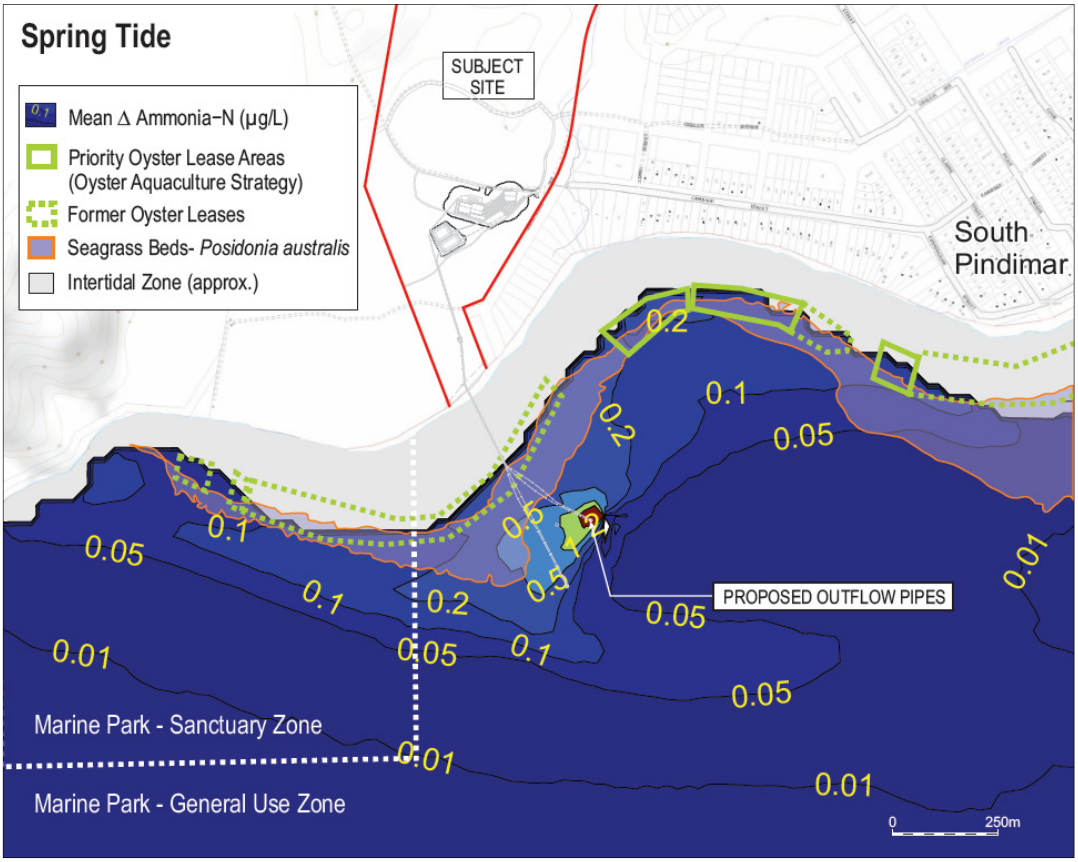



**Figure 20: Averaged Modelled Concentration of Ammonia (µg/L) originating from the Farm Outlets during the Spring Tide - Shown in Relation to *Posidonia* Seagrass Beds & Oyster Leases**

***(Source: adapted from Appendix 19)***

As illustrated in the above/ below figures and as shown in **Table 21** below ('*Expected concentration adjacent to outlet')*, almost immediately upon discharging from the Outlet Pipe, the ammonia from the farm will be diluted through mixing with the waters of the Port. On average, the concentration of ammonia (from the farm, not including background levels) in closest proximity to the Outlet is expected to reduce to 2 µg/L from the higher levels anticipated within the pipe (i.e. +78 µg/L - see **Table 20**). The highest expected averaged concentration increase of ammonia (originating from the farm) at the closest *Posidonia australis* population is expected to be 0.5 µg/L. Further discussion on seagrasses and aquatic ecology generally is provided at **Section 5.9** of this EA.

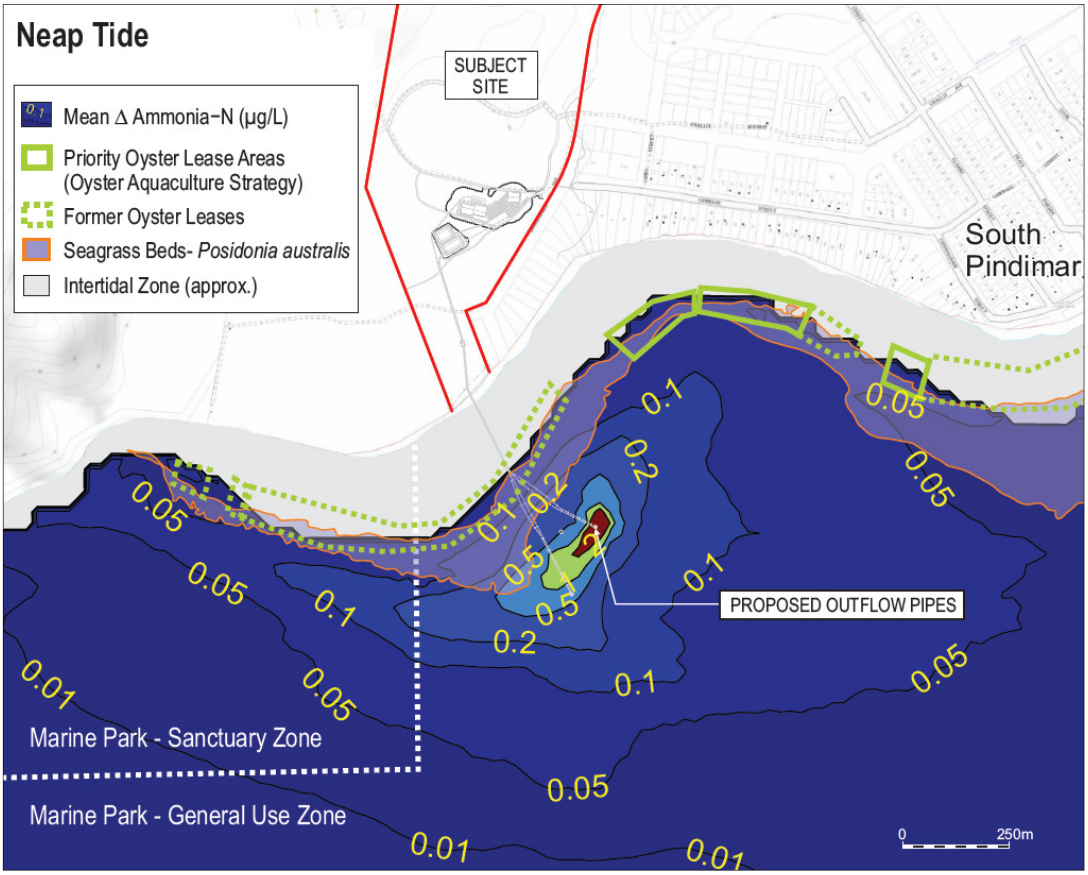



**Figure 21: Averaged Modelled Concentration of Ammonia (µg/L) originating from the Farm Outlets during the Neap Tide - Shown in Relation to *Posidonia* Seagrass Beds & Oyster Leases**

***(Source: adapted from Appendix 19)***

These concentration increases are **much less than 15 µg/L (the ANZECC trigger level) and much less than the background values of ammonia within the Port**, as discussed previously. Even taking into account the variable background ammonia levels outlined in **Table 19**, cumulative levels are expected to be significantly lower than the ANZECC trigger level. For example, assuming a background level of 4.3 µg/L, the ammonia concentration at the seagrass beds (including farm impacts) is expected to be around 4.8 µg/L. It is noted that these concentrations relate to the farm being stocked to full operational capacity - concentrations will be reduced whenever Abalone stocking density is below maximum production.

**Table 21: Expected Nutrient Concentration Increases from the Farm - at Outlets and Seagrass Beds**

| Nutrient | Expected conc. adjacent to outlet[1] (μg/ L) | Highest expected conc. at *Posidonia* habitat[2] (μg/ L) | ANZECC 2000 Guidelines trigger[3] (μg/ L) |
|---|---|---|---|
| Ammonia | 2 | 0.5 | 15 |

[1] Expected averaged concentration (originating from the farm) immediately adjacent to farm outlet- see **Figure 20** and **Figure 21** above
[2] Highest expected averaged concentration (originating from farm) at closest *Posidonia australis* habitat to outlet- see **Figure 20** and **Figure 21** above
[3] Inclusive of background nutrient concentration levels- see **Table 19** for previously recorded values.

Of course, concentrations might be intermittently higher at certain locations from time to time due to the variability of the tidal cycle. Accordingly, the Dilution Report also presents the maximum instantaneous values of ammonia from the farm during the modelled period (see Section 6 of **Appendix 19** and Item 42 within **Appendix 11**). The highest concentration increase adjacent to the outlet will reach up to 5μg/L (and over a larger area), while the highest concentration increase at the *Posidonia* beds will also reach up to 5μg/L. These values are substantially larger than the averaged increment (shown in the Figures above), consistent with the peak values having very short duration and being spatially localised at any one time. Regardless, the **maximum values (inclusive of mean background levels**) **are still well below the ANZECC trigger values.**

In summary, elevated nutrient concentrations arising from the farm will be rapidly diluted from the Outlets to well below ANZECC trigger values and the background nutrient concentrations within the Port.

### *LONG-TERM, LARGE-SCALE CHANGE IN AMMONIA CONCENTRATIONS IN PORT STEPHENS*

The Dilution Report also examined the impact of the farm on the long-term nutrient concentrations that are presently observed throughout the Port. As discussed previously, ammonia is considered to be the most relevant nutrient to be assessed, as it is the nutrient most critically impacted by the farm relative to background levels. Accordingly, the Dilution Report examined the average increase in ammonia within the Port due to discharge from the farm.

Calculations were undertaken based on a 'worst-case' scenario which ignored the influence of freshwater flows into the Port (which would enhance flushing of discharge from the farm out to sea) and instead relied only on the influences of the tidal flow. The detailed calculations can be found at Section 3 of **Appendix 19**.

The results indicated that the concentration of ammonia in the Port is likely to be elevated as a result of the farm by 0.036$\mu$g/L. This increase is:

- insignificant relative to ANZECC guidelines for trigger values; and
- insignificant relative to previous measurements of ammonia in the Port.

Accordingly, except immediately adjacent to the outlets, the proposed farm is *unlikely to cause a measurable change in nutrient concentration in either the inner or outer harbour* (p14).

#### 5.4.2.2 *Increased Turbidity*

Turbidity is the measure of the clarity (or murkiness) of water caused by suspended particles. Highly turbid waters are those with a large number of suspended particles which interfere with the passage of light through water.

Increased water turbidity could potentially arise from particulate waste in the water (e.g. uneaten food) discharged from the farm. A range of filtration measures are proposed as part of the farm's water treatment system in order to minimise particle production and to remove most of the particulates from the water column before release to the Port - these are outlined in **Section 5.4.3.1** of this EA.

It is important to note that, as outlined in **Section 5.4.3.1** below, the Abalone feed proposed to be used has been specifically designed to rapidly sink to the bottom of tanks for consumption by Abalone. This will help to reduce feed breaking up and being washed into the water column.

The Dilution Report at **Appendix 19** estimates that 80% of any particulate waste will be separated / filtered out of the water column before discharge (p5), via the proposed filtration systems. The efficacy of these systems has been established by others, including Pfiffer, Osborn *et. al*, in 2008 (for swirl separators) and Barrut, Blancheton *et. al* in 2013 (for protein skimmers).

In addition to filtration, the farm proposes the use of 2 Settlement Ponds, designed in accordance with the principles set out by Colt & Huguenin in 2002 (amongst others). The main purpose of such ponds in this situation is to act as a 'polishing system' or additional buffer to the proposed filtration systems.

Settlement Ponds allow for particulates within the water column, which have a greater density than water, to settle out of the water column onto the base and/or sides of the

Ponds (and their subsequent removal during cleaning activities). A review of settlement ponds by Cripps & Bergheim (cited within Thiess *et. al* 2004) found that *30 minutes is the recommended retention time for settlement. Based on this recommendation, a typical Abalone farm discharging 600L per second would require a settlement pond of 1,000m$^3$ in volume* (p39).

The proposed farm will release marine water at a rate of approximately 579 litres per second, similar to the hypothetical pond mentioned. However the farm proposes the use of 2 Settlement Ponds, each of which has a volume of 2,147m$^3$, with water from each farm facility to pass through at least one of these large ponds. Accordingly, based on the Cripps & Bergheim review, water from the farm would require a settlement time of only 15 minutes in a single pond to *effectively remove suspended solids, leaving a clear effluent* (Thiess *et. al* 2004, p39). Farm water is generally expected to have a residence time of approximately 2 hours in the Settlement Ponds (and proposed Settlement Tanks in some instances) before release, which is significantly longer than recommended by Theiss.

Accordingly, taking into account the proposed filtration measures and supported by the use of Settlement Ponds, the farm is expected to release a negligible amount of suspended solids into the Port. Any such solids would be rapidly diluted (see **Section 5.4.2.1** for a detailed discussion on dilution effects), and are not likely to have any impacts on turbidity within the Port.

It should be noted that many Abalone farms around Australia do not utilise settlement ponds as part of their treatment regime, as they were presumably not considered necessary by regulatory authorities. For example, with the exception of coarse filtration (to prevent Abalone escape), many farms within South Australia do not utilise *any* significant water treatment systems.

#### 5.4.2.3 *Chemical Contamination*

A small volume of chemicals will be utilised within the farm's processes, as listed within **Appendix 7** and discussed in **Section 3.7.7.9** of this EA. Many of the chemicals will not be utilised within the marine water stream (e.g. iodine used for handwashing and diesel fuel for generator use). However, some chemicals / pharmaceuticals will be used within Abalone tanks and raceways (e.g. water buffering agents) and so will remain within marine water.

Such chemicals will be used only on rare occasions and in negligible amounts. For example, up to around 60ml of hydrogen peroxide *in a 12 month period* will be used in

marine water to promote spawning. Such a small amount of chemical will be immediately diluted to non-hazardous concentrations once released within the general marine water stream (although it is noted that hydrogen peroxide decomposes into *water* and *gaseous oxygen*, and so could not be considered harmful, regardless). To place this in perspective, far greater concentrations and volumes of similar chemicals are frequently released into drains and subsequently the ocean from hairdressing salons and other such facilities.

Other expected dosages and their frequency of use are indicated in **Appendix 7**.

In summary, the risk of adverse impacts on the Port's water quality from chemical contamination is considered to be negligible, particularly in light of the large volumes of water passing through the farm and their subsequent dilution effects.

#### 5.4.2.4 *Decreased Dissolved Oxygen & Increased Dissolved Carbon Dioxide Levels*

The oxygen and carbon dioxide levels of farm water may change as a result of respiration by Abalone. This may also result in slightly reduced (more acidic) water pH levels. However, natural gas exchange between the water and the ambient air above the Settlement Ponds is anticipated to substantially restore levels to equilibrium before release into the Port. This issue is discussed further in **Section 5.4.3.1** below.

#### 5.4.2.5 *Decreased Calcium Levels*

Abalone extract dissolved calcium from marine water for shell growth. However, the percentage decrease in calcium levels resulting from the farm is anticipated to be insignificant during flow-through operations (Cenni *et. al.* 2010), and will not have any measurable impact on the water quality of the Port.

#### 5.4.2.6 *Other Impacts*

Potential impacts from Acid Sulphate Soils and stormwater management issues are addressed separately at **Sections 5.5** and **5.6** of this EA. Risks associated with the potential transmission of disease from the farm, including within released water, are addressed at **Section 5.3**.

### 5.4.3 PROPOSED MITIGATION MEASURES

In order to reduce the risk of the farm having detrimental impacts on the water quality of the Port, a number of management and monitoring measures are proposed. These systems and measures are conceptually illustrated in **Figure 22**, below, and are discussed in more detail in the following sections i.e.:

- *In-farm Mitigation & Treatment Measures; and*
- *Water Quality Monitoring.*

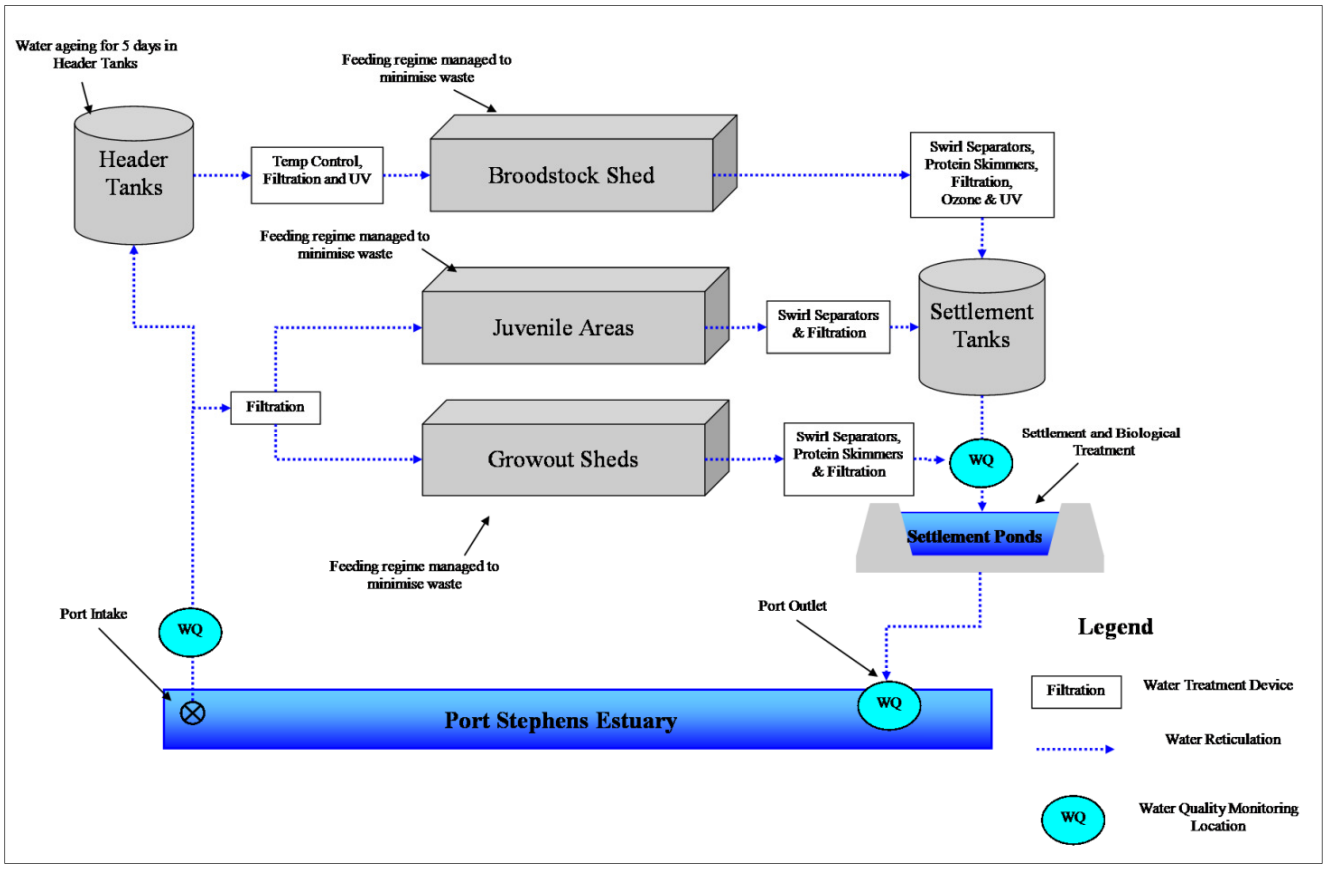



**Figure 22: Marine Water Quality Management System - Conceptual View**

#### 5.4.3.1 *In-Farm Mitigation & Treatment Measures*

Marine water will undergo a range of treatment processes within the farm.

As illustrated in **Figure 22**, after intake from the Port there will be some pre-treatment of water *before* introduction into Abalone tanks and raceways (e.g. ageing, filtering and UV),

primarily to minimise the risk of pathogen, pest or parasite introduction into the farm. Further details on this pre-treatment system are outlined in **Table 6** in this EA.

*During and after* exposure to Abalone, a number of management, design and treatment measures are proposed to manage water quality before release into the Port. These processes are described below, and are conceptually illustrated in **Figure 22**.

***ALL FARM FACILITIES***

- **Strict feeding protocols:** as discussed in **Section 3.7.7.3**, Abalone feeding practices will be managed and monitored carefully to minimise waste. Abalone fed on commercially available feed have an extremely high food conversion ratio (i.e. approximately 1.5:1, meaning that 1.5kg of feed is required to produce 1kg of Abalone). Accordingly, Abalone will utilise feed so efficiently that minimal excreted waste will be produced. The ingredients of the feed (e.g. milk, wheat, grains etc. rather than animal proteins) will ensure that, apart from Nitrogen and low levels of Phosphorus, no significant amounts of other nutrients will be produced as waste. Further, the selected feed has been designed to have a much higher specific gravity than water and will rapidly sink to the bottom of tanks and raceways to minimise any break-up and spread of feed throughout the water column. This also ensures that feed will not be washed away before being eaten. Finally, feed uptake will be carefully monitored and recorded to ensure that only the minimum amount is utilised to meet Abalone needs, reducing the production of waste. These measures will assist in reducing water turbidity and the production of waste nutrients such as Nitrogen. A more detailed discussion on Abalone food conversion and utilisation is provided in Section 2.1 of the Dilution Report at **Appendix 19**.
- **Filtering**: all water will be filtered during circulation and before release from each farm facility. The plans at **Appendix 2** of this EA illustrate the expected locations of these filtration units within certain farm facilities (e.g. Facility Shed, Grow Out Sheds), although not all systems are shown in order to reduce plan complication. 'Swirl separators' will remove large and heavy particles from the water (e.g. excrement and waste food). These units will be in place immediately downstream of the main production tanks. Use of swirl separators will ensure that solids can be removed from the main water flow, gently and continuously. Thus larger solids will be removed before they have a chance to break up and release nutrients. The efficiency of these separators depends on design, flow rates and the settling velocity of the particulates.

'Protein skimmers' (or 'foam fractionators') will efficiently remove very fine particles and dissolved organic material from the water column. These systems remove suspended and dissolved solids from culture water. The system concentrates volatile solids, total Kjeldahl nitrogen and total suspended solids, organic acids and bacteria in the foam condensate. Foam fractionation removes particulates less than 30 microns, including bacterial particles (Cripps & Bergheim 2000). Barrut, Blacheton *et al* found in 2013 that protein skimmers achieved a removal efficiency of around 80% for total suspended solids and their associated Nitrogen within the particle size range of their operating capabilities.

'Screen filters' will be used before water release to the Settlement Ponds in accordance with the directives of the *Sustainable Aquaculture Strategy for Land-Based Aquaculture*. It is proposed that a self-cleaning filter similar to the 'Triangle Filter TF2400' will be used. During operation, screen filters should be more than 80% efficient at removing particles within the targeted filter particle size range.

As discussed in **Section 5.4.2.2** of this EA, it is estimated that 80% of particulate waste will be filtered out before discharge to the Port. These treatment measures will ensure that any impacts on water turbidity are minimised and nutrient discharge from tanks / raceways is reduced.

- **Settlement & biological treatment:** after use within tanks and raceways, all water will be directed to the 2 Settlement Ponds (via Primary and Secondary Settlement Tanks where necessary, to ensure all water passes through at least 2 settlement systems). The bulk of the remaining suspended solids within the water column will settle to the bottom and/or sides of Ponds before release back into the Port, as outlined in **Section 5.4.2.2** above. The settlement system (considered a 'polishing system', supportive of other filtration methods) should be able to remove approximately 80% of any remaining solid wastes that enter the Ponds (Huguenin & Colt 1989, Maguire 1998).

  Residence time within the Settlement Ponds will also allow for natural air exchange, which will help to restore dissolved carbon dioxide and oxygen levels (and subsequently, water pH levels) to equilibrium (Housefield, G. 2013, pers. comm. 13 March). As for all such ponds within aquaculture farms, marine organisms will naturally establish (e.g. algae, various filter feeders, detrivores and herbivores). These organisms will consume excess organic matter, nutrients (in particular Nitrogen as Ammonia), algae and other vegetative biomass (i.e. 'biological treatment'). This process is similar to naturally occurring benthic processes and will reduce the levels of particulates, nutrients and organic

materials within the water column. Any excess growth of algae or other 'fouling' organisms will be removed and disposed of via the regular pond maintenance regime.

Note - while beneficial, the farm's water treatment regime does not rely on the biological treatment or settlement expected to occur within the Settlement Ponds (i.e. the calculations of potential impacts on water quality at **Appendix 19** *exclude* consideration of biological treatment and settlement).

#### *BROODSTOCK SHED*

In addition to the processes outlined above, water from the quarantine, broodstock and hatchery facilities (all located within the Broodstock Shed) will undergo further treatment to minimise the risk of pathogen release from the farm, as outlined below:

- **Ozone treatment**: after filtration, water will be disinfected with ozone to inactivate pathogens and
- **UV disinfection**: UV treatment will be used to support the ozone treatment and to ensure the removal of any residual ozone in the water column. UV treatment will both sterilise water and accelerate the decomposition of Ozone ($O_3$) to Oxygen ($O_2$).

Further discussion on these processes is provided at **Section 5.3** of this EA, and the indicative locations of the treatment units are shown in the plans at **Appendix 2** (*Broodstock Shed Floor Plan*).

### 5.4.3.2 *Water Quality Monitoring*

Monitoring of water quality within the farm and the Port Stephens estuary is proposed, as outlined within **Table 22** below and conceptually illustrated in **Figure 22**. A detailed *Water Quality Monitoring Plan* will be prepared should the Project gain approval. This Plan will be prepared in accordance with government regulatory requirements and Project approval conditions. It would be subject to approval by relevant authorities and will identify monitoring requirements and water quality trigger values.

Should monitoring results indicate that water quality exceeds nominated trigger values; appropriate contingency measures will be implemented. Such measures may include those listed below; however the most appropriate response will be determined on a case-by-case basis. Note that water monitoring frequency will increase in poor weather conditions or in response to a disease event.

- Reduce feeding of Abalone to 'maintenance levels';

- Cease water discharge from the tank/ facility temporarily (i.e. switch to 'full water recirculation');
- Increase aeration of water;
- Reduce stock levels; and
- Review water quality treatment system.

**Table 22: Proposed Marine Water Monitoring Regime**

| Water Variable Tested | Monitoring Location | Approximate Monitoring Frequency |
|---|---|---|
| Temperature | General intake water; intake for Broodstock Shed, Juvenile Shed, and External Juvenile Area | Continuously |
| | Growout Sheds intake | Weekly & randomly |
| | Settlement ponds | Weekly |
| | Port Stephens (adjacent to Outflow Pipes) | Monthly |
| Salinity | General intake water; intake for Broodstock Shed, Juvenile Shed, and External Juvenile Area | Continuously |
| | Growout Sheds intake | Weekly & randomly |
| | Settlement ponds | Weekly |
| | Port Stephens (adjacent to Outflow Pipes) | Monthly |
| Oxygen | Broodstock Shed, Juvenile Shed, External Juvenile Area intake | Daily |
| | Growout Sheds intake | Weekly & randomly |
| | Settlement ponds | Weekly |
| | Port Stephens (adjacent to Outflow Pipes) | Monthly |
| pH | General intake water; intake for Broodstock Shed, Juvenile Shed, and External Juvenile Area | Continuously |
| | Growout Sheds | Weekly & randomly |
| | Settlement ponds | Weekly |
| | Port Stephens (adjacent to Outflow Pipes) | Monthly |
| Nitrogen compounds | Broodstock Shed, Juvenile Shed, External Juvenile Area intake | Weekly |
| | Growout Sheds intake | Weekly & randomly |
| | Settlement ponds | Weekly |
| | Port Stephens (adjacent to Outflow Pipes) | Monthly |
| Total Nitrogen | Port Stephens (adjacent to Outflow Pipes) | Monthly |

#### 5.4.3.3 *Summary*

In summary, the farm is not considered likely to have an adverse or measurable impact on the water quality of Port Stephens. The mitigation measures outlined in **Table 23** below will be implemented should the Project be granted approval.

**Table 23: Proposed Mitigation Measures - Marine Water Quality**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Water Quality Monitoring | A detailed *Water Quality Monitoring Plan* shall be prepared and implemented before construction works begin. The Plan shall incorporate monitoring and reporting measures required by regulatory agencies. | Pre-Construction |
| Water Quality Contingency Measures | Should water quality monitoring results exceed nominated trigger values, appropriate contingency measures shall be implemented as outlined within the EA and the *Water Quality Monitoring Plan.* | Operation |

## 5.5 Soils & Potential Acid Sulphate Soils

### 5.5.1 EXISTING ENVIRONMENT

The following provides a general indication of the soil landscape within the subject site:

- The soils of the site are generally 'Podsols' within the Shoal Bay landscape variant. These generally comprise poorly drained Pleistocene sand sheets of low slope and local relief, with an elevation between 2m and 6m. The soil type varies with elevation, as follows:
  - **Lower elevations (less than 3m AHD):** soil comprises a Podsol (Uc2.20, Uc2.33) on deep Pleistocene sand sheets.
  - **Higher elevations:** soil comprises shallow to moderately deep, well drained brown Podsolic soils (Db2.21) and some yellow Podsolic soils (Dy3.21) on conglomerate.
- The site topography varies from around 2.5m AHD to 14m AHD. The ridge top and slope within the site are both eroded and have areas of rock exposed between the thin patches of this soil. The sand flat extends from the slope to the swale behind the frontal dune. The foredune is actively eroding due to wave

runup. The short beach integrates with an extensive tidal flat (approximately 200m wide).

- Assessment (Housefield 2013, unpublished) has determined that there is a moderate erosion hazard (on slopes).

#### 5.5.1.1 *Potential for Acid Sulphate Soils*

The common name given to soils and sediments containing iron sulphides is 'Potential Acid Sulphate Soils' (PASS). When exposed to air ('oxidised') and infiltrated by fresh water, these soils produce sulphuric acid, and potentially toxic quantities of iron, aluminium and heavy metals - they become actual 'Acid Sulphate Soils' (ASS). Soils may be exposed to air when they are moved above the water table (e.g. excavated) or the water table is lowered for a significant period of time (i.e. soils are allowed to dry). In NSW, ASS have been found in every coastal estuary. The *Port Stephens Acid Sulphate Soil Risk Map* provides broad-scale information about landforms, soil types and the risk of ASS occurring throughout the Port Stephens area.

The Map, as shown in **Figure 23** below, defines the landform of much of the site as an 'Aeolian Sand Plain' (Wa4), particularly in the southern areas where development will occur. This landform is considered to have a 'low probability' of ASS occurring within the soil profile. If present, they are likely to occur greater than 3m below the ground's surface. The *Acid Sulphate Soil Preliminary Assessment* (ASSPA - see **Appendix 4**), prepared for this proposal, notes that *soil tests, undertaken as part of this assessment, have found no acid-sulphate soils in terrestrial areas of the site*.

Land north of the Wa4 land is not described within the Map and has 'no known occurrence of ASS materials'.

However, a strip of land adjacent to the foreshore of Port Stephens is defined as an 'Estuarine Intertidal Flat' and has a 'high probability' of ASS occurring 'at or near the ground surface'. The ASSPA notes that *a band of PASS was detected 1.4m below the sediment surface in the intersection of the proposed pipe route…this area is all below the water table as it is flooded by the tide two times a day…by over one meter of marine water.*

The subtidal area (beyond the intertidal area) is mapped as 'Estuarine Bottom Sediments' and is also classed as having a 'high probability' of ASS occurring.

## 5.5.2 IMPACTS ASSESSMENT

### 5.5.2.1 *Potential Acid Sulphate Soils Management*

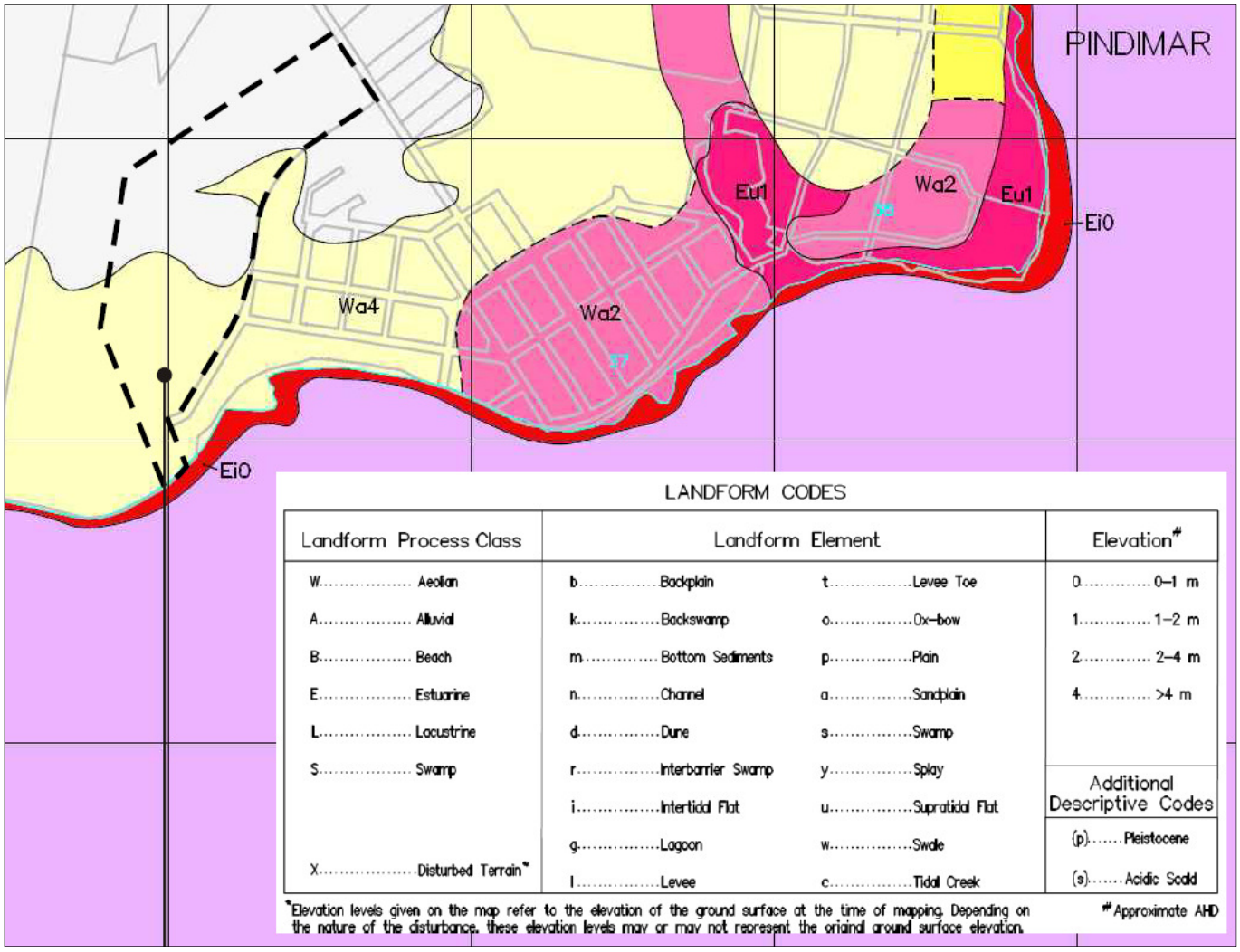
The main farm development will occur above 3m AHD, where the risk of encountering ASS only occurs 3m or more *below* natural ground level. Accordingly, most farm construction (e.g. buildings) will occur well above this depth and there is negligible risk of encountering ASS. Some excavation is proposed to occur in the main farm precinct (e.g. associated with Settlement Ponds), however *these ponds will be located in areas of deep aeolian sand…they will be lined with geomembrane material and will not be deeper than the water table…ponds will have a depth of around 2m…there is no plan to change the water table….* (ASSPA). Accordingly, excavation for these ponds is not anticipated to encounter ASS.

Construction of the proposed pipelines (i.e. burial through the intertidal area) and the Pumphouse will also involve excavation works.

The pipelines will be buried within a trench with a maximum depth of approximately 0.9m; however ASS were not found to occur until 1.4m depth during survey within the proposed pipeline route. Accordingly, excavation for the pipelines is not likely to result in an interaction with ASS.

Regardless, the ASSPA recommends a conservative approach to managing ASS through appropriate construction techniques and the application of neutralising agents to soils. These measures include:

- The careful staging of pipeline burial, so that excavation, pipeline burial and backfilling of each pipe length occurs promptly (same day). Accordingly, *the substrate will be exposed to the air for less than 6 hours before it is reburied in the anaerobic / saturated conditions from which it came…there will be no discernible impact on sediment oxygen levels from before to after pipe installation… (*Any shallow PASS not elucidated during the soil analysis) *will not become ASS as this requires lowering of the water table or long term exposure to air. It should also be noted that the water table is likely to change with the tides and that the well oxygenated alkaline seawater has and will continue to have a neutralising effect*.
- Lime (a neutralising agent) *will be used to cap sediments below the pipeline trench as recommended by (Chapman 1998). The sediments will be replaced in the reverse order to extraction i.e. bottom sediments in first*.




LANDFORM CODES

| Landform Process Class | Landform Element | | Elevation# |
|---|---|---|---|
| W..... Aeolian | b..... Backplain | t..... Levee Toe | 0..... 0–1 m |
| A..... Alluvial | k..... Backswamp | o..... Ox–bow | 1..... 1–2 m |
| B..... Beach | m..... Bottom Sediments | p..... Plain | 2..... 2–4 m |
| E..... Estuarine | n..... Channel | a..... Sandplain | 4..... >4 m |
| L..... Lacustrine | d..... Dune | s..... Swamp | |
| S..... Swamp | r..... Interbarrier Swamp | y..... Spiay | Additional Descriptive Codes |
| | i..... Intertidal Flat | u..... Supratidal Flat | (p)..... Pleistocene |
| | g..... Lagoon | w..... Swale | (s)..... Acidic Scald |
| X..... Disturbed Terrain* | l..... Levee | c..... Tidal Creek | |

*Elevation levels given on the map refer to the elevation of the ground surface at the time of mapping. Depending on the nature of the disturbance, these elevation levels may or may not represent the original ground surface elevation.

#Approximate AHD

KEY

| Map Class Description | Depth to Acid Sulfate Soil Materials | | Environmental Risk |
|---|---|---|---|
| HIGH PROBABILITY<br>High probability of occurrence of acid sulfate soil materials within the soil profile.<br>The environment of deposition has been suitable for the formation of acid sulfate soil materials.<br>Acid sulfate soil materials are widespread or sporadic and may be buried by alluvium or windblown sediments. | Below water level | Bottom sediments. | Severe environmental risk if bottom sediments are disturbed by activities such as dredging. |
| | | At or near the ground surface. | Severe environmental risk if acid sulfate soil materials are disturbed by activities such as shallow drainage, excavation or clearing. |
| | | Within 1 metre of the ground surface. | Severe environmental risk if acid sulfate soil materials are disturbed by activities such as shallow drainage, excavation or clearing. |
| | | Between 1 and 3 metres below the ground surface. | Environmental risk if acid sulfate soil materials are disturbed by activities such as deep excavation for pipelines, dams or deep drains. |
| | | Greater than 3 metres below the ground surface.* | Environmental risk if acid sulfate soil materials are disturbed by activities such as deep excavations, –e.g., large structure foundations or deep dams. |
| LOW PROBABILITY<br>Low probability of occurrence of acid sulfate soil materials within the soil profile.<br>The environment of deposition has generally not been suitable for the formation of acid sulfate soil materials. Soil materials are often Pleistocene in age.<br>Acid sulfate soil materials, if present, are sporadic and may be buried by alluvium or windblown sediments. | Below water level | Bottom sediments. | The majority of these landforms are not expected to contain acid sulfate soil materials. Therefore, land management is generally not affected by acid sulfate soils.<br>However, highly localised occurrences may be found, especially near boundaries with environments with a high probability of occurrence. Disturbance of these soil materials will result in an environmental risk that will vary with elevation and depth of disturbance. |
| | | At or near the ground surface. | |
| | | Within 1 metre of the ground surface. | |
| | | Between 1 and 3 metres below the ground surface. | |
| | | Greater than 3 metres below the ground surface.* | |
| NO KNOWN OCCURRENCE<br>Acid sulfate soils are not known or expected to occur in these environments | | No known occurrences of acid sulfate soil materials. | Land management activities not likely to be affected by acid sulfate soil materials. |
| DISTURBED TERRAIN | | Disturbed terrain may include filled areas, which often occur during reclamation of low lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged, or have under development or construction of dams or levees. Soil investigations are required to assess these areas for acid sulfate potential. | |

*Deep occurrences of acid sulfate soil materials not able to be confirmed by field inspection and sampling.

**Figure 23: Acid Sulphate Soils Risk Map - Extract**

The same principles will be adapted for the construction of the Pumphouse.

There will be no disturbance to the subtidal sediments as pipes will be laid directly upon the surface in these locations.

The location of the emergency egress boardwalk across Pig Station Creek is mapped as having a 'low probability' of containing ASS within the top 3m of soil. As pylons for the boardwalk will reach a maximum depth of approximately 600mm, interaction with PASS is not likely. Regardless, auger holes will be no wider than the diameter of the pylons, in order to minimise disturbance to sediment.

Accordingly, the farm is not likely to result in any impacts associated with PASS or ASS.

#### 5.5.2.2 *Other Issues*

The potential for farm impacts on groundwater is discussed at **Section 5.7** of this EA.

Potential impacts on the soil profile from construction activities will be minimised through the retention and reinstatement of topsoils wherever excavation is required. Refer to the discussion on construction methodology at **Section 3.7.3.4**.

In order to minimise the potential for soil erosion; buildings will generally be constructed along topographical contours, as demonstrated within the development plans (**Appendix 2**). Any unbuilt disturbed areas will be replanted quickly and erosion barriers put in place during construction and until vegetation is established.

Conceptual sediment and erosion control plans are provided as part of the development plans (see Sheet 5) and the ASSPA (i.e. for pipeline construction). Refer to **Appendix 2** and **Appendix 4**. Further details can be provided as part of a proposed *Construction Management Plan* to be prepared prior to construction works.

### 5.5.3 PROPOSED MITIGATION MEASURES

The mitigation measures outlined in **Table 24** will be implemented to assist in minimising impacts from the farm on soils.

**Table 24: Proposed Mitigation Measures - Soils & Potential Acid Sulphate Soils**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Potential Acid Sulphate Soils | Appropriate ASS management techniques shall be implemented during construction as outlined in the *Acid Sulphate Soil Preliminary Assessment*. Measures shall include the prompt reinstatement of soils after excavation and the application of neutralising agents where | Construction |

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| | appropriate. | |
| Sedimentation & Erosion | Appropriate sedimentation and erosion control measures shall be implemented, as outlined in the *Acid Sulphate Soil Preliminary Assessment* and within the *Sediment Control Plan* (within the development plans). Additional measures can be outlined within the proposed *Construction Management Plan* for the site. | Construction |
| Soil Profile | Excavation activities shall be managed to minimise impacts to the soil profile. For example, topsoil shall be stockpiled, reinstated and revegetated where appropriate, as outlined within the *Acid Sulphate Soil Preliminary Assessment*. | Construction |

## 5.6 Surface Water

### 5.6.1 EXISTING ENVIRONMENT

The general topography of the subject site is indicated in the Survey Plan, attached at **Appendix 2** of this EA (Sheet 1). The characteristics of the soils are addressed at **Section 5.5**.

A *Stormwater Management Plan* (SMP) has been prepared for the Project by SMEC (see **Appendix 17**). It notes that the majority of the subject site is located within the Pig Station Creek Catchment, which has a total area of around 113ha. Pig Station Creek is a third order watercourse which runs generally north-south in the vicinity of the site's eastern boundary, with 2 tributaries traversing the northern part of the site in a west-east direction. Pig Station Creek is located partially below the tidal range (to at least the area of the proposed boardwalk), and drains to Port Stephens to the east of the subject site.

The Pig Station Creek catchment is shown in **Figure 24**.

The proposed farm precinct will be positioned partially within this catchment (i.e. will drain to Pig Station Creek), while the remainder of the southern portion of the site drains directly to the Port Stephens Estuary.

Rainfall, average monthly rainfall evaporation and potential evapotranspiration data from the local area is also presented in the SMP.

It is noted that the subject site and nearby South Pindimar village are not currently serviced with reticulated potable water, and such servicing is not anticipated to occur in the foreseeable future.

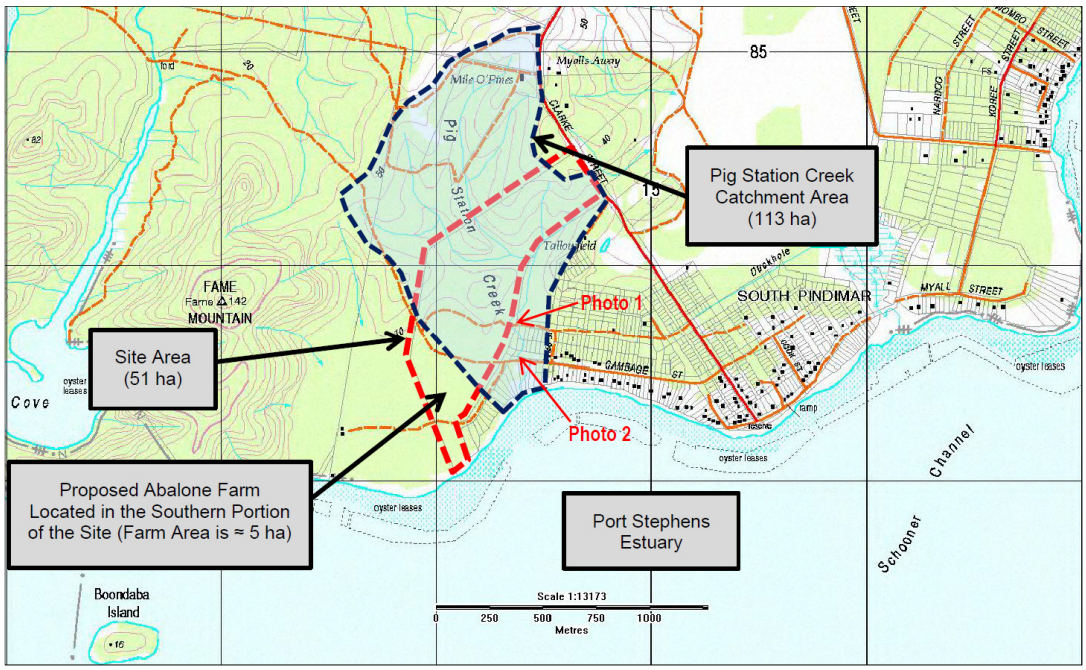



**Figure 24: Subject Site Location within the Pig Station Creek Catchment**

## 5.6.2 IMPACTS ASSESSMENT

### 5.6.2.1 *Stormwater Management Strategy*

The SWP outlines the proposed stormwater management strategy to control runoff from the farm's built footprint (an area of approximately 1.1ha which will accommodate the majority of farm infrastructure). No stormwater controls are proposed outside the built footprint as these areas will predominantly comprise managed native vegetation. The plan incorporates the principles of Water Sensitive Urban Design and comprises the following key features:

- **Rainwater Harvesting:** The majority of runoff from building roof areas will be collected in one of 6 x 10 KL rainwater tanks, positioned throughout the site. Harvested rainwater will be re-used on-site for toilet flushing and operational uses such as the washdown of raceways and hides. Modelling results indicate the tanks are likely to be full the majority of the time (see Section 5.4 of **Appendix 17**), therefore surplus water will be utilised for landscaping purposes and for the spraying down of roofs to provide supplementary cooling during the summer months, It is noted that potable (drinking) water will be separately purchased, as outlined in **Section 3.7.4.1** of this EA.
- **Vegetated Infiltration Swale**: Overflows from rainwater tanks and runoff from impervious areas such as roads and parking areas will be collected and treated in

a vegetated swale. The swale will be positioned in sandy soils and will have a minimal (approximately 0.5%) grade, so the majority of runoff from the farm precinct is expected to infiltrate into the underlying soils. During high flow conditions, some runoff will discharge into Pig Station Creek, downstream of the proposed boardwalk. However, as the Creek is tidal in this location any freshwater discharge from the swale is not expected to disturb the existing hydrologic regime.

- **Diversion Swales:** Drainage swales will be constructed at select locations to divert surface runoff from the farm precinct.

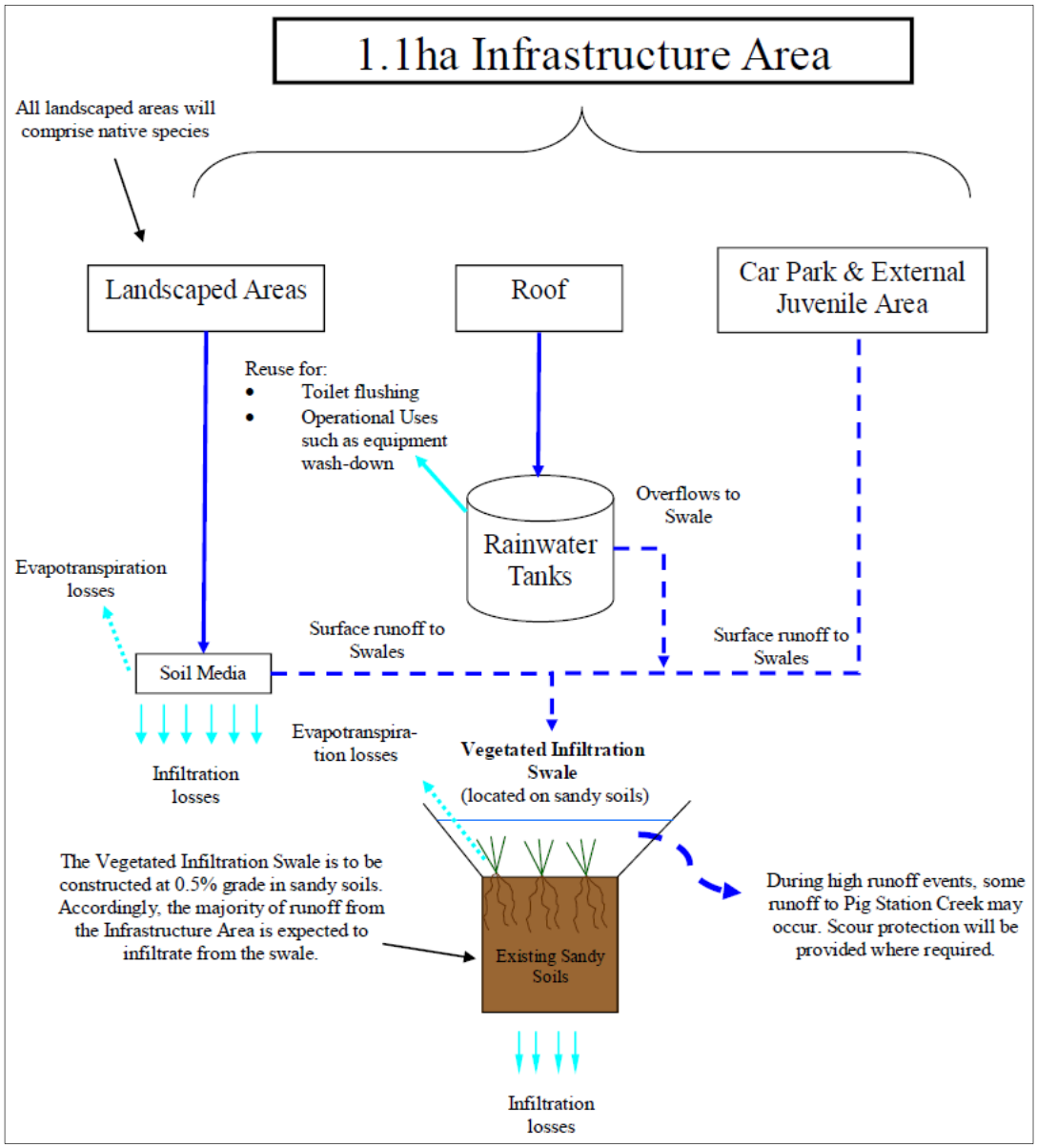



**Figure 25: Diagrammatic Illustration of Proposed Stormwater Management Strategy**

The key features of the management strategy are illustrated diagrammatically in **Figure 25** above, and the proposed stormwater management plan is provided at **Appendix 17**. It is noted that the Settlement Ponds are part of the marine water circuit and do not form part of the stormwater management system.

Note - all wastewater from farm operations (i.e. grey and blackwater) will be separately managed through the use of a pump-out sewage management system, as discussed in **Section 3.7.4.3** of this EA.

As outlined in **Section 5.13**, a dedicated 50,000 litre water tank is proposed to be maintained for the purposes of firefighting only. Water from the 6 rainwater tanks will be used to provide freshwater to this tank. However, should drought conditions limit the volume of water within this tank, water will be purchased to ensure the tank is at full capacity at all times.

#### 5.6.2.2 *Water Quality Modelling*

The SMP included water quality modelling based on MUSIC software (*Model for Urban Stormwater Improvement Conceptualisation*) to demonstrate the effectiveness of the stormwater strategy and to determine the key design parameters of the proposed water quality controls. Details of the modelling are provided at **Appendix 17**.

The modelling results indicate that:

- Runoff volumes from the developed farm precinct will be similar or less than existing conditions volumes; and
- Total Suspended Solids, Total Phosphorus and Total Nitrogen loads in runoff from the developed farm precinct will be similar or less than existing loads.

Based on modelling results, the SMP concludes that *from a stormwater management perspective, the project will have a neutral or beneficial effect on water quality, achieving the water quality management objectives outlined in Great Lakes Council's DCP 54* (p20).

### 5.6.3 PROPOSED MITIGATION MEASURES

The mitigation measures outlined in **Table 25** will be implemented to assist in minimising impacts from the farm on surface waters.

**Table 25: Proposed Mitigation Measure - Surface Water**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Surface Water Management | Appropriate surface water management controls will be implemented, as outlined within the *Stormwater Management Plan* These controls will be regularly inspected for effectiveness and maintained throughout the operational life of the farm. | Construction & Operation |

## 5.7 Groundwater

### 5.7.1 EXISTING ENVIRONMENT

The proposed farm precinct contains areas of exposed rock and sand beds. Available information indicates that the sand beds comprise unconfined aquifers directly recharged by rainwater in the vicinity of the site (Manly Hydraulics laboratory 1999).

The potential for groundwater to move through the aquifer is measured by its hydraulic conductivity. The aquifer in the vicinity of the subject site has a hydraulic conductivity of approximately 20m/day and transmissivity (i.e. *hydraulic conductivity x saturated thickness*) of approximately 400m$^2$/day (Manly Hydraulics Laboratory 1999). The direction of groundwater flow is generally southeast along the slope of the bedrock, towards Port Stephens.

The horizontal distance from the rocky ridgeline (within the site) to the Port is approximately 500 metres. As the groundwater is a water table aquifer, its depth is dependent on rainfall. There are no available records of groundwater depth in this location, although it is assumed to be relatively shallow. As the aquifers are continuously being recharged with fresh rainwater, the groundwater generally has a very low salinity (Manly Hydraulics Laboratory 1999).

No existing or potential users of the groundwater in this location have been identified. As the groundwater moves directly from the site into Port Stephens, there is unlikely to be any economic potential for use of the groundwater in this location.

### 5.7.2 IMPACTS ASSESSMENT

There are considered to be two potential sources of groundwater impacts from the farm, comprising seepage of marine water from the Settlement Ponds and other facilities into the groundwater system, and contamination of the groundwater via chemical use or spillage within the farm. These two issues are addressed below.

Note that the farm does not propose to access or use groundwater for any purpose.

#### 5.7.2.1 *Marine Water Seepage*

The proposed Settlement Ponds will receive all marine water utilised within the farm before release to the Port. These Ponds can hold a combined maximum volume of approximately 4.3ML of water, which is in excess of what would normally be required for farm operations. Ponds have been designed with sufficient capacity to allow for rainfall and storm events. Regardless, water can be released from the Ponds at a sufficient rate to ensure that water will not overtop banks.

In order to minimise the potential for marine water to seep directly into the groundwater table, Ponds will be lined with a heavy duty, impermeable pond liner likely to comprise high-density polyethylene (HDPE) or a similar material with a minimum thickness of 1.5mm. HDPE is commonly used for aquaculture purposes, as the material is chemically inert, relatively cost effective, has an extremely low permeability and good longevity (i.e. approximately 20 years). Use of the pond liners is anticipated to result in negligible seepage of saltwater from the Ponds into the groundwater table.

There are several open channels / drains proposed to transport marine water around the main farm precinct. These channels will comprise lengths of plastic half-pipe set into the ground. Due to the barrier created by the plastic, there is unlikely to be any seepage from the pipes into the surrounding soils.

Other tanks and marine water receptacles throughout the farm will be constructed of impermeable materials (i.e. plastic) and will be located above the ground's surface, with no potential for direct seepage.

As outlined in **Section 5.16** of this EA, crest levels of the Settlement Ponds are well above the Flood Planning Level and so are unlikely to be affected by flood events.

It is noted that the site is located in close proximity to the large saltwater source of Port Stephens. Accordingly, the site is likely to be naturally affected by volumes of salt transported from the Port as wind-blown spray.

#### 5.7.2.2 *Chemical Contamination*

The chemicals, pharmaceuticals and fuels proposed to be used within the farm are discussed in **Section 3.7.7.9**. The majority of these substances will be kept in small volumes and will generally be used indoors. Any spills that occur will be contained and remedied in accordance with relevant Material Safety Data Sheets. Due to the likely

location and nature of their use (e.g. inside the Facility Shed) these chemicals are not considered to present a significant hazard to the groundwater system.

In order to prevent contamination associated with diesel spills (i.e. for back-up generator use), areas proposed for the use and storage of diesel will be bunded to contain any spillage and to allow for clean-up (i.e. generator shed and Pumphouse). Further, HAZCHEM Spill Control Kits (i.e. 'wheelie bins') will be positioned in the Facility Shed, Pumphouse and generator shed to manage any spillage incidents. Refer to **Section 5.24** for further discussion.

Accordingly, there are not likely to be any significant impacts on groundwater from chemical use and storage within the farm.

### 5.7.3 PROPOSED MITIGATION MEASURES

As outlined above, provided recommended mitigation measures are implemented, there are not likely to be any detrimental impacts on groundwater arising from the Project. The recommended management measures are summarised in **Table 26** below.

**Table 26: Proposed Mitigation Measures - Groundwater**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Marine Water Seepage | Settlement Ponds shall be lined with a heavy duty, impermeable liner suitable for aquaculture uses (e.g. HDPE) before the introduction of marine water. | Construction |
| Marine Water Seepage | The integrity of pond liners and plastic channels shall be checked on a regular basis, and any tears, cracks or perforations repaired as soon as possible. | Operation |

## 5.8 Flora & Fauna - Terrestrial

### 5.8.1 EXISTING ENVIRONMENT

The subject site is predominantly undeveloped and covered in mature, native vegetation. Several small cleared areas are scattered throughout, particularly within the area of the proposed farm, as outlined within **Table 1** in this EA.

In order to adequately identify the existing ecological values within the site, a *Statement of Effect on Threatened Flora and Fauna* (the 'F&F Report') was prepared by Wildthing Environmental Consultants (see **Appendix 13**). The findings of this assessment are discussed in the following sections.

#### 5.8.1.1 *Vegetation Communities*

A detailed ground survey of the subject site and terrestrial 'additional areas' (see **Section 2.3.2**) was conducted as part of the F&F Report assessment, involving the undertaking of transect-based surveys. The results indicated that the 'study area' (including the area proposed to accommodate a pedestrian boardwalk and its surrounds) contained 14 vegetation communities, with 10 located within the subject site boundaries. Vegetation communities identified within the study area are listed in **Table 27** following (within **Section 5.8.2**), including their approximate area as a percentage of the total study area.

A detailed description of these communities is provided within the F&F Report. **Figure 26**, below, shows the location of each of these communities within the study area.

The areas of the site in which components of the farm are proposed to be located contain the following vegetation communities:

- **Ironbark** / **Tallowwood Open Forest**: main farm precinct;
- **Aquatic Dam Vegetation**: main farm precinct;
- **Coastal Sand Blackbutt Open Forest**: Settlement Ponds, Intake and Outflow Pipes and Pumphouse;
- **Swamp Mahogany- Paperbark Forest**: Intake and Outflow Pipes;
- **Saltmarsh**: boardwalk;
- **Mangrove**: boardwalk;
- **Cleared**/ **Modified Vegetation**: main farm precinct; and
- **Foreshore Vegetation**: Intake and Outflow Pipes.

The existing access roads also traverse areas of every vegetation community present within the subject site, with the exception of Spotted Gum / Ironbark Forest; Moist Riparian Forest; Foreshore Vegetation and Aquatic Dam Vegetation.

#### 5.8.1.2 *Habitat Values*

Habitat may be defined as the *physical and biological environment required for the survival of a specific population of a species* (p11). A comprehensive habitat appraisal was undertaken to inform the F&F Report, utilising vegetation community data, geomorphological features and the known occurrence of particular plant species or forms.

The main habitat types identified within the study area comprised *Eucalypt Forest; Cleared Open Areas* and *Coastal Marine*. Each of these habitat types offers a wide range of habitat opportunities for a range of species. Of note, areas within low lying areas of Swamp Forest contain preferred habitat for the threatened *Crinia tinnula* (Wallum Froglet); and areas of Eucalypt Forest accommodated two species of koala feed trees. The habitats proposed to be affected by the proposal *range from less ecologically significant areas such as open cleared areas to areas of Eucalypt Forest that would appear capable of offering suitable resources to both resident and transitory species* (p49). Further discussion on habitat values can be found within the F&F Report.

#### *SIGNIFICANT TREES*

A total of 191 'habitat trees' were identified as the result of a significant tree survey within the southern portion of the study area (i.e. within and around the farm location). Many of these trees were considered to be significant as a result of their large size and variety and number of hollows they contained. Details of each identified tree are provided within the F&F Report, and the location of each tree is shown in **Figure 27** below.

Note that approximately 13 significant trees are located within the development footprint of the farm.

### 5.8.1.3 *Coastal Wetlands*

Two areas of coastal wetlands, defined as such under *State Environmental Planning Policy No - 14 Coastal Wetlands* (SEPP 14) were identified in close proximity to the subject site. No development is proposed within the mapped SEPP 14 boundaries. SEPP 14 issues are discussed further in **Section 4.2.3.1** of this EA.

### 5.8.1.4 *Habitat Corridors*

According to the *National Parks and Wildlife Service Key Habits and Corridors for Forest Fauna - Occasional Paper 32* (refer to the F&F Report), the study area is located in an area of 'Key Habitat' and forms part of a sub-regional corridor that links habitat to the north, west and east. The location of the study area in the context of this corridor is shown in **Figure 28** below.

### 5.8.1.5 *Significant Flora Species*

In addition to the transect-based surveys described above, targeted searches for threatened flora species were undertaken across the site via the 'Random Meander

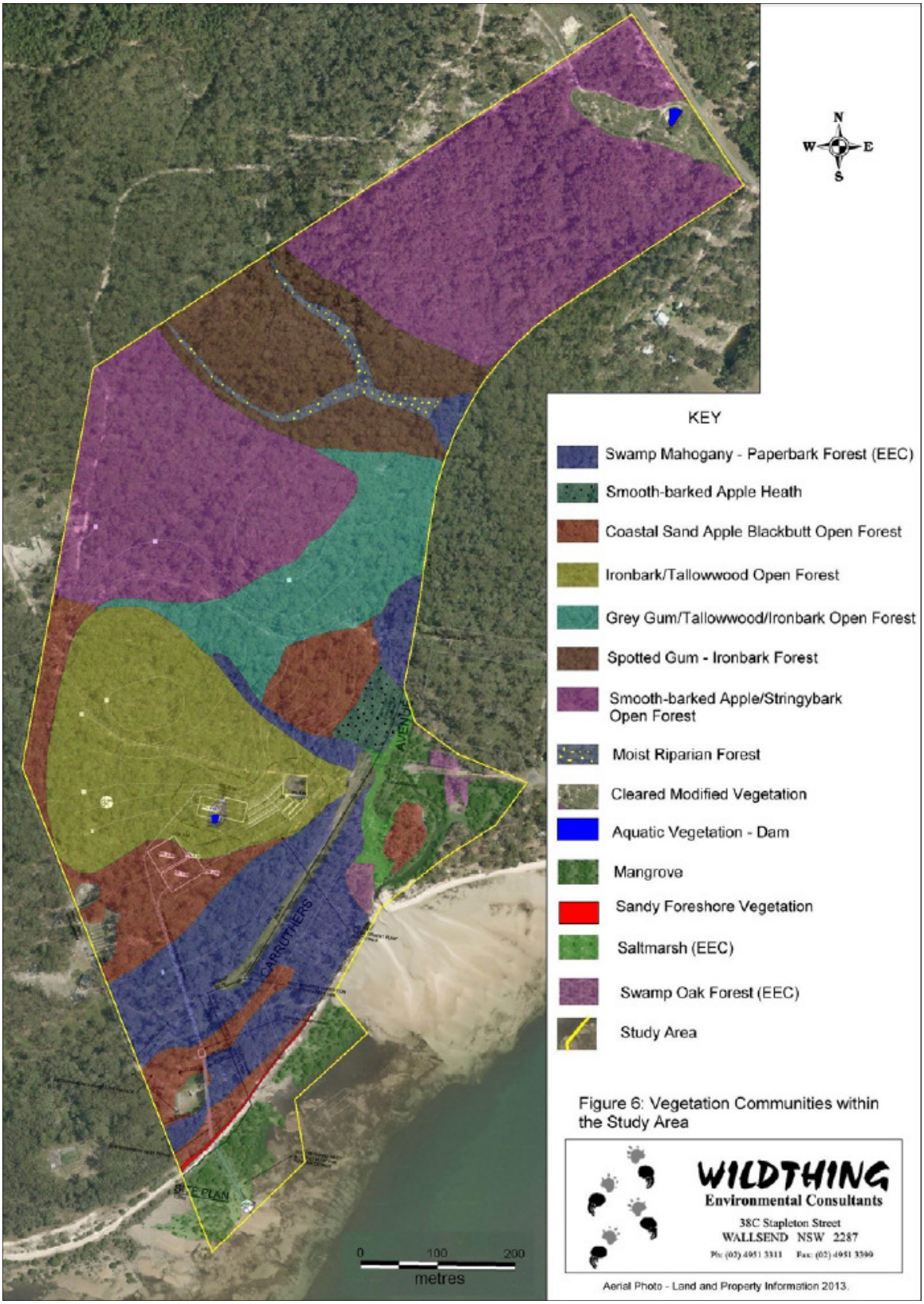



**Figure 26: Vegetation Communities within the Study Area**

***(Source: Appendix 13)***

Technique'. These surveys were undertaken during known flowering periods for cryptic threatened species with the potential to occur on the site, including *Tetratheca juncea* (Black-eyed Susan) and *Diuris arenaria* (Tomaree Doubletail).

Survey results identified 290 plant species occurring within the study area. While 28 threatened and rare species have previously been recorded within 10km of the study area (during previous surveys), none of these species were identified within the study area. Even though no threatened species were identified, it was considered that suitable habitat of varying quality was available for most of the threatened flora species.

#### 5.8.1.6 *Significant Fauna Species*

A total of 105 fauna species were identified within the study area during surveys. These species included the following:

- 22 mammal species (including arboreal mammals and bats);
- 11 amphibian species;
- 6 reptile species; and
- 66 bird species.

Further details on the identified species are provided within the F&F Report.

Of these, 5 threatened fauna species were definitively recorded within the study area, comprising:

- *Crinia tinnula* (Wallum Froglet);
- *Glossopsitta pusilla* (Little Lorikeet);
- *Pteropus poliocephalus* (Grey-headed Flying-fox);
- *Miniopterus australis* (Small Bentwing-bat); and
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

It is noted that no koalas (also a threatened species) were directly observed within the study area. However, due to the presence of characteristic scratches and scats, the species was considered to utilise the site. The site was considered to contain 'Potential Koala Habitat' pursuant to *State Environmental Planning Policy No 44 - Koala Habitat Protection* (SEPP 44). Yet the site was not considered to contain 'Core Koala Habitat'. SEPP 44 issues are discussed further in **Section 4.2.3.2** of this EA.

While no other threatened species were recorded, it was considered that foraging / hunting / nesting resources of varying quality were available for 51 additional threatened species.


**Figure 27: Habitat Trees in Proximity to Development Precinct**

***(Source: Appendix 13)***

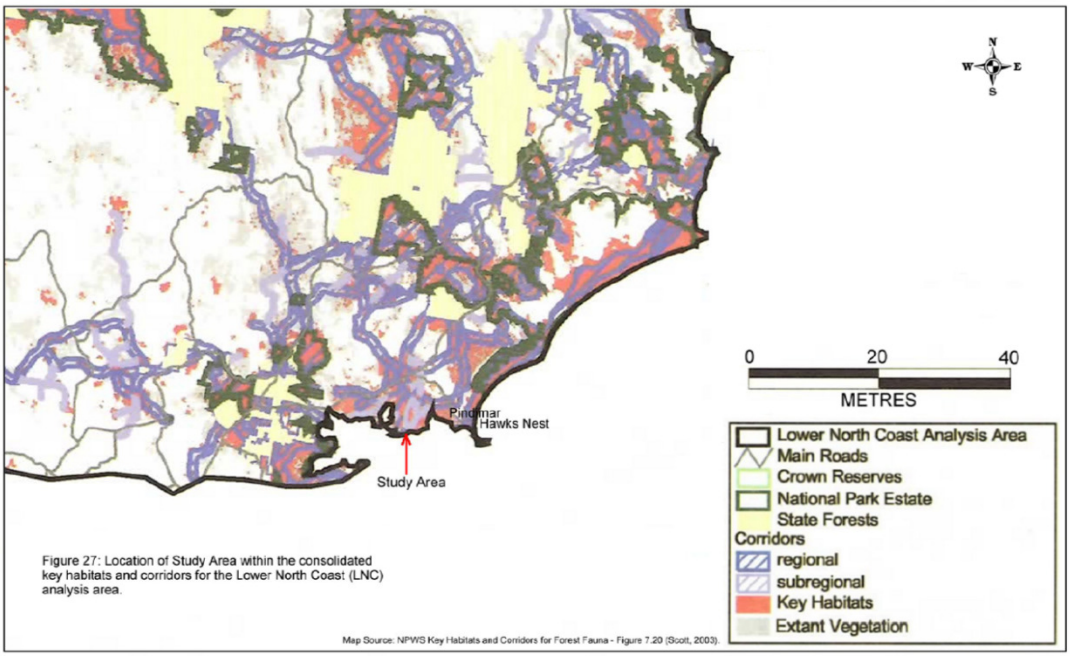



**Figure 28: Sub-regional Habitat Corridor**

***(Source: Appendix 13)***

Four 'nationally significant migratory species' (i.e. listed as such under the EPBC Act) were recorded within the area during fieldwork, comprising:

- *Haliaeetus leucogaster* (White-bellied Sea-Eagle);
- *Rhipidura rufifrons* (Rufous Fantail);
- *Numenius madasgascariensis* (Eastern Curlew); and
- *Numenius phaeopus* (Whimbrel).

#### 5.8.1.7 *Noxious Weeds*

Three noxious weed (flora) species were identified within the study area, comprising:

- *Lantana camara* (Lantana);
- *Rubus fruticosa* (Blackberry); and
- *Chrysanthemoides monilifers* ssp. *Monilifera* (Bitou Bush).

### 5.8.2 IMPACTS ASSESSMENT

Construction of the farm will require the clearing of approximately 65 trees to accommodate the building footprint (i.e. approximately 1.2ha). Further, it will involve the partial clearing (i.e. maintenance of separated tree canopies, management of groundcover etc.) of approximately 1ha for the purposes of bushfire risk management

(i.e. defendable space). Small areas of understorey vegetation will also be disturbed. Up to 13 significant 'habitat trees' (as discussed in **Section 5.8.1.2** above) are likely to be required to be removed.

Anticipated disturbance to vegetation communities is summarised in **Table 27** below. In total, approximately 4% of the vegetation within the study area is proposed to be disturbed or cleared, with 96% to remain undisturbed.

**Table 27: Vegetation Communities within the Study Area & Proposed Areas of Disturbance**

| Vegetation Community | Total Veg. Comm. Area within Study Area | Total (%) of Veg. Comm. Area to be Cleared/ Disturbed | Total (%) of Veg. Comm. Area to remain Undisturbed |
|---|---|---|---|
| Swamp Mahogany-Paperbark Forest (EEC^) | 7ha | Disturbed - 0.14ha (2%)<br>*Understorey veg 'disturbed' during pipeline construction/ burial* | 6.86ha (98%) |
| Smooth-barked Apple Heath | 0.7ha | Nil | 0.7ha (100%) |
| Coastal Sand Apple Blackbutt Open Forest | 5.8ha | Cleared - 0.35ha (6%)<br>*Building footprint*<br>Disturbed - 0.1ha (2%)<br>*Understorey veg 'disturbed' during pipeline construction/ burial* | 5.35ha (92%) |
| Ironbark/ Tallowwood Open Forest | 8.1ha | Cleared - 0.7ha (9%)<br>*Building footprint*<br>Disturbed - 1ha (12%)<br>*Thinned/ underscrubbed for APZ* | 6.4ha (79%) |
| Grey Gum/Tallowwood Ironbark Open Forest | 4.5ha | Nil | 4.5ha (100%) |
| Spotted Gum/ Ironbark Forest | 5.5ha | Nil | 5.5ha (100%) |
| Smooth-barked Apple/ Stringybark Open Forest | 20.5ha | Nil | 20.5ha (100%) |
| Moist Riparian Forest | 0.75ha | Nil | 0.75ha (100%) |
| Cleared/ Modified Land | 2.3ha | Cleared - 0.1ha (4%)<br>*Building footprint* | 2.2ha (96%) |
| Aquatic Vegetation-Dam | 0.04ha | Cleared - 0.01ha (25%)<br>*Building footprint* | 0.03ha (75%) |
| Mangrove* | 3ha | Disturbed - negligible<br>*Limited disturbance to* | 3ha (100%) |

| Vegetation Community | Total Veg. Comm. Area within Study Area | Total (%) of Veg. Comm. Area to be Cleared/ Disturbed | Total (%) of Veg. Comm. Area to remain Undisturbed |
|---|---|---|---|
| | | *pneumatophores from boardwalk construction* | |
| Sandy Foreshore Vegetation* | 0.2ha | Nil<br>*Limited disturbance associated with burying of pipeline- negligible area* | 0.2ha (100%) |
| Saltmarsh* (EEC^) | 0.5ha | Disturbed - negligible<br>*Limited disturbance from auger holes from boardwalk construction* | 0.5ha (100%) |
| Swamp Oak Forest* (EEC^) | 0.32ha | Nil | 0.32ha (100%) |
| | **59.21ha** | **Cleared - 1.2ha (2%)**<br>**Disturbed - 1.2ha (2%)** | **Undisturbed: 56.81ha (96%)** |

*Communities located outside the subject site, associated with the proposed boardwalk area and surrounds

^EEC - Endangered Ecological Community, pursuant to the *Threatened Species Conservation Act 1995*

Despite the anticipated clearing and disturbance, these impacts are not considered likely to have significant detrimental impacts on ecological values within the study area due to the implementation of recommended mitigation measures outlined in **Section 5.8.3** below,

The F&F Report found that the proposal may result in a small incremental disturbance to the sub-regional corridor discussed in **Section 5.8.1.4** above. However, it was considered that it *is unlikely to have a significant impact* (p50).

Regardless, in order to compensate for the vegetation disturbance, an area of high quality land in the northern portion of the site is proposed to be conserved in perpetuity. The legal mechanism through which this area is to be maintained is to be determined should the project gain approval, though is expected to involve the imposition of a restriction or covenant under Section 88 of the *Conveyancing Act 1919*). The proposed 'conservation area' (as shown in **Figure 29** below) encompasses approximately 5.14 ha, equivalent to 8.5 % of the study area (or around 10% of the subject site). This equates to an offset ratio of approximately 2:1. The conservation area includes the following features:

- areas of 4 vegetation communities, including Swamp Mahogany Forest (an EEC);
- two ephemeral drainage lines leading to Pig Station Creek, and associated riparian vegetation; and

- the maintenance of a valuable habitat corridor from the west of the site to the east.

The following sections further address the potential impacts of the proposal on terrestrial ecology issues pursuant to the relevant guiding legislation.

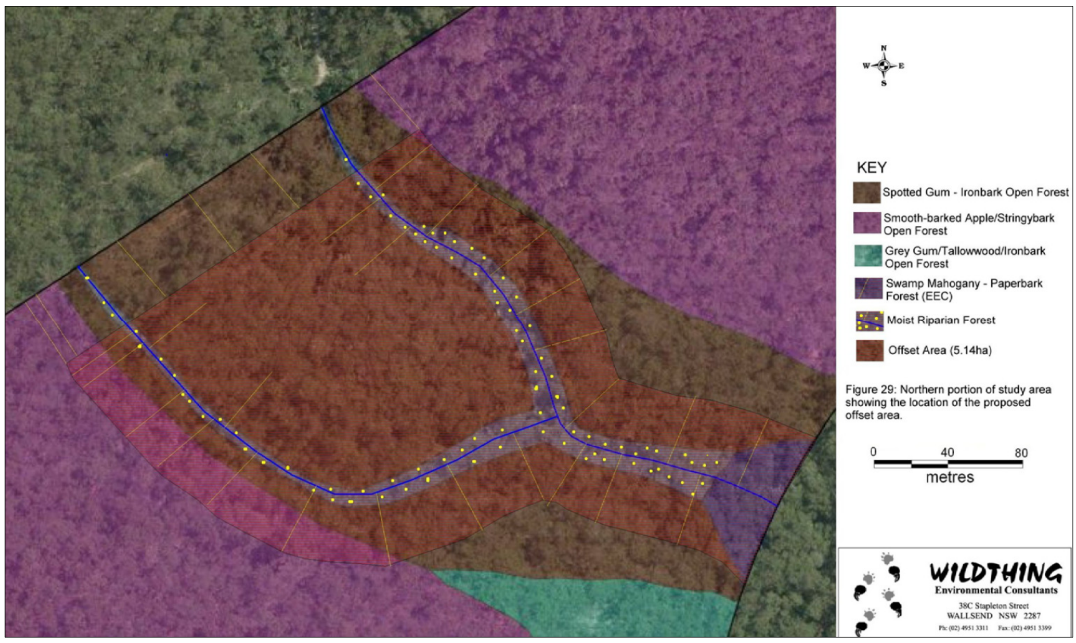



**Figure 29: Proposed Conservation Area within Subject Site**

### 5.8.2.1 *Considerations under Section 5A of the EP&A Act*

Section 5A of the EP&A Act provides factors which must be considered before determining if a proposal is likely to have a significant effect on threatened species, populations or ecological communities. As outlined in **Section 5.8.1** of this EA, the study area is known to accommodate six threatened fauna species and three EECs, but no threatened flora species. Two EECs (i.e. Swamp Mahogany and Saltmarsh) are proposed to accommodate components of the farm, comprising the Intake / Outflow Pipes and the pedestrian boardwalk, as shown in **Figure 26**.

A detailed assessment of the farm proposal with regard to these heads of consideration is provided within the F&F Report for all threatened species identified on site, and those considered to have potential habitat available within the study area. A discussion of the results of this assessment is provided in the following sections, encompassing:

- Endangered Ecological Communities;
- Threatened flora species; and
- Threatened fauna species.

In summary, provided the recommended mitigation measures are implemented, there are not likely to be any significant impacts upon threatened species or communities as a result of the Project.

### *ENDANGERED ECOLOGICAL COMMUNITIES*

**Swamp Mahogany- Paperbark Forest**

The area of Swamp Mahogany- Paperbark Forest within the site was found to contain floristic components consistent with the EEC known as *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.* The farm footprint, including the bushfire 'defendable space' (see **Section 5.13** of this EA) has been designed to avoid this area. However due to the farm's close proximity to the EEC there is the potential for secondary impacts such as stormwater runoff, sedimentation and weed infestation from the farm. Strict controls should therefore be applied to the farm precinct to prevent any degradation of this EEC, as outlined in **Section 5.8.3** of this EA (e.g. stormwater management).

The Intake / Outflow pipes will be positioned through areas of Swamp Mahogany in order to connect the farm to the Port. Between the farm and the Pumphouse, pipes will be positioned on low supports above the ground through this EEC. South of the Pumphouse, the pipes will be buried underground and the ground restored to its natural level. In all cases, the pipes are flexible and will be manoeuvred to minimise impacts upon trees.

However, there is likely to be disturbance to approximately 0.14ha of understorey as a result of the works. The preparation of a *Vegetation Management Plan* is proposed for the farm to manage the surrounding vegetation, which will help ensure the long-term viability of this community during and post construction. Considering the implementation of the recommendations outlined in **Section 5.8.3**, the proposal is therefore unlikely to cause extinction of this EEC in this locality.

**Saltmarsh**

Saltmarsh occupied a large portion of the intertidal zone of Pig Station Creek where the proposed boardwalk will be located. This EEC was generally intact, however had been subject to disturbances from previous illegal crossings of the creek by vehicles. The F&F Report found that *the boardwalk will be designed to require minimal disturbance to this community* (p82). Further discussion on Saltmarsh and coastal wetlands is provided at **Section 4.2.3.1** of this EA.

**Swamp Oak Floodplain**

The proposal will not have any impacts on the third EEC (Swamp Oak Floodplain) as it is outside the development area.

### *THREATENED FLORA SPECIES*

No threatened flora species were recorded within the study area. The species with the greatest likelihood of occurring on the site comprised *T. juncaea*, *A.asthenes and M. groveana*. However ideal habitat for these species occurred outside the farm development area and would therefore not be impacted regardless.

### *THREATENED FAUNA SPECIES*

The six threatened fauna species considered to be present within the site are discussed in the following sections.

In addition to these, the F&F Report considered that habitat for an additional 53 threatened species was available within the study area. At least 10 of these species, including the Large Bentwing-Bat and the Eastern Freetail Bat, were considered 'most likely' to utilise the site, although they were not recorded during surveys. The proposal will result in an incremental loss of potential habitat for these species, however taking into consideration the relatively large amount of suitable habitat in the local area and the relatively small area of disturbance, the proposal is *unlikely to disrupt the life cycle of the addressed threatened species such that local extinction would occur* (p87).

**Wallum Froglet**

The Wallum Froglet was recorded within the low lying areas of Swamp Mahogany, in the southern portion of the study area (outside the main farm precinct). Due to the close proximity of the farm to suitable habitat for the Froglet, there is the potential for secondary habitat impacts such as stormwater runoff and increased weed infestation. The management of these secondary impacts is discussed in **Section 5.8.3** below. Further, the positioning of the Intake / Outflow Pipes in this habitat could create a barrier to Froglet movement. In order to avoid such impacts, the pipes are proposed to be raised above the ground in some areas and buried underground in others (with the natural ground level reinstated), to allow unimpeded passage. The F&F Report concluded that, provided the pipes are installed with little disturbance to this habitat and create no barrier, the proposal is unlikely to cause the extinction of the Wallum Froglet in this area.

**Little Lorikeet**

The Little Lorikeet was recorded within the far south of the study area, and suitable foraging and nesting habitat was present across the majority of the study area. Approximately 1ha of such habitat will be fully or partially cleared in order to accommodate the farm development. To help reduce the impact on this species, suitable compensatory nesting habitat in the form of nest boxes should be erected within the

study area. Taking this recommendation into consideration, the proposal is unlikely to result in the extinction of any local population of this Lorikeet species.

**Koala**

No koalas were directly observed within the study area, however evidence of Koala activity in the form of characteristic scats and scratches was found within the southern portion of the site (i.e. outside the farm building footprint) and a historical record of a koala within the study area was identified (dating back to 1995). Other more recent records of koala sightings were identified within the locality but outside the study area.

Evidence suggests that the study area, particularly the area of Swamp Mahogany, has been periodically utilised by a small number of Koalas over a period of time and contains two species of koala feed trees. The proposal will result in the removal of approximately 24 specimens of a species of Koala feed tree (i.e. *E. microcorys*). To reduce the impact on koalas, it is recommended that as many specimens of *E. microcorys* as possible are retained within the development footprint.

Further, structures containing water should be designed to avoid unintended drowning of Koalas; and pipes or fences should not create barriers to movement of Koalas. The *Port Stephens Comprehensive Koala Plan of Management* notes that fences - where the bottom of the fence is a minimum of 200mm above ground level - will allow Koalas to move underneath. No fences are proposed within the subject site; however the Intake / Outflow Pipes will be raised a minimum of 200mm above the ground accordingly. Taking the recommendations into consideration the action is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at the risk of extinction.

**Grey-headed Flying-fox**

The majority of the study area contained suitable foraging habitat for this species, and potential camp sites were present within the denser areas of vegetation (although no camps were recorded during surveys). The proposal will result in the removal of a small amount of foraging habitat, which may be seen as an incremental loss of habitat within the locality. Taking into account the relatively large amount of suitable surrounding habitat it is considered that the proposal is unlikely to cause extinction of the local population of this highly mobile species.

**Small Bentwing- bat**

The majority of the study area contained suitable hunting habitat for this species. No preferred roosting habitat in the form of caves, culverts or other man-made structures was found to be present. The proposal is likely to result in a small incremental reduction in the

quality of hunting habitat in the local area. Taking into account the relatively large amount of suitable surrounding hunting habitat and the absence of preferred roosting habitat it is considered that the proposal is unlikely to cause extinction of the local population of this highly mobile species.

**Greater Broad-nosed Bat**

The majority of the study area contained suitable hunting habitat for this species. Roosting habitat in the form of tree hollows was also common. The proposal will result in a small incremental reduction in hunting habitat and the removal of a number of suitable roosting hollows. Taking into consideration the relatively large amount of suitable hunting and roosting habitat in the local area the proposal is considered unlikely to result in the extinction of any local population of this species. To help reduce the impact of the proposal, it is recommended that suitable compensatory nesting habitat in the form of custom-designed nest boxes be erected within the study area.

#### 5.8.2.2 *Considerations under SEPP 14 - Coastal Wetlands*

A detailed discussion pursuant to SEPP 14 is provided at **Section 4.2.3.1** of this EA. It was found that no component of the farm will intrude into mapped SEPP 14 wetlands, although the proposed boardwalk will be positioned on the boundary of Wetland 757a. Regardless, taking into consideration the design of the boardwalk and the proposed mitigation measures outlined in **Section 5.8.3**, the proposal is unlikely to have any significant effect on the SEPP 14 wetland. Conversely, it was found that construction of the proposed boardwalk may be of assistance in preventing damaging illegal vehicle access across the creek and wetlands.

#### 5.8.2.3 *Considerations under SEPP 44 - Koala Habitat Protection*

A detailed discussion pursuant to SEPP 44 is provided at **Section 4.2.3.2** of this EA. It was concluded that, while the study area contains areas of 'Potential Koala Habitat', the site did not meet the definition of 'Core Koala Habitat'. Accordingly, the preparation of an individual Koala Plan of Management was not required and no further provisions of the SEPP apply.

#### 5.8.2.4 *Considerations under the Commonwealth EPBC Act*

The EPBC Act lists Matters of National Environmental Significance (MNES), such as world heritage properties or nationally threatened species. The F&F Report undertook

detailed assessments to determine if the Project is likely to have any significant impact upon any MNES. A discussion of the results is provided in the following sections.

In summary, provided the recommended mitigation measures are implemented, there are not likely to be any significant impacts upon MNES as a result of the Project.

Note that additional consideration pursuant to the EPBC Act is provided at **Section 4.1.1** and within **Appendix 16** of this EA (additional aquatic and marine threatened species, assessed within the *Aquatic Ecology Assessment*).

### *WORLD HERITAGE PROPERTIES*

The Project is not considered to affect any World Heritage Properties.

### *WETLANDS RECOGNISED UNDER THE RAMSAR CONVENTION AS HAVING INTERNATIONAL SIGNIFICANCE*

The study area is less than 2km east of the Fame Cove inlet, which is included within the greater Myall Lakes Ramsar area. The proposal is unlikely to have any impacts on this Ramsar site.

### *LISTED THREATENED SPECIES & COMMUNITIES*

Thirty-six nationally threatened species were identified as having potential habitat within 10km of the subject site. One such species (the Grey-headed Flying-fox) was recorded within the site during surveys; and one additional species (the Koala) was considered to utilise the site though it was not recorded during surveys.

Impacts on both the Koala and Grey-headed Flying-fox are discussed in **Section 5.8.2.1** of this EA. It was found that the proposal is unlikely to significantly impact upon or cause extinction to the local populations of these species.

No other listed species were identified on site. The remaining nationally listed species (not recorded during surveys) were considered to have some habitat within the study area. While the proposal will lead to a small incremental loss of habitat within the locality, this impact was not considered to be locally significant.

Note that the potential for impacts on additional aquatic and marine threatened species are assessed within the *Aquatic Ecology Assessment* at **Appendix 16** of this EA.

### *MIGRATORY SPECIES PROTECTED UNDER INTERNATIONAL AGREEMENTS*

Forty-two nationally listed migratory species were identified as occurring or having potential habitat within 10km of the subject site, encompassing terrestrial, wetland and marine bird species. Four of these species were identified within the study area, comprising the White-bellied Sea-Eagle, Rufous Fantail, Eastern Curlew and Whimbrel.

In addition to the species listed above, the study area will provide areas of suitable habitat for a number of the migratory species assessed. However the relatively shallow mostly intertidal water contained within the study area will only provide marginal habitat at best for the listed pelagic birds (e.g. Shearwaters and Albatrosses).

The F&F Report concluded that *considering the relative commonality of the four migratory species within the local area and the relatively small impact on habitat in the locality, it is unlikely that these species or any of the listed migratory species would be significantly impacted by the development* (p96).

#### *NUCLEAR ACTIVITIES*

The Project does not involve any nuclear activity.

#### *THE COMMONWEALTH MARINE ENVIRONMENT*

The Project does not involve the modification of the Commonwealth marine environment.

### 5.8.3 PROPOSED MITIGATION MEASURES

As outlined above, a number of recommended features have been incorporated into the design of the farm to minimise impacts on terrestrial ecology. A number of additional recommended mitigation measures are outlined **Table 28** in below.

**Table 28: Proposed Mitigation Measures - Terrestrial Ecology**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Conservation Area | The identified *conservation area* shall be maintained in perpetuity for conservation purposes. The legal mechanism to manage this land shall be determined with government agency stakeholders should the Project gain approval. | Pre-Construction |
| Vegetation Management | A *Vegetation Management Plan* shall be prepared, outlining protocols for the management of retained vegetation within the site, including the conservation area. This plan should encompass measures applicable during the construction and operational phases. | Pre-Construction |
| Vegetation Management | An arborist shall be consulted before and/or during construction of the pipelines to advise on methods of reducing impacts on root zones of nearby trees. | Pre-Construction & Construction |
| Impacts on Nocturnal Species | Artificial lighting used to operate at night or for security purposes shall be minimised and confined wherever possible to minimise impacts on nocturnal fauna. | Construction & Operation |

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Koala & Wallum Froglet Impacts | Consideration shall be given to retaining known Koala Feed Tree species within the development footprint wherever possible. | Pre-Construction & Construction |
| Koala & Wallum Froglet Impacts | No barriers which will impact the safe movement of Koalas or Wallum Froglets shall be put in place. Terrestrial pipelines (outside the main farm precinct) will be either raised a minimum of 200mm above the ground or buried underground and the natural ground levels reinstated. | Pre-Construction & Operation |
| Koala & Wallum Froglet Impacts | Structures containing water shall be designed to avoid the unintentional drowning of Koalas. | Pre-Construction |
| Habitat Trees | Wherever possible, hollow bearing trees shall be retained. Any removal of hollow bearing trees shall be supervised by a suitably qualified ecologist. | Pre-Construction & Construction |
| Habitat Trees | Hollow bearing trees that are required to be removed shall be compensated by the placement of suitable nest boxes at a ratio of 2:1. | Construction |
| Habitat Values | Strict controls shall be applied to the development to prevent any future degradation to surrounding native habitat in the form of stormwater runoff and sedimentation. | Construction & Operation |
| Weed Management | All infestations of invasive weed species, particularly Lantana and Bitou Bush, shall be controlled within proximity to the farm. | Construction & Operation |
| Boardwalk Construction | For construction of the proposed boardwalk, the auger holes shall be the same diameter as the pylons to minimise the amount of sediment to be removed. Spoil from such excavations shall be removed from the site and disposed of at an appropriately licensed landfill. | Construction |
| Boardwalk Construction | To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic shall not be used. | Construction & Operation |

## 5.9 Flora & Fauna - Aquatic / Marine

### 5.9.1 EXISTING ENVIRONMENT

The proposed development involves the installation of underwater Intake and Outlet pipes within the aquatic/ marine habitats of Port Stephens, adjacent to the subject site.

Accordingly, an *Aquatic Ecology Assessment* (AEA) was prepared for the Project by Bio-Analysis Pty Ltd (see **Appendix 16**) and is referred to within this section of the EA. The AEA involved an investigation of the existing aquatic / marine environment in the vicinity of the subject site, and an assessment of the Project's potential impacts on these habitats and any associated flora and fauna.

The Port Stephens estuary contains a number of different aquatic habitats. The habitats in which the proposed development will be located are indicatively shown in **Figure 30**, below, (based on a 2009 aerial image) and described briefly in the following sections. Additional details on the attributes of each of these habitats are provided at **Appendix 16**.

### *ESTUARINE WATER COLUMN*

The water column provides habitat for many species of flora and fauna, including phytoplankton (e.g. microscopic algae), zooplankton (microscopic animals, larval stages of certain fish and species, etc.), pelagic and benthic fishes, turtles, dolphins and invertebrates (e.g. jelly fish).

### *INTERTIDAL MANGROVE HABITAT*

Mangroves are salt tolerant plants generally found growing along shorelines and creeks within estuaries, which provide important habitat for a range of species. The mangrove habitat in the vicinity of the site was located close to the shoreline / sandy beach and ranged in width from 10m to 95m. It consisted of sparsely distributed juvenile and mature *Avicennia marina* mangroves (i.e. Grey Mangroves). The aerial roots (pneumatophores) of the mangroves were found to be relatively dense. A range of fauna was found within this habitat, including molluscs (e.g. oysters), crustaceans and various fish species.

A photograph of this habitat, in the vicinity of the proposed pipeline route, is shown at **Plate 25** below.

### *INTERTIDAL SAND FLAT*

An extensive 'intertidal' (meaning *between the low tide and the high tide marks*) sand flat was identified adjacent to the subject site, composed of fine to medium grained sand and mud. The proposed pipelines will pass through approximately 150m of this habitat type. There appeared to be significant long-term sand movement in this area due to exposure to waves and tides. The sand flat was once vegetated with the eelgrass *Zostera capricorni* (as shown in **Figure 30**, based on a now-outdated [December 2009] aerial image) but these beds have now predominantly disappeared, most likely due to sand burial and/ or wave exposure. Several small, sparse patches of *Z.capricorni* and paddle weed (*Halophila ovalis*) were found to be present only at the outer edge of the intertidal area.

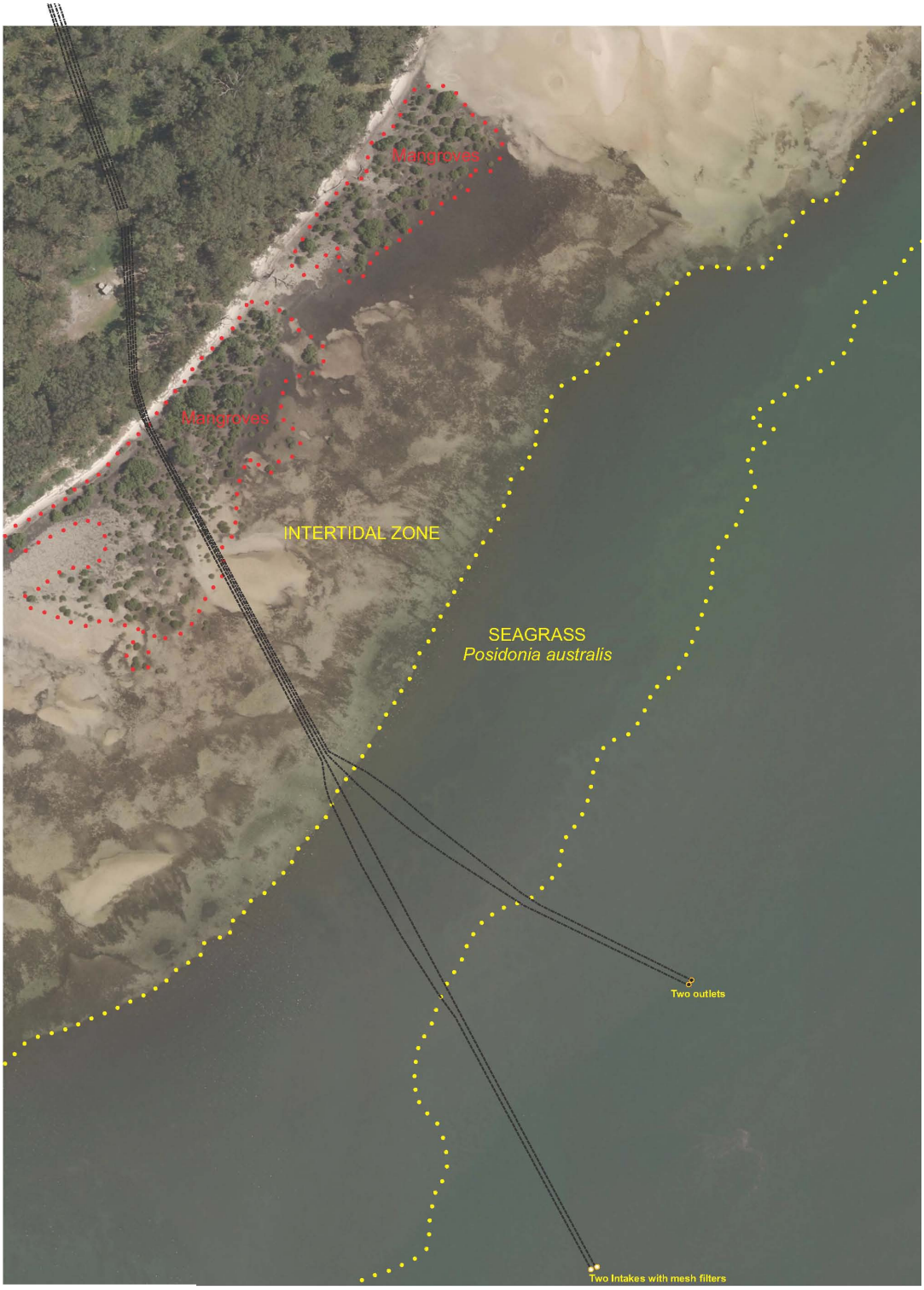



**Figure 30: Aquatic Habitats of Port Stephens - Subject Site & Proposed Development (Intake & Outlet Pipes) (Aerial Image- 2009)**

(***Source: Appendix 16)***

It is noted that the seagrass distribution in the intertidal area has changed significantly in recent years. As indicated in the aerial images at **Figure 30** (December 2009) above and **Figure 31** (May 2010 and June 2011) below, there has been a significant reduction in seagrass coverage in the vicinity of proposed pipelines between 2009 and 2011. The survey undertaken as part of the AEA (2012) indicates the seagrass distribution in this area has decreased further since 2011.

**Figure 31: Approximate Pipeline Position on Aerial Images, showing Seagrass Distribution Change in Intertidal Areas from May 2010 (*left*) to June 2011 (*right)***

Intertidal sand and mud flats are permanently or periodically inhabited by a diverse assemblage of benthic fauna (meaning *organisms living on or in sea or lake bottoms*), ranging from minute bacteria to larger invertebrates termed 'macrobenthos'. Macrobenthic organisms in estuaries are generally diverse and most species are relatively non-mobile (e.g. burrowing tube-worms). A detailed survey of macrobenthic fauna in the vicinity of the site was undertaken as part of the AEA (see from p26, **Appendix 16**). Results of the survey indicated that this area was not significantly different in species richness compared to other reference locations within the Port, although the area supported relatively low numbers of individuals.

This area also provides habitat for a range of fish species (e.g. mullet and bream) which utilise the habitat for feeding during high tide.

A photograph of the intertidal sand flat habitat is provided at **Plate 26** below.

**Plate 25: Mangrove habitat in the vicinity of the site (i.e. along the proposed pipeline route). Small & juvenile Grey Mangroves are visible, including pneumatophores (aerial roots)**

**Plate 26: Intertidal sand flat habitat adjacent to the subject site (at low tide)**

### *SUBTIDAL VEGETATED SEAGRASS MEADOW*

As outlined above, sparse patches of *Z.capricorni* and *H.ovalis* were found to be present at the outer edge of the intertidal sand flat, at about 1m depth (i.e. at the interface of the intertidal and subtidal [meaning *area below the level of mean low tide, normally covered by water*] zones). Beyond this interface, a subtidal seagrass meadow comprised predominantly of the seagrass *Posidonia australis* was identified. The percentage coverage of *P.australis* within the proposed pipeline route ranged from approximately 70-85%, although coverage became sparse at around 3m depth. All 3 of these seagrass species are commonly found within the Port Stephens estuary.

Clumps of drift, attached and epiphytic forms of algae were found interspersed throughout the seagrass meadow, including *Microdictyon* (a macroalgae species); *Sargassum* (a macroalgae species which attaches to hard substrata such as shells); and encrusting bryozoans and diatoms growing on the leaves of *P.australis*.

Seagrass meadows perform important roles in stabilising bottom sediments and shorelines, and act as water filters for suspended solids. They also provide nursery grounds, food and habitat for a wide range of fauna species including epifauna (meaning *living on the sediments*, or attached to submerged objects / aquatic animals/ plants); infauna (meaning *living within [beneath] the sediments*); and recreationally and commercially important species of fish, crabs and prawns (e.g. bream, leatherjackets and mullet).

There have been large-scale declines of seagrass meadows within NSW estuaries due to anthropogenic disturbance. The endangered populations of *P. australis* within the estuaries of Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie are under particular threat due to historical and current intensity of urbanisation and associated disturbance (DPI 2012). However, the population within Port Stephens is not listed as an endangered population under the *Fisheries Management Act 1994*. Colonies of *P. australis* are present in several areas of the Port Stephens estuary, with particularly large patches occurring near One Tree Island (around 3km south-west of the site) and Cut Feet Island (around 4km east of the site) (Creese *et. al* 2009).

A photograph of *P.australis* at approximately 1m depth is shown at **Plate 27** below.

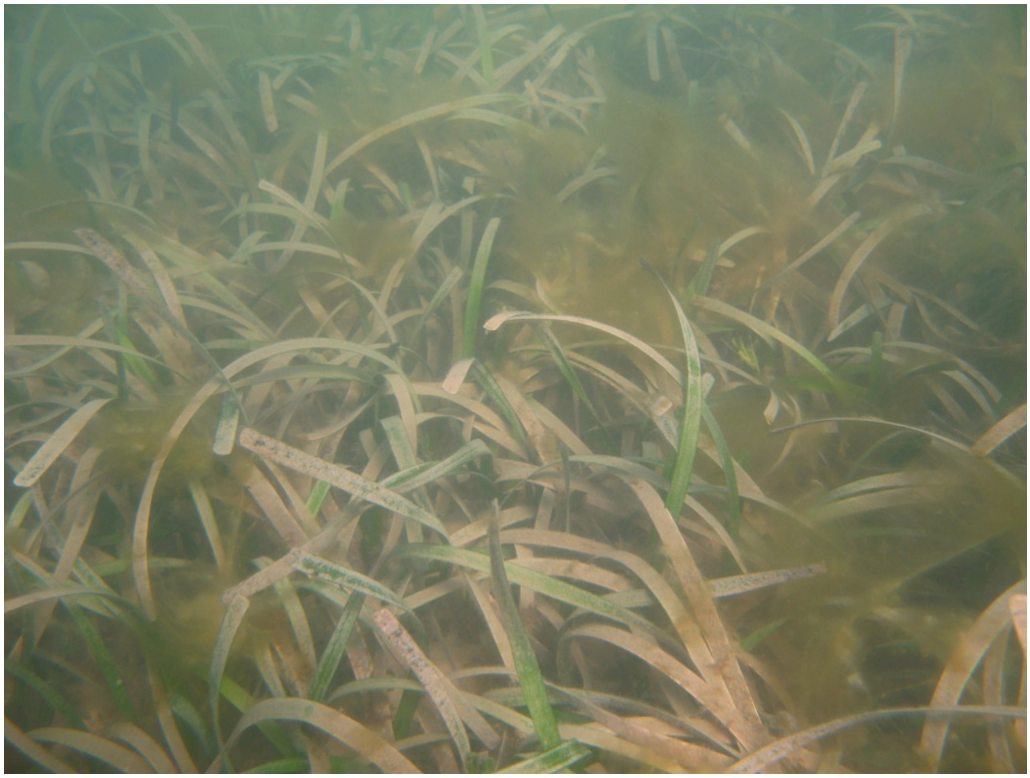


**Plate 27: *Posidonia australis* seagrass meadows at approximately 1m depth**

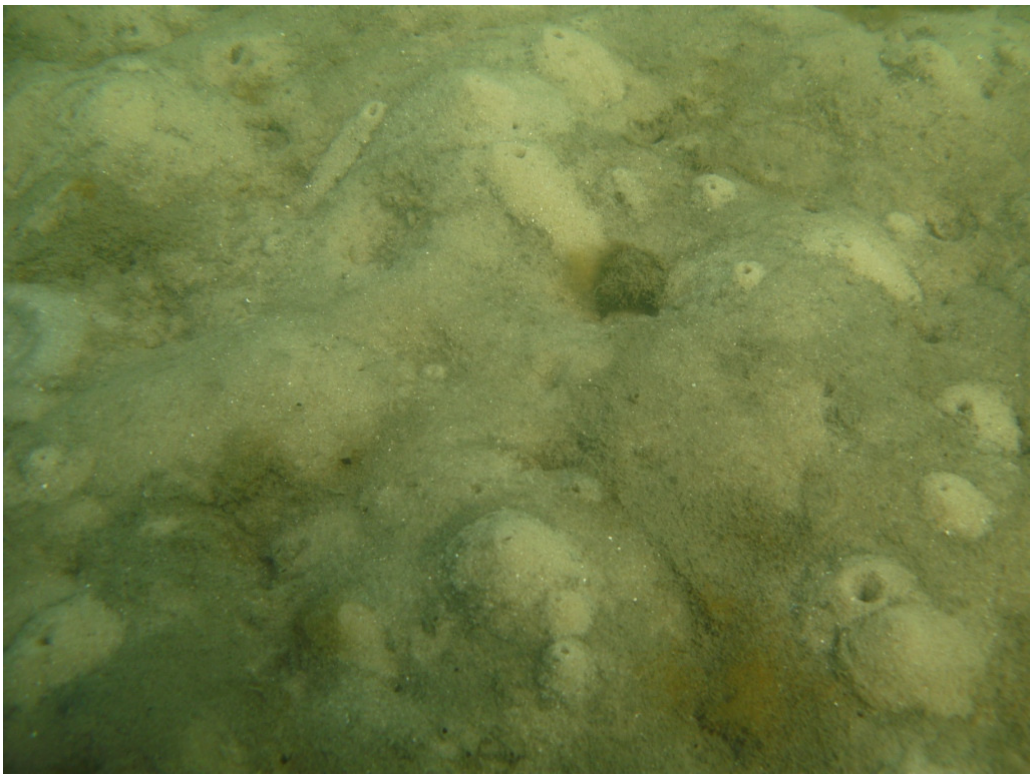


**Plate 28: Subtidal un-vegetated soft substratum habitat**

***SUBTIDAL UN-VEGETATED SOFT SUBSTRATUM***

Beyond the seagrass meadows, an area of un-vegetated soft, silty sediments was identified. This habitat supports a diversity of benthic fauna, ranging from meiobenthos (meaning *small invertebrates with a size of about 0.045 - 0.5mm*) to macrobenthos. Macrobenthos and meiobenthos play important roles in processes such as nutrient cycling, and are a key source of food for a variety of organisms.

A photograph of this soft sediment habitat is provided at **Plate 28** above.

### 5.9.2 IMPACTS ASSESSMENT

As illustrated in **Figure 30,** two Intake Pipes and two Outlet Pipes are proposed to extend from the subject site into the Port. The pipes will be buried within a common trench extending from the land (i.e. the Pumphouse) to the southern edge of the intertidal zone (i.e. south of the Indian Spring Low Tide Mark), where they will emerge from underground and be raised on low supports to the terminals of the pipes. It is noted that the pipes will be covered by water during all typical tide cycles.

Water will be continuously extracted from the Port via the Intake Pipes at a depth of approximately 15-20m; and water will be continuously released from the Outlet Pipes at a depth of approximately 6m. Further details of the piping system are shown in the development plans at **Appendix 2**.

As a result of these works, there is the potential for aquatic habitats and/or threatened aquatic species to be impacted. The AEA at **Appendix 16** provided an assessment of likely direct (e.g. construction impacts, entrainment / impingement from water intake) and indirect impacts, as discussed in the following sections. It also provided a discussion on potential farm impacts related to key nearby infrastructure and conservation areas (i.e. Marine Parks, oyster farms). Potential impacts on Pig Station Creek arising from the proposed boardwalk (see **Section 3.7.8.1**) are also discussed.

Generally, the *Aquatic Ecology Assessment* (AEA) concluded that *the construction and ongoing operation of the Abalone farm will result in minimal impacts to aquatic species and habitats adjacent to the site or in the estuary in general* (p72).

#### 5.9.2.1 *Mangroves*

The proposed pipelines will extend out from the shore through approximately 70m of mangrove habitat. The proposed trenching works are anticipated to directly impact upon two medium sized mangrove trees, as the minor trimming of one medium sized mangrove

and major trimming (i.e. removal of branches) of another is required. Disturbance to the lateral and aerial roots (pneumatophores) of these trees will also result, and there are likely to be impacts upon a number of small mangrove seedlings.

The AEA notes that the risk of mangrove death from trimming is very low (p21); however there is a high risk that one mangrove may die as a result of damage to the root system. If this was to occur, it was recommended that the dead mangrove be left in situ to serve as habitat (Roberts, D. 2013, pers. comm. 10 March).

The AEA proposed to minimise impacts on mangroves via careful trench excavation (to avoid root system disturbance) and the transplantation of small seedlings in nearby locations (considered to have a high success rate). A mangrove monitoring regime is also proposed in order to assess the impacts of the construction works on the habitat, including the success of seedling transplantation, as outlined in **Section 5.9** of this EA.

Overall, the AEA found that *the risk to the mangrove habitat…as a result of any construction or operation of the farm is considered to be low or negligible* (p22)

#### 5.9.2.2 *Benthic Fauna (Invertebrates)*

Trenching works within the intertidal sand flat will have the potential to disturb benthic fauna. However the AEA notes that *this will be a short term impact and they will recolonise the sand flat very quickly. Studies have shown that benthic invertebrates will colonise disturbed sediments within the timescales of months* (p22).

Within the subtidal zone (i.e. where pipes are proposed to be raised above the seabed on low supports), there is the potential for invertebrates to be directly impacted via the placing of support footings onto the seabed. Infaunal macrobenthic invertebrate assemblages are anticipated to recover quickly, whilst sessile epibenthic invertebrates (e.g. sponges, ascidians) are likely to colonise the pipeline structures, which is not considered to be a detrimental impact. The AEA notes that *the impacts on the benthic fauna next to the footprint of the pipeline will be short-term and very small* (p26).

#### 5.9.2.3 *Seagrasses*

Whilst, at the time of writing, no significant numbers of *Z.capricorni* plants were recorded within the intertidal zone where trenching works are proposed to occur (see **Section 5.9.1** - '*Intertidal Sand Flat*'), the AEA recommended that an additional inspection for this species be undertaken prior to trenching. The transient nature of *Z.capricorni* has been observed in other locations, and there is the potential for populations to recolonize quickly. If *Z.capricorni* plants are identified within the trenching footprint, the AEA

suggests the temporary removal of plants until pipeline construction is complete, via recommended methods. Once sediment has been reinstated over the pipelines, the seagrasses should be transplanted roughly into the same position from which they were removed.

The AEA notes that, even if *H.ovalis* specimens were to also recolonise the intertidal area before trenching works, disturbance to this species will be minimal as it *can and will recolonise any disturbed areas very quickly* (p23).

Within the subtidal zone, there is anticipated to be a direct impact on a linear area (approximately 40m$^2$) of *P.australis* seagrasses due to the placement of pipe support footings onto the seabed (i.e. crushing of leaves). There is also the potential for indirect impacts on *P.australis* in the immediate vicinity of the pipes as a result of shading from the pipes and associated algal / organism growth. The availability of light is known to be a limiting factor for seagrass growth. Fragmentation of *P. australis* beds (i.e. decreases in patch size resulting in a larger ratio of perimeter to area) may also potentially occur and may facilitate penetration of food (prey organisms) that attract predators and other variables (including invasive species) to the interior of patches, having detrimental, neutral or beneficial effects (depending on the variable). Finally, the AEA also identifies scouring and erosion around the base of the footings as a potential risk to seagrass habitat (although this has not been identified to be a problem where similar technology has been utilised in other Abalone farms e.g. in South Australia).

The placement of the proposed pipelines has been designed with the minimisation of impacts on *P.australis* as a key priority. As shown in the plans at **Appendix 2**, the pipes are proposed to be raised above the seabed in the vicinity of *P.australis (*i.e. approximately 50cm high), and the distance / separation between adjacent pipes will be maximised over the seagrass meadow. This will minimise the area of seagrasses crushed, and will minimise shading impacts as light penetration can occur around the pipes. The AEA notes (p24) that studies on Abalone farms in South Australia have shown that raising pipelines over seagrass habitat reduced seagrass shading impacts. These measures will also help to reduce any seagrass fragmentation impacts. The potential for fragmentation impacts, amongst other seagrass impacts from the proposal, are to be monitored as part of a proposed *Seagrass Monitoring Plan*, as outlined in **Section 5.9.3** of this EA.

An image of successful pipeline co-existence within seagrass beds is provided at **Plate 29**, following (at the Streaky Bay Abalone Farm in South Australia). The proposed farm pipelines will be similar in that the pipes will be raised above the seabed, creating opportunities for seagrass growth underneath.

The AEA makes additional recommendations to reduce impacts on *P.australis*, including the use of SCUBA divers to ensure pipe footings are carefully placed (to minimise damage to seagrasses outside the pipeline area) and regular inspections of pipelines for potential scouring effects after construction. The preparation of a *Seagrass Management Plan* is also recommended, to guide and minimise any disturbance resulting from the construction of pipelines. The AEA concludes that *the impacts associated with laying pipes to the local* P.australis *population are considered to be minimal…the scale of anthropogenic disturbance is very small compared with changes that occur to seagrass habitats as a result of 'natural' disturbances* (p23). It is noted that the *P.australis* seagrasses within Port Stephens are not listed as an endangered population pursuant to the *Fisheries Management Act 1994* (FM Act).

Note that an assessment of water quality associated with water released from the farm is provided at **Section 5.4**. It concludes that water quality impacts from the farm will not have a detrimental impact upon seagrasses.

#### 5.9.2.4 *Fish*

Most species of fish which occur in the vicinity of the site will be able to avoid impacts from the laying of the pipeline footings by simply swimming away. However, the Syngnathidae fish family (which includes pipefishes and seahorses) are highly vulnerable to human impacts due to their sedentary nature and low rates of reproduction. The Syngnathidae family are protected under the FM Act and are common within seagrass habitats of the estuary.

In order to avoid pipefishes or seahorses being crushed under the pipe footings, the AEA recommends the fish be manually 'ushered' out of the way by divers as the footings are emplaced (p38).

Once the footings are in place these fishes, as well as other species of fish, are likely to make use of the structures as habitat. The construction of 'artificial reef structures' (such as the proposed pipelines) are well known for increasing local fish biodiversity. They have been *used extensively around the world to create fish habitat, regenerate damaged ecosystems and to enhance angler catch* (DPI n.d.*d*).

The photographs below show aquaculture pipelines within seagrass meadows at the Streaky Bay Abalone Farm in South Australia. The elevated pipelines, established about 4 years before these photos was taken, provide significant plant anchorage opportunities and enhanced fish habitat values. The proposed farm pipelines are expected to serve a similar function.


**Plate 29: Views of existing elevated aquaculture pipelines providing fish habitat within seagrass meadows (South Australia)**

*(Source: Andrew Christian, KASANDI Maintenance & Diving Services)*

The AEA notes that *it has been well demonstrated that artificial structures can increase diversity and abundance of invertebrates and fish assemblages within estuaries* (p39).

#### 5.9.2.5 *Entrainment / Impingement of Organisms*

'**Entrainment**' refers to the incidental / accidental drawing in and trapping of marine organisms as a result of water extraction (i.e. water intake into the farm).

'**Impingement'** is where a marine organism comes into contact with water intake screens, which may result in bruising or other injuries.

As the farm will require the constant intake of water via the Intake Pipelines, there is the potential for marine organisms to be affected by entrainment and/or impingement. While larger organisms such as mature fish can easily avoid the intake current, smaller biota (e.g. plankton, small prawns) could become trapped or drawn onto / through the inlets.

Previous research on the effects of entrainment / impingement has typically focussed on impacts from significantly larger water intake structures than proposed within the farm (e.g. associated with power stations and desalination plants). These structures are expected to have a much higher mortality rate for entrained/ impinged organisms than the farm due to exponentially larger intake water volumes and other chemical and physical assaults on entrained organisms associated with these facilities (e.g. use of biocides such as Chlorine, increased temperature or salinity, etc). Notwithstanding this, previous studies on the impacts of entrainment / impingement from power plants indicate that even these larger structures have only a minimal impact on fish populations and communities. Barnthouse (2013) undertook a review of scientific literature spanning 40 years in relation to impacts from power stations around the United States, and concluded that *any impacts caused by impingement and entrainment are small compared to other impacts on fish populations and communities, including overfishing, habitat destruction, pollution and invasive species* (p1).

The survival of organisms impinged on intake screens depends on variables such as the size and species of organism and their ability to escape the screens and / or recover from impact injuries. Four studies on the effects of impingement associated with power stations in NSW (Ruelllo, Henry *et. al*, cited in The Ecology Lab 2005) indicated that the rate of impingement for fish and crustaceans in NSW is not large and affects relatively few species of economic importance. Further. a multi-year study of the effects of 19 power plants in California (Steinbeck n.d. cited in Water Reuse Association 2011) indicated that a plant extracting around 415ML of marine water a day (more than 8 times the volume of the farm's intake) was projected to have a daily larval fish impingement impact of around 900g (i.e. *less than the daily food intake of one pelican- up to 1.8kg /*

*day* [p4]). Accordingly, it can be inferred that the impacts of impingement from the farm are likely to be significantly smaller, and may be considered negligible in the overall context of the Port.

The survival rates of any biota entrained into the farm's piping system will predominantly depend on the size of the organism, but are expected to be low. The farm's filtration systems are likely to capture and remove most entrained small organisms, although there is the potential for extremely small organisms (including almost all phytoplankton) to pass through the system without harm before their eventual return to the Port through the Outlets (i.e. if they do not pass through the more highly-treated marine water streams, such as the Broodstock or Quarantine facilities).

It should be noted that, in the context of other water extraction facilities around NSW, the proposed volume of water extracted by the farm (and any associated entrainment / impingement impacts) is relatively small. For example, the Sydney Desalination Plant at Kurnell, which came into operation in 2009, has the capacity to extract up to 520ML of marine water per day from the surrounding waters (over 10 times the capacity of the proposed farm), at a similar intake velocity to the farm (around 0.1 metres per second [m/sec]). While assessment of the Plant's water intake found that there would potentially be some localised impacts on plankton from entrainment (assumed to have a 100% mortality rate in that case due to chemical and other water treatment systems, including an exponential increase in salinity in discharge water), there would be *little effect* on a broader (more regional) scale (The Ecology Lab 2005).

Regardless, the farm proposes to minimise the risk of entrainment or impingement of marine organisms via the methods outline below:

- **Intake velocity**: as noted within the AEA, the water flow velocity into the pipes will be very low, at a rate of approximately 0.1m/sec. Such a low velocity reduces both the capture effect of the intake screen and the frictional head loss across the screen (Housefield, G. 2013, pers. comm. 10 February). Importantly, the existing sweeping velocity of the tidal currents around the inlet is likely to vary between 0.5 and 3m/sec (Sanderson 2013). This means that the strength of the intake draw-in current is generally less than that of the passing tidal current, which will result in enhanced protection from impingement / entrainment, even during slackwater (Housefield, G. 2013, pers. comm. 10 February).

  There is evidence to indicate that the proposed intake velocity is low enough to ensure that most species of organisms are able to safely move away from intake screens without becoming trapped or drawn in. For example:

- in laboratory trials, entrainment of juvenile Golden Perch and Silver Perch was reduced, with very little injury or mortality resulting from incidental screen contacts or impingement, at intake velocities (measured 8cm from the intake screen) of up to 0.4m/sec (1.5m/sec slot velocity through the screen) (Boys 2012);
- the US Environmental Protection Agency has determined that desalination plants with water intake velocities of less than or equal to 0.15m/sec are deemed to have met impingement mortality performance standards (cited in Water Reuse Association 2011);
- studies on zooplankton (Buskey *et. al*. 2002) found that, while zooplankton generally drift with large eddies in the ocean (at the scale of kilometres), they may move independently of smaller eddies (at the scale of millimetres to centimetres). For instance, copepods can exhibit motion independent of the surrounding flow, and can detect sudden flow perturbations that trigger them to swim at speeds of up to 0.5m/ sec (i.e. significantly faster than the farm's intake velocity of 0.1m/sec);
- studies associated with power plant intakes in NSW (Ruelllo, Henry *et.* al, cited in The Ecology Lab 2005) suggested that a marine water intake velocity of less than 0.6m/ sec would assist in minimising the effects of impingement;
- Pipefishes were not harmed by entrainment on large screens at the Eraring Energy Power Station water intakes, where the velocity of water passing through the inlet canal can be as fast as 2m/ sec (p39, AEA);
- a study (Clark *et al* 2005) of four species of warm-temperate marine and estuarine fishes (often found within Port Stephens - Sciaenidae, *Argyrosomus japonicus*; Sparidae, *Pagrus auratus*, *Acanthopagrus australis*; Percichthyidae, *Macquaria novemaculeata*) found that larvae could swim at speeds of 0.15 - 0.2m/sec (i.e. faster than the proposed intake velocity);
- a study on juvenile pacific salmonoids found that nearly 100% of fish fry were protected if the approach velocity was less than 0.12m/sec (Nordlund 1996 cited in Blackley, 2003); and
- adult Tailor in tidal currents were found to have a swimming burst speed of around 0.5m/ sec (p39, AEA), which would be more than sufficient to escape from the proposed water intake.

- **Intake depth & location**: the proposed inlets will be located at a depth of approximately 15 - 20m, within the subtidal soft substratum habitat. At this depth and in this habitat-type, many species of marine organisms with the potential to be impacted will not be present, including slow moving fish (e.g. seahorses and pipefishes) and the majority of zooplankton due to the absence of 'thin plankton layers' on which they feed (note - these 'thin plankton layers' are concentrated areas of biological activity usually located at depths of less than 3m, which can contain up to 75% of the total biomass in the water column [McManus & Woodson 2012]. Accordingly, only a relatively low percentage of plankton [25% or less] is likely to be present at the depths of the pipe inlets, with a correspondingly low percentage of zooplankton).

  Further, the majority of fish eggs are buoyant and spend the short time before hatching in the upper / surface water layers - the remainder (which are negatively buoyant) either rest on the seabed or are attached to substrate (Housefield, G. 2014, pers. comm., 23 January). Accordingly, there is a low risk of a significant numbers of eggs becoming entrained in the inlets, particularly considering the intake depth, velocities and sweeping currents. Vegetation such as algae which, as a food source or as habitat supports more numerous and diverse organisms, is absent at this depth. The dominant organism type within the subtidal soft substratum habitat is likely to comprise benthic fauna (i.e. *living within the sediment*). Benthic fauna are unlikely to be impacted by the intake current due to the intake structure's elevated position above the seabed.

- **Intake screens:** the proposed inlets will include the installation of appropriate passive fish screens. An example is shown at **Figure 32** below. Passive screens are used extensively in water extraction applications (such as for power station cooling towers) to prevent the entrainment / impingement of debris, fish and other aquatic life. Their effectiveness is related to their slot width capping and low flow-through velocity. It has been demonstrated that 1mm openings (as are likely to be used within the farm) are highly effective for larval exclusion and to reduce entrainment (Sydneywater 2006). Screens will be examined and cleaned regularly to ensure fouling / clogging of the intake is kept to a minimum (note- gauges will also alert farm management whenever there is a significant change in the water intake vacuum, indicating that screen cleaning is required). Any impinged organisms could be released back into the same waters (but away from the intakes) to maximise the potential for survival.

In summary, the farm's impacts on aquatic biota from entrainment / impingement are expected to be relatively small and unlikely to have any significant impacts on populations

within the Port. The design and management of the intakes, as proposed, will serve to further minimise the potential for impacts to occur.

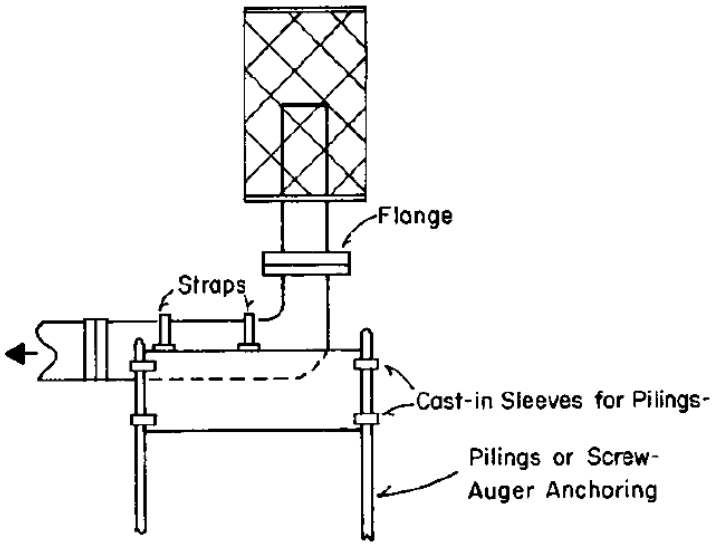



**Figure 32: Passive Fish Screen - Example**

*(Source: Colt & Huguenin 2002)*

### 5.9.2.6 *Threatened Species*

The AEA undertook an assessment of the potential direct and indirect impacts of the Project on all known and likely protected aquatic threatened species, ecological communities and habitats adjacent to the site with regard to the FM Act and the *Threatened Species Conservation Act 1995*. Relevant species listed under the Federal *Environment Protection and Biodiversity Conservation Act 1999* were also addressed. Species assessed included the Estuary Cod, Weedy Seadragon, Grey Nurse Shark, various Marine Turtle species and the Dugong.

The AEA found that *it is highly unlikely that any threatened species or populations will be impacted by the Abalone farm* (p73). Refer to **Appendix 16** for further discussion.

### 5.9.2.7 *Marine Park Sanctuary Zone*

As outlined in **Section 4.2.4.7** of this EA, the pipelines will extend into the Port Stephens - Great Lakes Marine Park. While the pipes will be located in the 'General Use Zone', a 'Sanctuary Zone' is located approximately 135m to the west of the pipes (a minimum of 415m from the proposed pipe outlets).

The AEA notes that *given the distance from the marine park* (Sanctuary Zone) *and the dilutions reported by Sanderson (2013), there will be no impact to the Marine Park or changes to localised ecological processes that could cause any impacts* (p25). It is noted that marine water quality impacts resulting from the farm are discussed in more detail in **Section 5.4** of this EA.

#### 5.9.2.8 *Oyster Farms*

As discussed in **Section 4.2.3.4** of this EA, even though 'priority oyster aquaculture areas' have been identified approximately 335m to the east of the proposed pipes, no operational leases currently exist. Regardless, the AEA notes that *any discharge of water from the farm will result in the fast dilution of any nutrients that could have the potential to impact on oysters within the port (Sanderson 2013)* (p25).

#### 5.9.2.9 *Pig Station Creek*

As discussed in **Section 3.7.8.1** of this EA, an emergency pedestrian egress boardwalk is proposed to cross Pig Station Creek. Pig Station Creek enters the Port Stephens estuary to the east of the subject site. The boardwalk will pass through approximately 20m of previously disturbed saltmarsh, as well as areas of Grey Mangroves. No mangroves are required to be disturbed with the exception of minor trimming works. The impacts of the boardwalk on terrestrial ecology are discussed further in **Section 5.8.2** of this EA.

The AEA notes that the installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams were listed as a key threatening process under the FM Act. Whilst 'bridges' (such as the proposed boardwalk) *are exempt, the construction of the boardwalk would need to be done without blocking fish passage in the creek* (p26). A detailed construction methodology which addresses this issue will be prepared before the undertaking of construction works.

The AEA concludes that *the construction of the boardwalk across the creek will have negligible impacts on aquatic flora and fauna* (p26).

### 5.9.3 PROPOSED MITIGATION MEASURES

As outlined in the AEA, and discussed in **Section 5.9.2** above, the Project is not likely to result in any significant detrimental impacts on aquatic ecology values. The proposed mitigation measures outlined in **Table 29** below will be implemented to further minimise the farm's impacts.

**Table 29: Proposed Mitigation Measures - Aquatic Ecology**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| General Construction Impacts | All trenching and piping works shall be supervised by an appropriately qualified and experienced marine ecologist with an established record in mangrove and seagrass ecology, as outlined within the *Aquatic Ecology Assessment*. | Construction |
| Mangrove Impacts | All possible care shall be taken during trenching works to minimise impacts on mangrove root systems. Should the mangrove specimen (identified within the *Aquatic Ecology Assessment*) die as a result of trenching, the tree shall remain in-situ to serve as habitat. | Construction & Post-Construction |
| Mangrove Impacts | Any small mangrove seedlings (<1m) within the trench footprint shall be transplanted to another location within the existing mangrove habitat using appropriate techniques referenced within the *Aquatic Ecology Assessment*. | Construction |
| Mangrove Impacts | A *Mangrove Monitoring Plan* shall be prepared and implemented, as outlined within the *Aquatic Ecology Assessment*. | Pre-Construction & Operation |
| Seagrass Impacts | A survey for *Z.capricorni* specimens within the trenching footprint shall be undertaken prior to any trenching works. Should specimens be located, they shall be transplanted in accordance with the methods outlined in the *Aquatic Ecology Assessment*. | Pre-Construction & Construction |
| Seagrass Impacts | SCUBA divers shall be present to ensure pipe footings are settled onto the seabed without causing undue damage to *P.australis* leaves outside the footing placements. | Construction |
| Seagrass Impacts | A *Seagrass Management Plan* shall be prepared and implemented prior to construction works, incorporating appropriate measures to reduce impacts on seagrasses from the construction of the pipelines, as outlined within the *Aquatic Ecology Assessment.* | Pre-Construction |
| Seagrass Impacts | A *Seagrass Monitoring Plan* shall be prepared and implemented, as outlined within the *Aquatic Ecology Assessment*. This Plan should include the monitoring of appropriate reference sites. | Pre-Construction & Operation |
| Scouring Impacts | Once pipelines are in place, there shall be regular inspections by divers to identify potential scouring impacts. If impacts are identified, appropriate erosion controls shall be put in place (e.g. hessian matting). | Operation |
| Impingement / | Appropriate passive fish screens shall be | Construction & |

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Entrainment | installed on pipe inlets, and inspected and maintained on a regular basis. | Operation |
| Blocking Fish Passage (Pig Station Creek) | A detailed boardwalk construction methodology, aimed at avoiding the blocking of fish passage in Pig Station Creek, shall be prepared and implemented prior to construction. | Pre-Construction & Construction |

## 5.10 Aboriginal Heritage

### 5.10.1 EXISTING ENVIRONMENT

As outlined in **Section 2.3** of this EA, much of the subject site is vegetated and is not significantly disturbed.

In 2002, an *Aboriginal Heritage Assessment* was prepared with regard to the previous Abalone farm DA by Wildthing Environmental Consultants (attached within **Appendix 15** of this EA). This Assessment indicated the likely presence of an Aboriginal shell deposit or midden along the foreshore of Port Stephens, at the southern boundary of the subject site. This midden, located within a foredune, has historically suffered from erosion due to likely previous human interaction impacts and wave run-up.

A new *Aboriginal Heritage & Archaeological Assessment* (AHAA) was prepared by Myall Coast Archaeological Services with regard to the current proposal (see **Appendix 15**). The AHAA builds upon and updates the original Assessment, in light of recent legislative changes to Aboriginal heritage protection and in response to the current proposal.

The AHAA involved the following tasks undertaken in accordance with the *Draft Part 3A EP&A Act Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* to identify items or places of Aboriginal significance within the site:

- Consultation with the Aboriginal community (details are provided at **Section 5.10.1.1** below);
- Review of existing information, including written materials, the AHIMS database (*Aboriginal Heritage Information Management System)* and maps;
- Predictive modelling, involving analyses of various aspects to produce a model of possible archaeological deposits within the study area. Such aspects included Aboriginal heritage values, landscape, soils, geological features, and past land use; and

- Visual inspection of the site and 'ground truthing' of the above modelling. Although the entire subject site was considered within the AHAA, only the proposed farm area and a 50m buffer were intensively surveyed, as the rest of the site *was not impacted by the development proposal* (p34).

The key findings of these tasks are outlined below:

- The 'tribe' or 'band' of people who were likely to utilise the subject site were the family groupings of the Worimi, or possibly the Wonnaruah, whom Bennet (1926, within the AHAA) described as the Gringai. The early Gringai people were hunters and gatherers, living off the abundant wildlife.
- A review of the AHIMS database indicated the presence of fourteen individual Aboriginal 'objects' within 10km of the subject site, and two 'Aboriginal Places' within 20km. These included middens; ceremonial / scarred trees; isolated stone artefacts and grinding grooves. One of these objects was the previously mentioned shell deposit (or midden) located within the frontal berm along the foreshore of the subject site, as illustrated in **Plate 30**. This deposit was located predominantly in the western portion of the site.
- Shell deposits may be natural or a result of anthropogenic feasting. It was not possible to confirm if the shell deposit was a midden without excavation, which was not considered necessary or beneficial. Accordingly, it was conservatively assumed that the deposit is a midden, potentially quite old and extensive.
- The potential extent of the midden was considered to be larger than originally identified in 2002. An area associated with and just north of the likely midden was defined and considered to have the potential to contain archaeological evidence (discussed further in **Section 5.10.2** below). An examination of the midden showed that it had been affected by natural beach processes over the past 10 years (since the last survey) and some of the midden and sand had been eroded.
- With the exception of the shell deposit, there was no additional archaeological evidence found during the re-survey of the site. Most of the farm site was considered unlikely to contain any archaeological evidence or potential as it is *disturbed land as defined in the NP&W Act as amended* (p50).

**Plate 30: Exposed shell deposit, assumed to be an Aboriginal midden, located at the foreshore of Port Stephens**

#### 5.10.1.1 *Aboriginal Community Consultation*

As outlined within the AHAA, comprehensive liaison was undertaken with Aboriginal stakeholders so they could advise on and oversee the Aboriginal cultural heritage assessment. In summary, the following occurred:

- An advertisement was placed in the local newspaper (*Myall Coast Nota*) on 24 May 2012, seeking contact with interested Aboriginal stakeholders. The Nota also ran a front page story in the same edition based on the Project and the submission of the advertisement (Craig 2012);
- Letters were written to identified Aboriginal people and organisations seeking expressions of interest in the Project;
- Several stakeholders responded and registered interest, including representatives of the Worimi Local Aboriginal Land Council (LALC) and Karuah LALC;
- An initial meeting was held with stakeholders to explain the Project and seek information (3 July 2012), and a joint visual inspection of the site was conducted on 26 July 2012); and

- The draft AHAA was forwarded to stakeholders from comment and feedback, and an *Aboriginal Cultural Heritage Report* was prepared by stakeholders and included within the AHAA (see **Appendix 15**).

### 5.10.2 IMPACTS ASSESSMENT

The significance of the potential midden was discussed amongst the stakeholders at the time of the assessment. It is noted that all such archaeological evidence is considered significant to the Aboriginal community and the preference is to leave the evidence in-situ. The midden was accepted as significant and worthy of protection.

At the time the AHAA was undertaken, the proposed pipelines were to be located in close proximity to the potential midden and associated area of sensitivity, as shown in **Figure 33** below. It was considered by all the stakeholders that the pipeline route was too close to the midden, and needed to be moved.

An analysis of the land was undertaken and a preferred route was identified which would move the pipe further away from the midden. This new location was considered to *ensure the protection of the assessed heritage values* (p50). Accordingly, the farm design was amended as shown within **Figure 34** below and evidenced within the development plans at **Appendix 2.** The preparation of an *Aboriginal Heritage Management Plan* was also proposed to protect the midden and any new Aboriginal heritage values that may arise during construction of the farm.

The AHAA concluded that *there are no impacts from the proposed development directly or indirectly on Aboriginal heritage as all known Objects and landscapes that may have archaeological potential are outside the proposal area and will be left in-situ and covered by a management plan* (p52). Details of the proposed Management Plan and associated recommendations are provided at **Section 5.10.3**. The registered Aboriginal stakeholders concurred with the findings and recommendations of the AHAA and endorsed the Aboriginal Cultural Heritage Report.

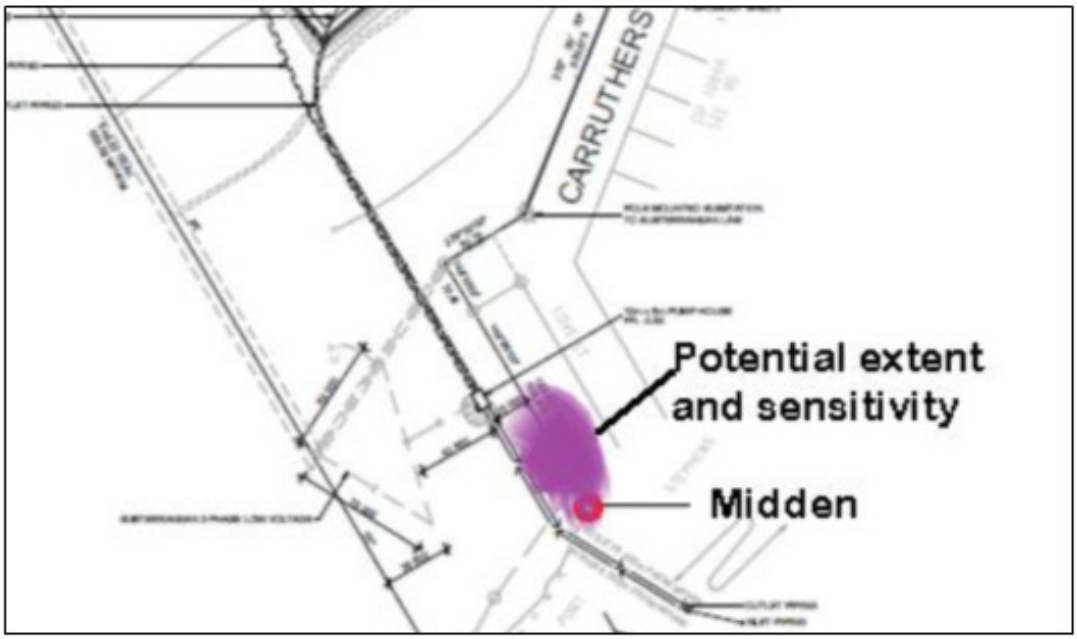



**Figure 33: Potential Aboriginal Midden - Initially Proposed Pipeline Route**

***(Source: Appendix 15)***


**Figure 34: Potential Aboriginal Midden - Amended (Current) Pipeline Route**

### 5.10.3 PROPOSED MITIGATION MEASURES

As outlined in the AHAA, and discussed in **Section 5.10.2** above, the Project will not result in any detrimental impacts to Aboriginal heritage within the site, provided certain recommendations are implemented. No additional assessment or survey is required. The management measures recommended within the AHA are outlined within **Table 30** below.

**Table 30: Proposed Mitigation Measures - Aboriginal Heritage**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Aboriginal Heritage | A post-approval *Aboriginal Heritage Management Plan* shall be prepared for the conservation of the midden as per Aboriginal community requirements, with on-going consultation with the Aboriginal community throughout the development process.<br>It shall be prepared in consultation with the Aboriginal stakeholders to address the preservation and protection of key Aboriginal heritage values, and to deal with measures to be taken in the event that new Aboriginal objects of significance or a nature not anticipated (such as burials or ceremonial items) are discovered during construction. This plan is to generally include:<br>a) The bagging, tagging and collection of any artefacts that may be unearthed during the construction process and kept with the Karuah LALC until an appropriate keeping place is determined by the management plan; and<br>b) An *Aboriginal Cultural Education Program* shall be developed by the proponent for the induction of personnel involved in the construction activities in the project area in consultation with the Karuah LALC. | Pre-Construction |

## 5.11 Traffic, Access & Parking

### 5.11.1 EXISTING ENVIRONMENT

The only vehicular access to the subject site is via local roads within the village of South Pindimar. Although the site has a direct frontage to Clarke Street (at the site's northern boundary), no viable road currently exists to the farm area from this location. Access to the site involves the following roads, as illustrated in **Figure 35** below:

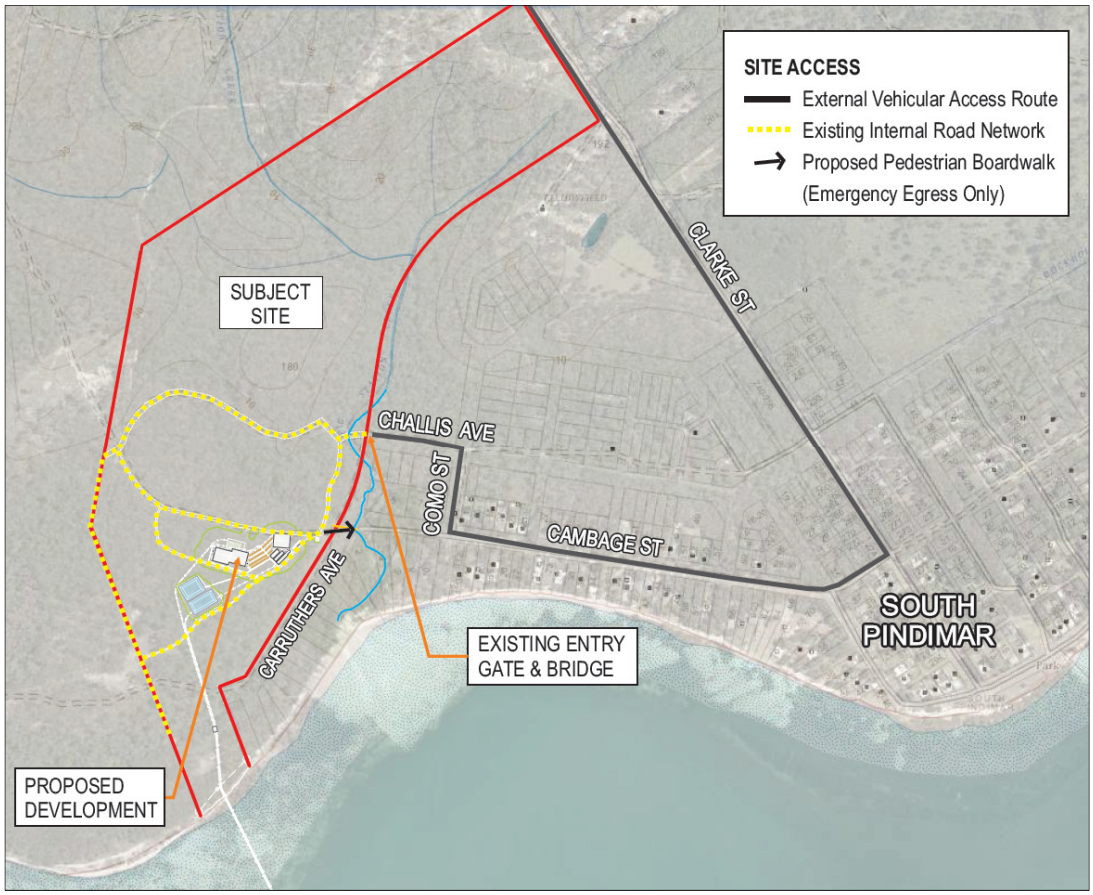



**Figure 35: Proposed Vehicular & Pedestrian Access Routes**

- **Clarke Street** (Pindimar Road): provides connections to Tea Garden Road and the Pacific Highway. Comprises a sealed, dual carriageway road, providing the only access to the South Pindimar area;
- **Cambage Street:** sealed local road terminating in a cul-de-sac at the intersection with Como Street. From this location, an informal pedestrian pathway continues along the road corridor and leads west through vegetation and wetlands to Pig Station Creek;
- **Como Street:** local road comprising a compacted gravel pavement;
- **Challis Avenue**: local road comprising a compacted gravel pavement (in this location, leading to the subject site). The carriageway is only partially cleared east of Como Street. Provides connections to the subject site's internal roads.

The internal road network is accessed via a short driveway (from Challis Avenue) and a wooden bridge over Pig Station Creek. The bridge has been recently upgraded and is capable of supporting a load of at least 15 tonnes. Existing internal roads form three interconnected loops and provide access throughout the subject site, including to the proposed farm precinct and the private land directly adjoining the site's western boundary. The roads comprise a variety of surfaces (i.e. rock base, sand, gravel and compacted earth) and are generally of a single-vehicle width.

No data is available with regard to existing traffic volumes within South Pindimar. However, as Clarke Street services only a small residential population (i.e. Pindimar and Bundabah) and does not provide connections to other road networks, traffic levels are assumed to be low.

There are currently no formalised pedestrian access paths to the site, or within the site, beyond the road network.

## 5.11.2 IMPACTS ASSESSMENT

### 5.11.2.1 *Vehicular Access*

As discussed in **Section 3.7.8**, it is proposed to continue the use of the existing local road network to access the farm. The creation of any new access route other than via Cambage Street (for example, via Challis Avenue directly from Clarke Street) will require the clearing of vegetation and greater environmental impacts than the use of the existing road network.

As the road connections between Cambage Street and the subject site comprise a durable surface (i.e. compacted gravel), and the volumes of traffic accessing the site are anticipated to be low (see **Section 5.11.2.2**), no additional upgrade works to these external roads are likely to be required.

The internal road network will be graded and levelled where required to maintain a trafficable surface. Low vegetation will be cleared where necessary to ensure a minimum formed road width of 4m, within a clear corridor 6m wide by 4m high, in order to comply with firefighting access requirements (see **Section 5.13**).

A number of passing bays have been designated throughout the site, predominantly at road intersections, also to comply with firefighting requirements. Due to the existing widths of road in these locations, the clearing of trees is not likely to be required to achieve these parameters. Accordingly there are not likely to be any ecological impacts associated with the continuing use of these roads.

A small number of larger vehicles will need to access the site at certain times (e.g. construction vehicles, garbage collection trucks). Garbage trucks will access the bin storage area located adjacent to the farm. Trucks are able to utilise the internal road network, including the 'T-intersection' in this location, to execute a three-point turn in order to exit the site in a forward direction. Alternatively, vehicles are able to continue forward through the internal roads (i.e. through one of the 'loops') to exit the site in a forward direction without undertaking any turns. Considering the low number of large vehicles likely to access the site on an ongoing basis, this situation is considered to be acceptable.

#### 5.11.2.2 *Traffic*

During the **construction phase**, the proponent estimates traffic volumes to the site will be low, in the order of 20 vehicle movements per day. This traffic generation will be temporary, and vehicles will only access the site during standard construction working hours. Construction activities are not anticipated to require the temporary closing of, or disruption to, any public road. Accordingly, there is not anticipated to be a significant impact arising from this traffic generation.

During the **operational phase** (i.e. at full capacity), the farm is anticipated to employ approximately 15 full-time equivalent staff. The farm will not be open to the public, and only occasional visitors are anticipated. Accordingly, the proponent estimates the farm will generate the following levels of traffic:

- **Vehicle with trailer** (e.g. large 'Ute') for the transport of live Abalone: up to two per week;
- **Small rigid truck** for general deliveries (e.g. Abalone food): around one per week;
- **Employee vehicles**: maximum of approximately eight (and only on certain workdays), based on an assumed occupancy rate of two staff per vehicle. Note that on most workdays there will be fewer staff required on site;
- **Visitor vehicles**: approximately two per week;
- **Garbage collection vehicle:** up to two per week.

Based on the above, as a 'worst-case scenario', the farm is likely to result in a maximum of approximately 12 x 2-way traffic movements during a single day of operation, based on the following assumptions:

- eight (8) staff vehicles;

- one (1) Abalone transport;
- one (1) general delivery;
- one (1) garbage collection; and
- one (1) visitor.

This level of traffic generation is considered to be low and is not likely to adversely impact upon the amenity, safety or functionality of the local road network.

#### 5.11.2.3 *Parking & Loading Areas*

Eight carparking spaces are proposed to be located adjacent to the Office building, including one space accessible for people with disabilities. These spaces will be designed and constructed in accordance with relevant Australian Standards. Additional cleared, predominantly hardstand areas (i.e. natural rock) are available adjacent to the proposed carpark for overflow parking purposes if required. Bicycle use by staff will be encouraged and storage racks can be provided if demand arises, however due to the rural nature of the farm access the rate of bicycle use is not considered likely to be high.

A truck loading / unloading bay is proposed along the existing roadway adjacent to the Facility Shed. Parking in this space will allow easy transfer of goods between the Facility Shed and vehicles.

There are no available guidelines for parking requirements associated with aquaculture facilities. However, considering the number of vehicles likely to access the site during a single day (as outlined above), the level of parking proposed is considered to be adequate.

#### 5.11.2.4 *Pedestrian Access*

Due to the rural nature of the farm access, no pedestrian paths are proposed to the site. Within the main farm precinct, paving will be utilised where required between facilities for ease of access. In addition, a wooden boardwalk is proposed to provide a connection between the farm area and the existing path at the end of Cambage Street, to provide emergency pedestrian egress.

Considering the agricultural nature of the farm, this pedestrian access is considered appropriate.

### 5.11.3 PROPOSED MITIGATION MEASURES

As the farm is not likely to create any adverse impacts on the functionality, safety or amenity of the local road network, no specific mitigation measures are proposed.

## 5.12 Noise

### 5.12.1 EXISTING ENVIRONMENT

The area surrounding the subject site has a predominantly rural / bushland character, with the exception of the suburban environment of the nearby village of South Pindimar. The nearest sensitive receivers to the subject site comprise residential dwellings along Cambage Street, east of the site. The closest dwelling-house, located on the corner of Como Street and Cambage Street, is located approximately 200m from the subject site boundary and 300m from the main farm precinct. The farm will be separated from this dwelling house by dense vegetation.

A *Noise Assessment - Abalone Farm Pindimar* ('NA-2003') was prepared by Richard Heggie Associates in 2003, in relation to the previous DA for this Abalone farm (refer to **Appendix 20** of this EA). In 2011 a *Noise Impact Assessment* ('NIA-2011') was prepared by Advitech in relation to the current proposal (refer to **Appendix 21**).

In order to establish the existing, 'ambient' noise environment of the South Pindimar area, the NA-2003 utilised background noise data obtained in 2000 at No. 41 Cunningham Street (approximately 1km east of the subject site). Background noise levels at this location were considered to be representative of the area, including the noise environment of sensitive receivers adjacent to the proposed development.

It was considered unlikely that the noise environment of South Pindimar changed significantly since 2000, as very little development has occurred during this time. However, in order to obtain a more current characterisation of background noise, the NIA-2011 undertook additional background noise monitoring in close proximity to the previously monitored location in 2011. These monitoring locations are shown in **Figure 36**, below.

An ARL316 environmental noise logger was used to measure the ambient noise level in the receiving environment, comprising the $L_{A90}$ background noise level and the $L_{Aeq}$, $L_{A10}$ and $L_{A1}$ noise levels. Other data such as time and temperature were also recorded. The results of data analysis, in accordance with the provisions of the *NSW Industrial Noise Policy* (INP), allowed for the determination of the Rating Background Level (RBL) and

Intrusiveness Criteria for the receiving environment. These results are indicated in **Appendix 21**, and an extract is provided in **Table 31** below.

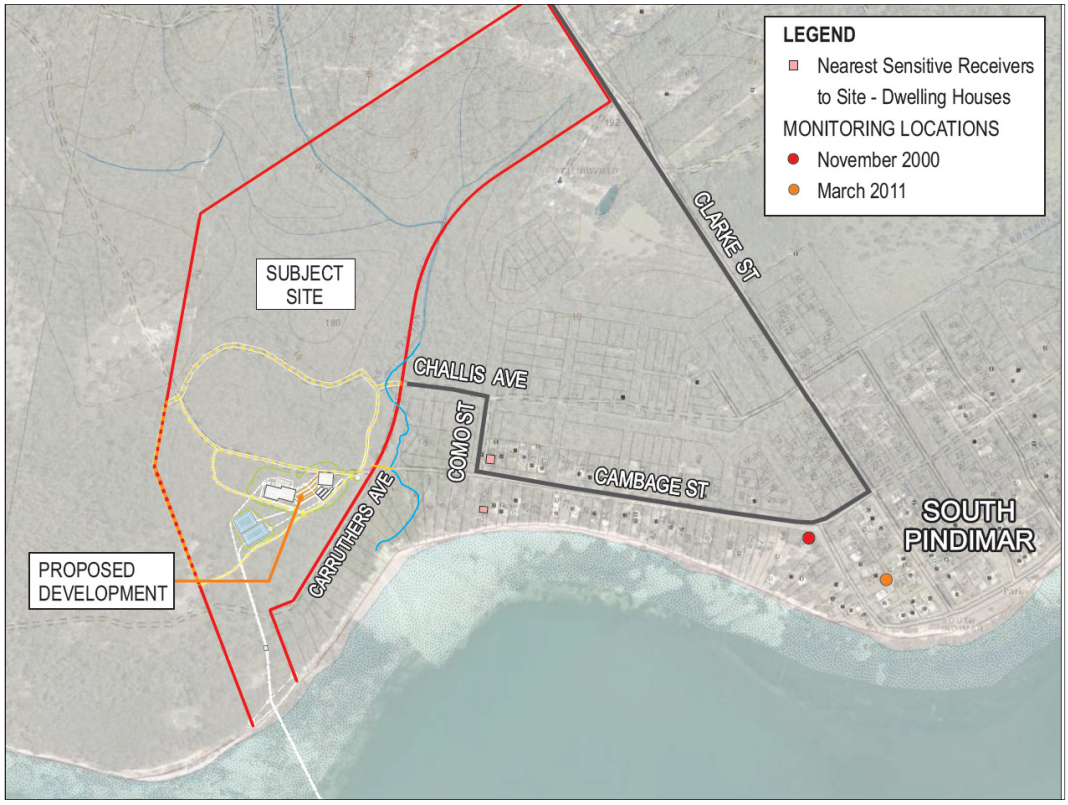



**Figure 36: Background Noise Monitoring Locations - 2000 & 2011**

**Table 31: Background Noise Monitoring Results, dB(A )- Extract**

| | Day (0700 to 1800) | Evening (1800 to 2200) | Night (2200 to 0500) |
|---|---|---|---|
| Rating Background Level (RBL) | 34 | 33 | 32 |
| Mean $L_{Aeq}$ | 53 | 46 | 41 |

The mean $L_{Aeq}$ was derived for the purposes of establishing an amenity criteria specific to existing industrial noise impacts. Analysis of monitoring data indicated that the existing noise environment is characterised by the *Rural* receiver type, defined in the INP as *an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic* (p9, NIA-2011). The main sources of existing noise in the South Pindimar area were found to be from typical urban sources (e.g. birds, children playing, car doors).

## 5.12.2 IMPACTS ASSESSMENT

A detailed assessment of potential noise impacts from the proposed farm was undertaken as part of the NA-2003. The current farm proposal does not propose any significant changes to the 'noise generating plant and processes' originally proposed for the previous DA. Therefore the impact assessment in the NA-2003 remains valid.

However, as mentioned in **Section 5.12.1** above, the background noise data in the NA-2003 and subsequent Project Specific Noise Levels (PSNL) were based on data obtained in 2000, and there was considered to be a risk that the character of the receiving noise environment may have changed since that time. Accordingly, the NIA-2011 proposed the following works in order confirm the likely impacts of the proposed farm:

- *Attended and unattended monitoring to assess background ($L_{A90}$) and ambient ($L_{Aeq}$) noise levels, and identify existing industrial noise contributions in the receiving environment adjacent to the proposed development site;*
- *Determine the PSNL in accordance with the procedures established in Section 2 of the INP;*
- *Present a comparison of the PSNL established in the original assessment with the PSNL from the current monitoring data; and*
- *Provide an assessment of operational impact predictions against the PSNL.*

The results of these activities are discussed in the following sections.

No predictive noise modelling was undertaken as part of the NIA-2011, as the original model on the NA-2003 is considered to be representative of impacts associated with the current proposal.

### 5.12.2.1 *Noise Criteria*

#### *OPERATIONAL STAGE CRITERIA*

The NIA-2011 established a PSNL for the proposed farm, based on an analysis of background monitoring data, as indicated in **Table 32** below. Review of attended monitoring data indicated that no contribution was observed from industrial noise sources in this receiving environment. For the purposes of determining the amenity criteria, any contribution from industrial sources was assumed to be 10dB below that of the measured $L_{Aeq,period}$ noise level.

The NIA-2011 notes that *monitoring results… indicate RBLs from March 2011 are generally consistent with those observed in the November 2000 monitoring data. In both*

*instances the intrusiveness criteria is the limiting noise criterion in assigning the PSNL* (p10).

**Table 32: Assessment of PSNL in Receiving Environment**

| Assessment Period | Day | Evening | Night |
|---|---|---|---|
| **Intrusiveness Criteria $L_{Aeq,15minute}$ (RBL+5)** | **39** | **38** | **37** |
| Mean $L_{Aeq}$ (Measured) | 53 | 46 | 41 |
| Mean $L_{Aeq}$ (Ambient Industrial Contribution) | 43 | 36 | 32 |
| Recommended Acceptable $L_{Aeq}$ Rural | 50 | 45 | 40 |
| **Amenity Criteria** | **50[1]** | **45[1]** | **40[1]** |
| **Project Specific Noise Level (March 2011)** | **39** | **38** | **37** |
| **Project Specific Noise Level (November 2000)** | **38** | **37** | **35** |

1- Existing noise level >6dB below ANL. Amenity criteria equal to ANL

### *CONSTRUCTION STAGE CRITERIA*

As discussed in **Section 3.7.3.2** of this EA, construction activities will occur during standard working hours (7am-6pm Monday to Friday, and 8am to 1pm on Saturdays). **Table 33**, below, indicates construction noise management levels at sensitive receivers adjacent to the subject site. These are the levels *above which construction noise impacts would require significant management* (p10).

**Table 33: Construction Noise Management Levels**

| Receiver | Receiver Type | Management Level, $L_{Aeq,15minute}$ | Construction Noise Criteria, dB(A) |
|---|---|---|---|
| Adjacent Residential | Rural | RBL + 10 | 44 |

## 5.12.2.2 *Assessment of Noise Impacts*

### *OPERATIONAL STAGE NOISE IMPACTS*

The 'acoustically significant' plant and equipment proposed to be used within the farm typically includes *pumping stations, generators, air conditioning units and a small number of heavy vehicle movements associated with deliveries to and from the site* (p11). Water pumps will be in operation 24 hours per day, however other acoustically significant plant will only be utilised during the daytime (e.g. 7am to 6pm).

An analysis of prevailing meteorological conditions indicates the site is not subject to wind conditions that will significantly enhance noise propagation to nearby receivers. However, the analysis conservatively assumes that temperature inversions may occur during the winter night period.

The NIA-2011 found that *there are no acoustically significant differences between the current proposal and that subject to detailed assessment in 2003. Consequently, it is assumed the impact predictions presented as part of* (NA-2003) *remain representative of potential operational stage impacts…* (p11). The impact predictions from the NA-2003 are reproduced in **Table 34** below.

**Table 34: Impact Predictions at Nearest Sensitive Receiver[1] - dB(A)**

| | Meteorological Scenario | | PSNL | |
|---|---|---|---|---|
| Period | Neutral | Temp. Inversion | Original | Revised |
| Day | 37 | n/a[2] | 38 | 39 |
| Evening | <20 | n/a[2] | 37 | 38 |
| Night | <20 | 20 | 35 | 37 |

1- Reproduced from NA-2003

2- Not assessed as these conditions are not considered to present during these periods

The NIA-2011 found that the noise emissions from the proposed farm operations would comply with the PSNL established on the basis of either the 2000 or the 2011 data. In conclusion, *this assessment indicates that the noise emissions from the site would meet the requirements of the* NSW Industrial Noise Policy (p11).

### *CONSTRUCTION STAGE NOISE IMPACTS*

The 'acoustically significant' plant and equipment proposed to be used within the farm during the construction stage may include an *excavator, bobcat and delivery of materials via heavy vehicles* (p12). Construction activities will only occur during standard work hours, as discussed in **Section 5.12.2.1** above. It was considered that meteorological scenarios with significant potential to enhance noise propagation will not present during construction hours (i.e daytime). Accordingly, impact predictions for construction noise assume propagation only under neutral conditions.

The NIA-2011 found that *the* $L_{A10,15minute}$ *impact prediction would comply with the contemporary construction noise criteria of 44dB(A) during the day period. It should be noted this provides a conservative assessment of impacts, as the* $L_{A10}$ *noise level would typically exceed that of the* $L_{Aeq}$ *level for the same source. Consequently,* $L_{Aeq}$ *noise levels from construction activities would likely be lower than the 42dB(A) impact prediction at the nearest sensitive receiver* (p12). In conclusion - *review…indicates that noise emissions would satisfy the requirements of the* Interim Construction Noise Guideline *during the proposed construction hours* (p13).

### *ROAD TRAFFIC NOISE IMPACTS*

The NA-2003 provided a detailed assessment of likely noise impacts from traffic generation associated with the farm. Details of likely traffic movements are provided within Table 7.3.1 of **Appendix 21**.

In order to accurately model noise generation a worst case scenario was predicted. This will occur during the operational phase of development and will comprise vehicle movements associated with *six employees' cars, one delivery of food, one delivery to market, one garbage collection and two visitors* (p16). This will represent a 'peak hour', likely to occur in the morning or afternoon at the start or end of a shift. The results of this prediction are provided in **Table 35** below. Based on this assessment the NA-2003 concluded that *'peak hour' traffic noise generated by the development will be below the EPA design goal for both daytime and night-time periods* (p17).

**Table 35: Likely Vehicle Noise Contribution**

| Phase of Development | Period | Likely Vehicle Noise Contribution ($L_{Aeq(1hour)}$) | Traffic Noise Goal |
|---|---|---|---|
| Operation | Daytime (7am to 10pm) | 39 dBA | 55 dBA |
| | Night-time (10pm to 7am) | 32 dBA | 50 dBA |

The NIA-2011 confirms that *the criteria presented in the* (NA-2003) *remain valid in the context of the current proposal. As access arrangements under the current proposal remain unchanged from that originally subject to assessment, it is considered traffic noise impacts would be consistent with the objectives of the* Environmental Criteria for Road Traffic Noise (ECRTN) (p12).

It is noted that, since the preparation of the NIA-2011, the ECRTN has been superseded by the *NSW Road Noise Policy*. However, the Project is also compliant with the provisions provided within this new guideline.

## 5.12.3 PROPOSED MITIGATION MEASURES

As outlined in the NIA-2011, and discussed in **Section 5.12.2** above, it is considered that *the noise impacts associated with the construction and operation of the proposed Abalone farm would satisfy the objectives of the relevant noise regulations* (p13). As the farm is not likely to produce any noise which will unreasonably interfere with the amenity of the surrounding area, no specific mitigation measures are required. Nevertheless, a number of proposed noise mitigation measures are outlined in **Table 36** below, in order to further minimise any potential noise impacts from the proposal.

**Table 36: Proposed Mitigation Measures - Noise**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Construction Noise | All plant, equipment and vehicles shall have appropriate noise attenuation apparatus fitted, as required. | Construction |
| Construction Noise | All plant, equipment and vehicles shall be well maintained and regularly serviced. | Construction |
| Operational Noise | All plant, equipment and vehicles shall be well maintained and regularly serviced. | Operation |

## 5.13 Bushfire

### 5.13.1 EXISTING ENVIRONMENT

The subject site is heavily vegetated and directly adjoins large areas of vegetated land, particularly to the west of the site. The *Great Lakes Bushfire Prone Land Map* identifies the site as containing *Category 1* bushfire prone vegetation, as indicated in **Figure 37** below.

A *Bushfire Protection Assessment* (BPA) was prepared for the farm by Australian Bushfire Protection Planners (see **Appendix 22**). The BPA assessed the topography and vegetation within close proximity to the main farm precinct (i.e. where buildings are to be located and people are most likely to be present), in accordance with the requirements of *Planning for Bushfire Protection 2006* (PBP).

It was found that, according to PBP definitions, 'Forest' was the predominant vegetation formation class within 140m of the farm precinct on all sides. The 'effective slope' of land for 100m from farm buildings is provided in **Table 37** below.

### 5.13.2 IMPACTS ASSESSMENT

The BPA involved a detailed assessment of the bushfire risk to the subject site, and an examination of the measures required to minimise bushfire risk to the development. The site was found to be located in a *high bushfire risk area with no direct, safe vehicular / pedestrian access to the 'safer place' provided by the South Pindimar Village* (p3).

The proposed farm buildings were found to be Class 7 buildings pursuant to the *Building Code of Australia* (BCA).

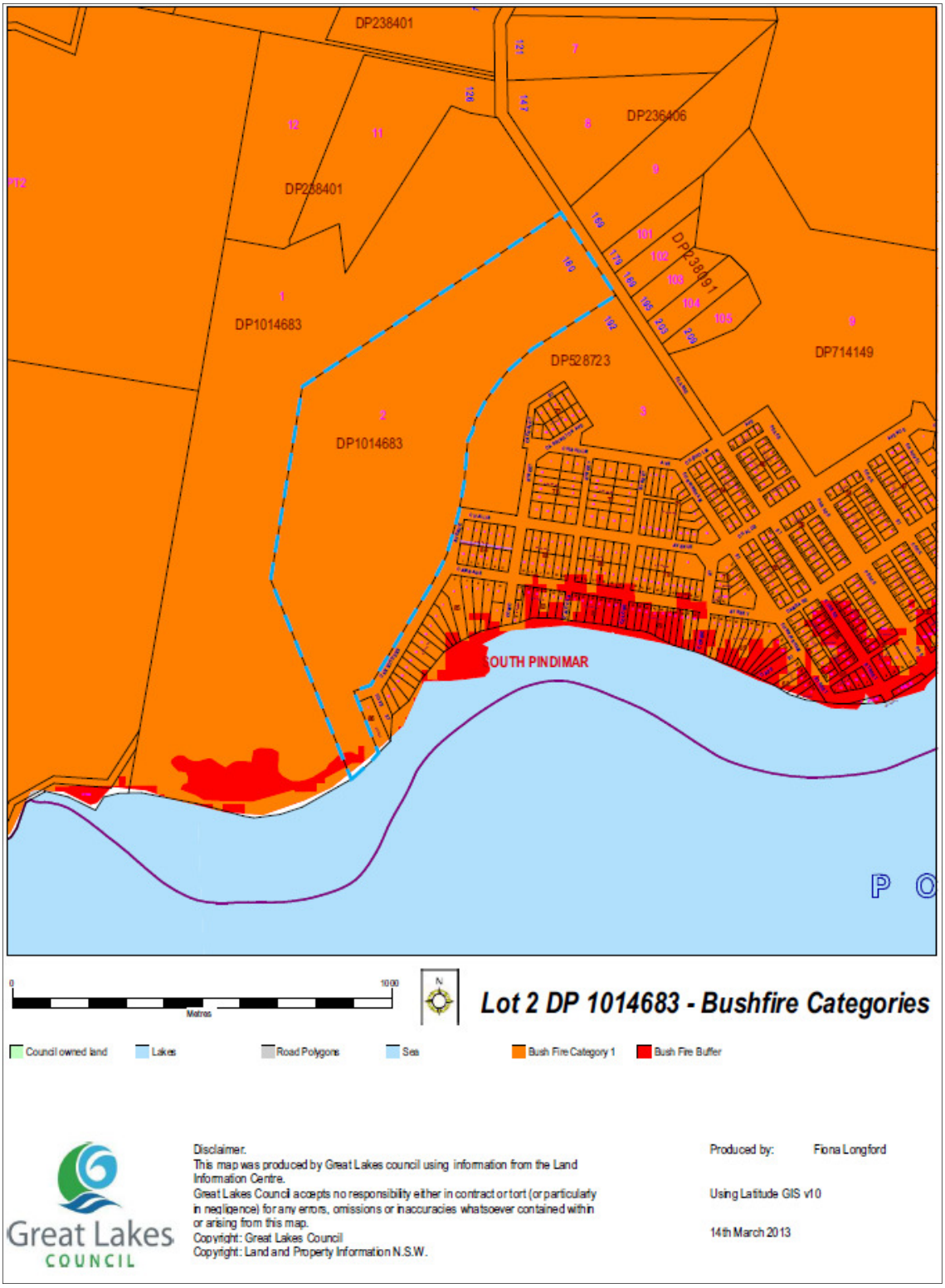



**Figure 37: Great Lakes Bushfire Prone Land Map - Extract**

### 5.13.3 PROPOSED MITIGATION MEASURES

In order to minimise the risk of bushfire detrimentally impacting upon the farm, the BPA presented a number of bushfire management strategies, outlined in the following sections. Further details are provided at **Appendix 22** of this EA.

#### 5.13.3.1 *Defendable Space*

The BPA reviewed the farm design against the widths of defendable space required to *provide a separation distance which is sufficient to minimise flame contact on the buildings and to provide a firefighting platform wide enough to permit the safe extinguishment of a bushfire, after the fire front has passed* (p30).

It was found that the farm can provide adequate 'defendable spaces' between buildings and surrounding bushfire prone vegetation. The recommended widths are outlined in **Table 37** below. It is noted that other structures within the farm (e.g. Settlement Ponds, pipelines etc.) were not considered to be infrastructure requiring special protection from bushfire risk.

**Table 37: Defendable Space Requirements - Bushfire Risk**

| Aspect (i.e. direction from farm precinct) | Effective slope of land for 100 from proposed buildings | Recommended width of defendable space to farm precinct |
|---|---|---|
| North | 5 degrees upslope to the north | 20m wide |
| East | Level | 20m wide |
| South | Level | 20m wide |
| West & North-West | < 5 degrees downslope | 30m wide |

The BPA provided details of how defendable space areas should be managed. Minimum standards for managing defendable spaces include the following:

- *Trees and shrubs should be maintained in such a manner that tree canopies are separated by 2 metres and understorey is not continuous (retained as clumps);*
- *Tree crowns shall not over-hang buildings and shall be maintained to provide a minimum clearance of 5 metres between the buildings and mature tree canopies;*
- *Accumulated ground fuels (grasses, leaves and twigs) shall be regularly managed to maintain a maximum fuel loading of 3-5 tonnes per hectare.*

The BPA recommended that a *Fire Management Plan* be prepared identifying the protocols for management of the vegetation within the farm precinct and surrounding defendable spaces.

The farm will implement and manage the required defendable spaces, as illustrated in **Figure 38** below. Accordingly, partial clearing or thinning of existing vegetation will be required in this area. The potential ecological impacts of this measure are addressed in **Section 5.8** of this EA.

#### 5.13.3.2 *Access for Firefighting Operations*

The BPA found that some sections of the existing internal access road network will need to be upgraded to allow access for firefighting operations by Rural Fire Service (RFS) vehicles. Roads within the site were required to meet the following parameters:

- Minimum road width of 4m, within a corridor cleared of grasses and shrubs 6m wide x 4m high;
- The road surface and bridge across Pig Station Creek shall be designed and constructed to carry a heavy rigid vehicle of 15 tonne GVM (*note - this upgrading has already occurred*);
- Passing bays shall be provided at 200m intervals or at strategic locations which permit fire appliances to pass safely (i.e. blind corners);
- The access gate to the property shall be relocated to the west of Pig Station Creek so as to provide a turning area at the intersection of the existing access roads (*note - the existing gate is proposed to remain, however it will remain unlocked at all times to allow for RFS access. New gates are proposed at the head of each access road west of Pig Station Creek*). Information on additional turning head provision is provided within the BPA;
- Access gates shall be a minimum 3.6m clear width.

The above recommendations will be implemented and managed should the Project be granted approval.

#### 5.13.3.3 *Emergency Management for Fire Protection / Evacuation*

The BPA considered that the existing access roads within the site will not be safe to use for escape during bushfire events which spread rapidly through the vegetation within the subject site and adjoining lands. Accordingly, the construction of an alternate egress from the farm was recommended in the form of a pedestrian boardwalk across Pig Station Creek, connecting to the existing path at the western terminus of Cambage Street. This boardwalk is proposed as part of the Project, as illustrated in **Figure 38** below.

In addition, a proposed onsite 'Safe Refuge' will be designated and signposted within the proposed Office building. This building will benefit from shielding by adjacent buildings, and will provide an emergency refuge area during a bushfire emergency should site egress not be feasible. The BPA also recommended that an Evacuation Plan be prepared for the farm and submitted to Great Lakes Council and the NSW RFS prior to the commencement of construction works.

Further, the development of a *Bushfire Emergency Procedures Plan* was recommended, to identify protocols for protection of the operation of the farm during bushfire emergencies.

#### 5.13.3.4 *Construction Measures for Buildings*

The BPA recommended that the proposed buildings should be constructed to the standards of Bushfire Attack Level (BAL) 40, as defined within *Australian Standard 3959-2009*.

Further recommended construction standards were provided to prevent burning embers from impacting upon buildings, including the fitting of metal flyscreens to windows and non-combustible gutter guards to roof gutters. These measures will be implemented during farm construction.

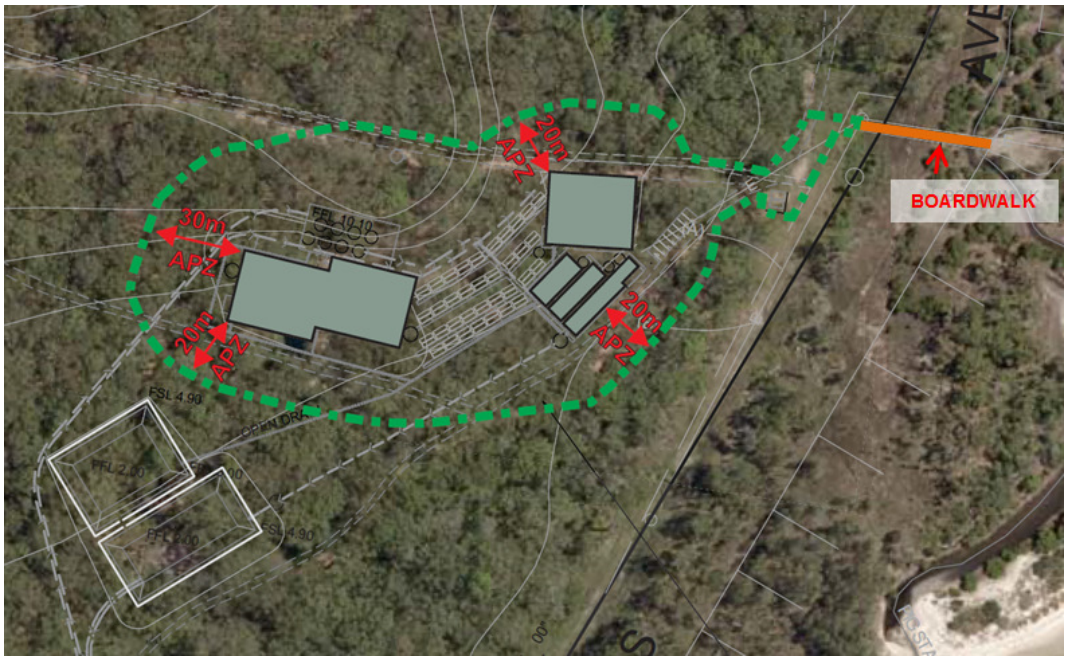



**Figure 38: Defendable Space (Asset Protection Zones i.e. *APZ*) & Proposed Emergency Egress Boardwalk**

### 5.13.3.5 *Water Supplies for Firefighting Operations*

The BPA recommended that a static water supply of 50,000 litres is provided for firefighting operations, complete with a diesel-powered pump and fire hose reels installed in locations throughout the development precinct. A 50,000 litre tank is accordingly proposed to be positioned north of the Header Tanks, as illustrated in the development plans at **Appendix 2**. Water within this tank will be reserved for firefighting purposes only. Additional details on water supply to this tank are provided at **Section 5.6** of this EA.

In addition, a fire hydrant is proposed to be located adjacent to the Bin Storage Area, providing access to the static water supply in close proximity to the farm buildings.

**Table 38** below outlines and summarises the measures proposed to minimise bushfire risk to the farm.

**Table 38: Proposed Mitigation Measures - Bushfire Risk**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Defendable Space | A *Fire Management Plan* shall be prepared, identifying protocols for the management of vegetation within the farm precinct and surrounding defendable spaces (as outlined within the *Bushfire Protection Assessment*), prior to construction. | Pre-Construction |
| Construction Standards | Detailed design of proposed buildings shall incorporate the recommended building construction standards provided within the *Bushfire Protection Assessment.* | Pre-Construction |
| Evacuation Plan | An emergency *Evacuation Plan* shall be prepared prior to construction works, and copies shall be submitted to Great Lakes Council and the NSW Rural Fire Service. | Pre-Construction |
| Access for Firefighting Operations | Access roads within the site, including passing bays and turning heads, shall be maintained to the parameters outlined within the *Bushfire Protection Assessment.* | Construction & Operation |
| Water Supplies | A dedicated static water supply and suitable connections shall be provided, as outlined within the *Bushfire Protection Assessment.* The water shall be reserved for firefighting purposes only, and maintained at the tank's full capacity. | Operation |
| Emergency Procedures | A *Bushfire Emergency Procedures Plan* shall be prepared, identifying protocols for protection of the farm during bushfire emergencies. This will include the designation of an onsite 'Safe Refuge' within the Office complex. | Pre-Occupation |

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Smoke Alarms | Smoke alarms shall be fitted to and maintained within all buildings. | Operation |
| Emergency Egress | The emergency egress boardwalk across Pig Station Creek shall be clearly sign-posted with a gate provided for security at the site boundary. A key to the gate shall be located in a 'break glass' enclosure on the development side of the boardwalk. | Construction |

## 5.14 Visual Amenity

### 5.14.1 EXISTING ENVIRONMENT

The Port Stephens area is considered to be visually sensitive and significant. The *Foreshore Management Plan for Port Stephens* (Umwelt 2009) notes that *the view across the water to natural bushland in the distance is one that is particularly enjoyed by residents and visitors to the southern shoreline. The northern shoreline and its surrounding ridgelines are generally undeveloped in contrast to the southern shoreline which is fairly intensely developed and populated* (p7.1).

Views north from the southern shoreline are expansive across Port Stephens. A key visual feature in the landscape around Pindimar comprises the densely vegetated ridgeline associated with the Gir-um-bit National Park and Fame Mountain (west of the subject site), as shown in **Plates 31 and 32** below.

At a landscape scale, the entire subject site appears covered in mature vegetation, rising gently to a relatively high point in the northern section of the site. The dwelling-houses and other structures within South Pindimar village are just visible along the shoreline.

Larger-scale views of the area are included in the *Visual Impact Assessment*, attached at **Appendix 23** of this EA.

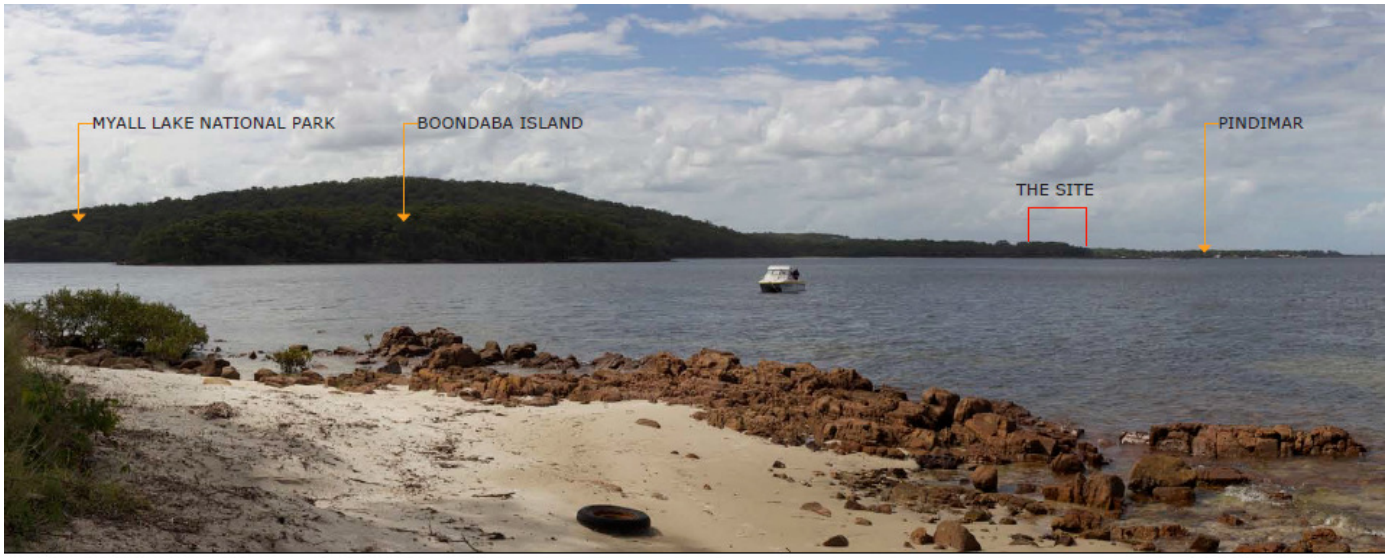



**Plate 31: View north-east towards the site from Soldiers Point**


**Plate 32: View north towards the site from Corlette Point**

From closer viewpoints, the site still appears fully vegetated. Views from the south (i.e. Port Stephens) are dominated and screened by the presence of mature mangroves fringing the shoreline and mature forest beyond, and views from the east (i.e. South Pindimar village) are also dominated by forest (refer to **Plates 33** and **34** below).

### 5.14.2 IMPACTS ASSESSMENT

Relevant to this Project, the *Foreshore Management Plan* (Umwelt 2009) identifies the key influences to visual amenity in the Pindimar area as:

**Plate 33: View north towards the site from Port Stephens**

**Plate 34: View west towards the site from the intersection of Cambage Street & Como Street (i.e. end of sealed section of public road)**

- Urban development and the clearance of natural vegetation on the surrounding slopes;
- The extent of foreshore reserve and foreshore vegetation;
- Water quality; and
- Foreshore erosion and foreshore structures.

The potential impacts of the farm in relation to visual amenity, including the key influences listed above, are discussed below.

The farm is not likely to result in any detrimental impacts to the Port's water quality (as outlined in **Section 5.4**); and it will not release any visible 'effluent' on or below the water's surface which may impact upon amenity (e.g. foam, water discolouration etc.).

The majority of the built farm components will be located in the southern-central portion of the site, as indicated in the plans at **Appendix 2**. The closest farm components to the foreshore and site boundaries will comprise the Pumphouse building and the Intake / Outflow Pipes, 3 proposed navigational buoys, and the boardwalk crossing over Pig Station Creek. These components are addressed below:

- The Pumphouse will be a low structure, partially buried underground and covered with earth and vegetation. It will be separated from the foreshore by approximately 100m and screened by dense vegetation. Accordingly, it is unlikely to be visible from outside the site.
- The pipelines will be buried from the Pumphouse through the foreshore and intertidal area, before emerging underwater below the Indian Spring Low Tide Mark. They are unlikely to be visible at any time, with the possible exception of an extremely low tide event (i.e. only on very rare occasions, and at a distance of around 200m from the shoreline). No foreshore vegetation clearing is proposed, beyond minimal undergrowth clearing associated with burial of the pipes, which will then be revegetated. Only one or two mangrove trees are likely to be impacted by construction of the pipelines, as outlined in **Section 5.9**.
- Proposed navigational buoys (as conceptually illustrated in **Plate 38, Section 5.19** in this EA) are likely to be visible from the Port; *however these would form only a minor element in the overall visual landscape and is in keeping with the character of the area…the visual impact of these buoys is low due to their distance from the shore* (**Appendix 23**).

- The proposed boardwalk will be a low, wooden structure in natural (timber) hues. It will be in keeping with the visual appearance of the existing (much larger) boardwalk connecting the villages of North and South Pindimar. From the village of South Pindimar (i.e. at the western end of the sealed Cambage Street), the boardwalk is not likely to be visible due to separation and the presence of dense vegetation, as indicated in **Plate 35** below.

When viewed from Port Stephens, the main farm buildings are unlikely to be visible, due to the separation from the Port and the presence of dense, mature vegetation.

As indicated in **Figure 39** (and shown more clearly at **Appendix 23**), the position of the buildings within the site and the retention of surrounding forest will serve to screen any viewpoints from the Port i.e. the buildings will remain below the tree canopy level. Due to distance, it is unlikely the farm would be visible from areas on the southern side of Port Stephens. Results of a Viewpoint Analysis, undertaken as part of the *Visual Impact Assessment*, are provided at **Plates 35** to **38** below, and in more detail at **Appendix 23**.

Near the farm's eastern boundary with Carruthers Avenue, all vegetation will be retained with the exception of the farm building footprint and defendable space (see **Section 5.13**). Additional vegetation will be planted adjacent to the proposed bin storage area, to ensure the site is fully screened (refer to Sheet 4 of the development plans at **Appendix 2**).

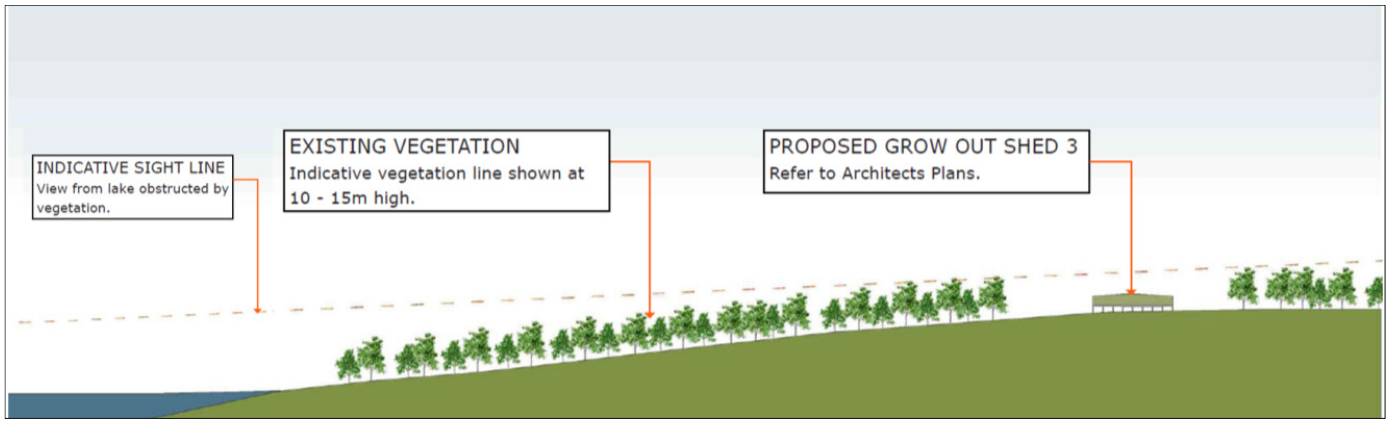



**Figure 39: Site Cross Section - Indicative Sightline from Port Stephens (Extract)**

***(Source: Appendix 23)***


**Plate 35: Views from Cambage Street, looking west towards the subject site. As indicated, the boardwalk is not likely to be visible from this viewpoint**


**Plate 36: Views from Challis Avenue, looking west towards the subject site. No changes are proposed in this area, and the existing visual amenity will not change**


**Plate 37: Views from Cambage Street, looking west towards the subject site. As indicated, no part of the development is likely to be visible from this viewpoint**

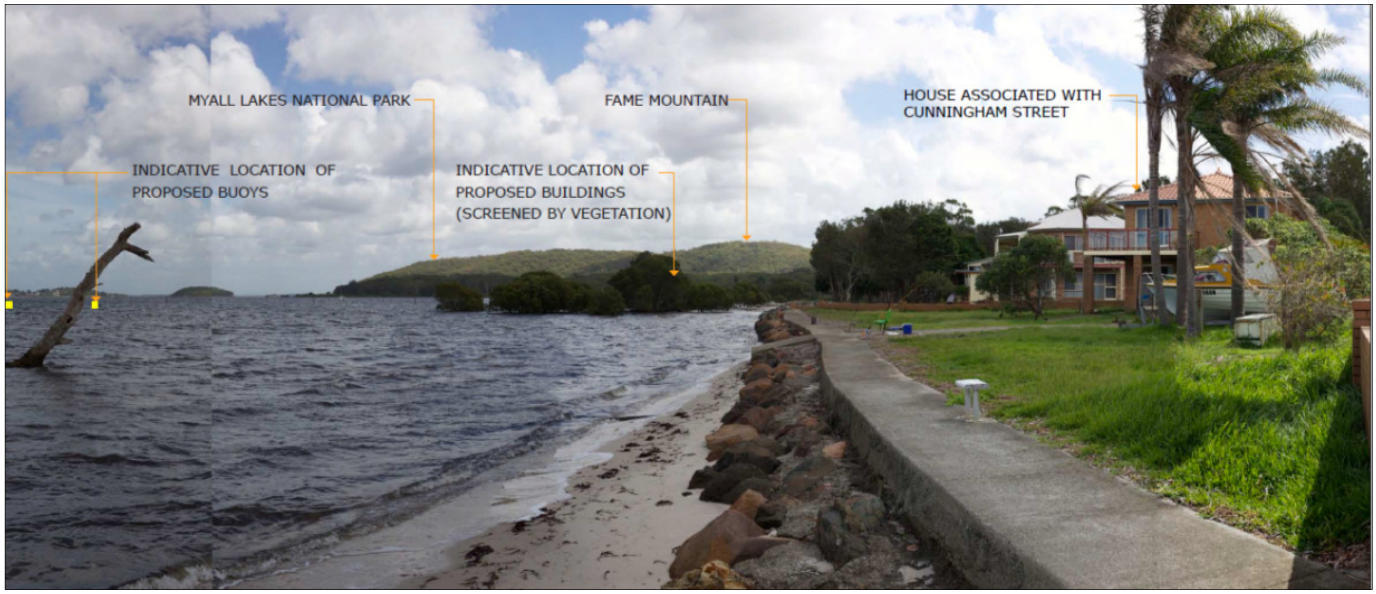



**Plate 38: Views from the corner of Cunningham and Curlew Streets, looking west towards the subject site. With the exception of the proposed navigational buoys, no part of the development is likely to be visible from this viewpoint**

The *Visual Impact Assessment* concluded that *overall, the proposed development would have a minimal impact on the existing surrounding environment in terms of landscape and scenic values…due to the extent of existing vegetation surrounding the proposal, it is likely that the proposal would be unnoticeable from most viewpoints. The height of the*

*development will not exceed the ridgeline or tree line and there will be minimal loss of tree canopy.*

### 5.14.3 PROPOSED MITIGATION MEASURES

As outlined above, the farm is not considered likely to create any adverse impacts on the visual amenity of the area. Regardless, additional mitigation measures are outlined in **Table 39** below.

**Table 39: Proposed Mitigation Measures - Visual Amenity**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Screening | The density of native vegetation between the farm and Carruthers Avenue shall be maintained to provide a sufficient visual screen. Existing vegetation shall be supplemented with native vegetation species if required. | Construction & Operation |
| Revegetation | Disturbed areas visible from outside the site (e.g. in pipe burial locations) shall be revegetated as soon as practicable. | Construction |
| Building Colours | Appropriate building colours (i.e. compatible with surrounding bushland) shall be utilised. No reflective materials shall be used. | Construction |

## 5.15 Air Quality, Odour & Greenhouse Gas Emissions

### 5.15.1 EXISTING ENVIRONMENT

While no data is readily available with regard to the existing air quality of the Pindimar area, it can be reasonably assumed to be of a high quality. This is due to the absence of significant polluting development in the area (including a low density of urban development and few roads); the proximity of the area to reliable ocean winds; and the presence of significantly vegetated areas. It is noted that numerous studies have found that trees and other vegetation play a significant role in the removal of many gaseous and particulate pollutants from the air (Galveston-Houston Association for Smog Prevention 1999).

### 5.15.2 IMPACTS ASSESSMENT

The Project will involve few activities that may result in potential air pollution or odour generation. These activities, and a discussion of their potential impacts, are discussed below. A discussion on greenhouse gas generation is also provided.

### *DUST DISTURBANCE DUE TO CONSTRUCTION ACTIVITIES*

Construction activities will generally involve the clearing of vegetation, the transport of construction materials, excavation of land, construction / assembly of buildings, and the movement of plant and vehicles during the construction phase. These activities have the potential to generate dust which may disperse beyond the site to the nuisance and/or detriment of neighbouring development. The construction of the farm is likely to be staged over several years and appropriate measures can be implemented to reduce any potential dust impacts on nearby properties.

Due to the temporary nature of construction activities; the relatively small area of vegetation to be cleared; the relatively small building footprint; the significant vegetated buffer between the development footprint and the nearest sensitive receiver; and the implementation of appropriate construction management measures (see **Section 5.15.3** below), it is anticipated that this impact can be appropriately mitigated so that there will be no detrimental impacts to neighbouring development.

### *DUST DISTURBANCE FROM TRAFFIC / PLANT MOVEMENT DURING PROJECT OPERATION*

During operation of the farm, approximately 12 vehicles are anticipated to access and leave the site on a typical workday, including staff and delivery vehicles. These vehicles will travel via sealed / gravelled public roads, and accordingly only minimal dust is likely to be created from this source.

The roads within the farm comprise dirt, gravel, sand and other unsealed surfaces. However, the presence of the dense vegetation separating the internal access roads from public areas outside the site is expected to mitigate the transmission of any significant levels of dust outside the site. Additional mitigation measures are outlined in **Section 5.15.3** below. Considering the low traffic volume anticipated to be generated by the farm, issues associated with dust from this source are not considered to be significant.

### *EMISSION OF GASES FROM CHEMICAL USE OR STORAGE*

A relatively small number and volume of chemicals will be utilised within the farm, as outlined in **Section 3.7.7.9**. These chemicals will be utilised only when necessary, and in accordance with Material Safety Data Sheets (MSDS) and manufacturer's instructions. These chemicals will be stored in appropriately sealed containers and appropriate spill management equipment will be on hand, in accordance with relevant MSDS directions.

In consideration of the above, the potential for significant air pollution to be generated from this source is considered to be negligible.

### *EMISSION OF GASES FROM FUEL STORAGE*

A small volume of diesel fuel will be stored on site, to power emergency backup equipment in the event of an electricity failure. This fuel will be stored in appropriately sealed containers in accordance with MSDS directions. Accordingly, the potential for significant air pollution to be generated from this source is considered to be negligible.

### *EMISSION OF GASES FROM THE OPERATION OF FUEL-OPERATED MACHINERY, EQUIPMENT OR VEHICLES*

All vehicles and machinery will be fitted with appropriate anti-pollution devices, as required under the *Protection of the Environment Operations (Clean Air) Regulation 2010*. Vehicle use within the construction phase will be short-term; and vehicle use within the operational phase will be limited to staff movements and minimal delivery vehicle movements. Accordingly, the potential for significant air pollution to be generated from this source is considered to be negligible.

### *PRODUCTION AND EMISSION OF ODOURS DURING PROJECT OPERATION*

The farm operation will involve some activities that have the potential to generate odours, including the cleaning of tanks and ponds; the storage of Abalone feed; the temporary storage of waste products and any dead Abalone stock; and the storage or use of chemicals and fuels.

A guideline document prepared by the (former) Department of Environment & Conservation, titled *Assessment & Management of Odour from Stationary Sources in NSW 2006*, indicates that a number of factors should be considered when determining the potential impacts of odour from a development. The guideline factors are briefly considered and discussed in **Table 40** below.

**Table 40: Odour Assessment - Factors for Consideration**

| Factors for Consideration | Discussion |
|---|---|
| Type of operation | The proposal comprises the culture of live Abalone, which will not involve the slaughtering or processing of any stock on site. The potential odour-generating activities anticipated are as follows:<br>▪ Cleaning of tanks and ponds- to occur infrequently;<br>▪ Storage of Abalone food (i.e. dry commercial feed);<br>▪ Storage of chemicals and fuels; and<br>▪ Temporary storage of biological waste and dead Abalone stock before disposal at landfill.<br>This kind of development will typically be considered a 'diffuse' odour source. |

| Factors for Consideration | Discussion |
|---|---|
| Size of operation | Activities with the potential to generate odour (as above) are few and will be temporally limited. |
| Proposed management practices | A number of management practices are proposed, as discussed following this table. |
| Density of population likely to be impacted | The nearest sensitive receivers to the development footprint comprise two dwelling houses, one located on the northern side of Cambage Street, and one on the southern side, approximately 330m to the east (in the village of South Pindimar). Additional low-density dwelling houses are positioned progressively further from the site east along Cambage Street. The population density in the vicinity of the site is considered to be low. |
| Local topography | The terrain between the development and the dwelling houses is relatively flat. |
| Surrounding vegetation | Almost the entire distance between the development footprint and dwelling houses are significantly vegetated via tall forest / woodland and mangrove areas. |
| Possibility of cumulative impacts | No other intensive agriculture development, or other potentially odour-generating development, is known to occur in the vicinity of the site. |

The guidelines also provide strategies for avoiding and mitigating odour impacts. The proposed farm has been designed and will be managed generally in accordance with these strategies, as outlined below:

- **Appropriate site selection**: The size of the subject site and the location of the main farm precinct allow for a significant 'buffer' from surrounding landuses, comprising approximately 330m of vegetated land. It is noted that much of this buffer area outside of the site comprises SEPP 14 wetlands, which are unlikely to ever accommodate 'sensitive' development. There are not likely to be any cumulative odour impacts due to the absence of existing odour-generating development in the area.
- **Managing odour at the source:**
  - ***Materials selection*** - Packaged Abalone feed will comprise hard, dried biscuit products, which will not be odorous. Nevertheless, feed will be stored in appropriately sealed containers within farm buildings. Only necessary chemicals will be utilised on site (refer to **Section 3.7.7.9** of this EA), and only in small amounts which will not result in significant odour production.
  - ***Project design* -** food and chemical storage areas will be located inside sealed buildings in order to reduce the potential for odour dispersion.

Open-air ponds (which may facilitate the generation of mild odours during cleaning) are separated from the nearest neighbours by approximately 450m. General farm waste will be stored in sealable waste dumpsters before collection.

- ***Appropriate management and maintenance regimes*** - general farm waste will be stored in sealable waste dumpsters before collection. Waste will be regularly collected from the farm via a contract service. Should there be a catastrophic loss of Abalone stock, mortalities will be stored in refrigerators or otherwise chilled with ice and placed in sealed bags prior to an appropriate off-site land-based disposal location. Chemicals and Abalone feed will be stored in appropriate sealed containers at all times, within sealed buildings. The Settlement Ponds will require only infrequent cleaning and any vegetative waste (e.g. excess algae) removed from the ponds will be stored in appropriately sealed containers until collection and disposal off-site. Should there be any complaints from neighbours of nuisance odours, it is proposed to undertake an investigation of the complaint in consultation with the complainant, so that appropriate remedial measures can be formulated should they be required. All staff will be trained in work practices that minimise odour generation.

- **Managing odour in the pathway:** All potentially odour-generating development (e.g. outdoor ponds) will be located behind significant areas of natural vegetation (i.e. the 'buffer' area). This vegetative barrier will help to direct odours away from neighbours; will maximise odour dilution; and will potentially release a masking fragrance. In addition to contributing to the dispersion of odours, the positioning of the farm in a cleared area surrounded by mature vegetation will help to reduce wind over any potential odour sources (e.g. ponds), further reducing the potential for the dispersion of odours towards public areas and sensitive receivers.

A review of the discussion in **Table 40**, and the proposed management practices above, indicates that the potential for the development to produce offensive or nuisance odours to the detriment of the public will be negligible. This is primarily due to the small scale, nature and infrequent undertaking of odour-generating activities; the significant separation of the development from nearby sensitive receivers and other public areas; the presence of vegetation as a 'buffer' between development and neighbours; and the implementation of appropriate management techniques.

### *GREENHOUSE GAS EMISSIONS*

The main source of greenhouse gas generation from the farm will arise from electricity use. As outlined in **Section 3.7.4** of this EA, the farm will be supplied 3-phase electrical power via the nearby electricity transmission lines. The key demand for electricity will be to operate the pumps transporting water throughout the farm. Research by the proponent indicates that there are currently no viable renewable energy production means (e.g. solar power) to power this use.

Electricity use within the farm will be minimised wherever possible via the following design and management measures:

- **Use of insulation** within appropriate buildings, to minimise the need for artificial cooling / heating;
- **Use of heat pump hot water systems** (which absorb and utilise heat from the ambient air to heat water) on all relevant buildings. These systems, whilst operated via electricity, are approximately 3 times more efficient than conventional electric water heaters; and
- **Use of solar powered outdoor lighting** (i.e. pedestrian paths).

## 5.15.3 PROPOSED MITIGATION MEASURES

There is not considered to be a significant risk that the farm will result in detrimental impacts on air quality. However, to reduce and manage this risk, a number of mitigation measures are proposed, as outlined in **Table 41** below.

**Table 41: Proposed Mitigation Measures - Air Quality**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Dust Emissions | The *Construction Management Plan* prepared for the Project shall include the following provisions:<br>a) Disturbed surfaces and excavated fill shall be watered to minimise dust generation during dry and windy conditions.<br>b) Traffic movements on disturbed areas shall be minimised and limited to those necessary to undertake works.<br>c) Material stockpiles shall be covered or otherwise stabilised if in place for more than 20 days.<br>d) Trucks or other equipment leaving the site shall be clean and have dust covers in place.<br>e) Earthworks shall cease when wind speeds exceed about 10 metres per second | Construction |

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| | (approximately 36km/hr) unless the Site Manager can ascertain that dust controls are operating effectively and dust generation is not creating a nuisance. | |
| Vehicle Emissions | All vehicles shall be fitted with appropriate anti-pollution devices, as required under the *Protection of the Environment Operations (Clean Air) Regulation 2010.* | Operation |
| Odour | All potentially odorous farm waste shall be stored in appropriately sealed containers until collection and disposal off-site. | Operation |

## 5.16 Flooding

The subject site is located adjacent to the Port Stephens estuary, and lower portions of the site are prone to flooding from estuarine flood events. A NSW government-funded flood study titled *Port Stephens Design Flood Levels: Climate Change Review* was prepared for the Port Stephens estuary by WMA Water in November 2010. The study found that the following factors would contribute to flooding in the Port Stephens estuary:

- **Elevated ocean levels**: resulting from astronomical tides, barometric pressure effects and wind and wave set up;
- **Wave runup**: around the foreshores of the estuary; and
- **Catchment runoff:** from the Karuah and Myall Rivers.

The study applied detailed hydrodynamic modelling to estimate governing flood levels for a range of Annual Exceedance Probability (AEP) events, at various locations around the estuary.

The study also investigated the effects of the following potential climate change impacts on flood levels in the estuary, as follows:

- **Sea Level Rise**: Sea level rises of up to 0.91m above existing levels were assessed.
- **Increased Rainfall Intensities**: Rainfall intensity and volume increases of up to 30% above existing levels were assessed.

**Table 42**, below, provides the applicable design flood levels at the subject site for the 5% and 1% AEP and extreme flood events (i.e. the '1 in 20 year' and '1 in 100 year' flood events, respectively). Levels for both existing and climate change conditions are provided.

**Table 42: Governing Flood Levels at the Subject Site**

| | 5% AEP | 1% AEP | Extreme |
|---|---|---|---|
| Existing Conditions | 2.3 m ADH | 2.4 m ADH | 2.7 m ADH |
| Climate Change Conditions | 3.2 m ADH | 3.3 m ADH | 3.6 m ADH |

Note: Flood levels were sourced from *Port Stephens Design Flood Levels: Climate Change Review* (WMA 2010) at model output location 35 (lower Pindimar). Flood levels including wave runup effects have been selected.

The *Floodplain Development Manual* (DIPNR 2005) recommends that a Flood Planning Level (FPL) is established based on the predicted 1% AEP flood level, including climate change, plus a 0.5m free board. Accordingly, the FPL for the subject site is **3.8m AHD**. This level was adopted as a minimum level for all floor levels of all habitable dwellings as well as the crest level of the Settlement Ponds.

As demonstrated in **Table 43**, the minimal floor levels for each building, as well as the crest levels for the Settlement Ponds, are significantly clear of the FPL of 3.8m AHD (refer to **Appendix 2** for development plans) and are therefore not likely to be impacted by floods.

**Table 43: Proposed Floor Levels**

| Building | Proposed Floor Level (m AHD) |
|---|---|
| Facility Shed & Office | 4.2 |
| Juvenile Shed | 4.8 |
| Broodstock Shed | 5.3 |
| Growout Sheds | 6.0 |
| Settlement Ponds | 4.9 |

It is noted that the proposed Pumphouse will be partially buried underground and will have a floor level below the FPL (i.e. at about -2m AHD). Accordingly, it may from time to time be affected by flooding. If this was to occur, water can be pumped out of the Pumphouse via a submersible bilge pump after floodwaters recede. As outlined within **Section 3.7.6.2** of this EA, the farm is able to cease pumping (i.e. water intake from the Port) and recirculate marine water within the farm facilities for a limited time during such situations. Accordingly, this is not considered to be a significant risk to the operation of the farm.

The Project will not have any effect on the existing processes that cause flooding in the Port Stephens estuary (i.e. elevated ocean levels, wave runoff and catchment runoff). Surface water management is addressed at **Section 5.6** of this EA.

## 5.17 Coastal Processes

The coastal processes affecting Port Stephens, and in particular the Pindimar area, have been addressed in a number of previous reports including (most recently) *Living on the Edge - A Foreshore Management Plan for Port Stephens* (Umwelt 2009).

The Pindimar foreshore was found to be a 'depositional area', generally *characterised by a sandy, mangrove lined shoreline, backed by flood prone land at the base of steep slopes* (Umwelt 2009). Foreshore recession in this area currently occurs where mangroves are absent from the nearshore zone, however *the western foreshore of the village of Lower* (South) *Pindimar has a healthy beach profile with no foreshore protection structures* such as seawalls or groynes. The foreshore is *well protected from wave action, being exposed to a narrow wind wave fetch to the south east* and *a long term erosion signature is not present* (Umwelt 2009).

The key coastal processes that may impact on the farm relate to flooding impacts (including sea level rise); potential scouring around pipelines and water outlets; and wave / tidal impacts on the general stability of the pipelines. As the Pindimar area is a *depositional area* it is not anticipated that tidal processes will result in the uncovering of buried pipelines within the intertidal area.

Flooding impacts are addressed at **Section 5.16** of this EA. The potential for scouring around the pipeline supports is addressed at **Section 5.9** of this EA. Neither of these issues are considered to present a significant risk.

There is the potential for the scouring of the seabed in the vicinity of the water outlets. However, this is considered to be a negligible risk as:

- The water outlets will be slightly raised and flows will not be directed towards the seabed (i.e. they will be directed horizontally); and
- The velocity of outlet water will low.

The stability of the pipelines is proposed to be managed through the anchoring of pipelines with concrete supports. As outlined in Section **3.7.3.4** of this EA, pipelines will be securely strapped to low concrete supports which will be either placed directly onto the seabed or buried within the intertidal trench. A detailed *Construction Management Plan* is proposed to be prepared which will provide further details on the methodology for pipeline construction.

Accordingly, no additional management measures are likely to be required in relation to coastal processes.

## 5.18 Climate Change

The (former) NSW Department of Environment & Climate Change projected the following climatic changes for the Hunter Region by 2050 (DECC, 2008):

- **Hotter climate**: days projected to be hotter over all seasons (1 to 3 degrees Celsius), with the greatest increases during winter and spring.
- **Increased rainfall**: projected in all seasons except winter.
- **Increased storminess and sea levels.**

A discussion on the potential impacts of sea level rise and increased rainfall intensities on flooding within the farm is provided at **Section 5.16** in this EA. In summary, apart from manageable and temporary impacts on the underground Pumphouse, flooding associated with climate change is not anticipated to have any significant effects on the farm infrastructure or operations.

The potential impacts of increased storminess include an elevated risk of coastal erosion. However, as outlined in **Section 5.17,** the area in the vicinity of the farm is considered to be a well-protected 'depositional' area with a lower likelihood of erosional impacts. The retention of the existing mangroves lining the site will assist with ongoing protection from increased wave action associated with climate change.

For minimal mortality and viable growth, Abalone require water temperatures of between 12 and 25 degrees Celsius, depending on their stage of growth or the breeding cycle (Heasmann & Savva, 2007). The farm will aim for typical operating water temperatures between 17 and 25 degrees Celsius, with an optimal temperature of 20 degrees. The ambient surface water temperature in the Port near the subject site (i.e. at Soldiers Point) has been recorded as ranging between 9 and 29 degrees Celsius (between 2004 - 2012), with an overall average of 20 degrees (source - unpublished data provided by Port Stephens Council). The average temperature of water at greater depths within the Port was not available at the time of writing, but is expected to be lower than the surface water temperature.

An overall hotter climate may have a subsequent minor impact on the ambient temperature of marine water stored and circulated within the farm, although the farm buildings have been deliberately positioned to benefit from a (cooler) southerly aspect. Although such impacts on water temperature are expected to be negligible, the following measures may need to be implemented and/or with more frequency to manage water temperature on occasion:

- Air cooling in Grow-out Sheds (preferably via retro-fitted solar-powered air conditioners);
- The wetting of shed roofs with rainwater to cool buildings (note - the farm's tanks are anticipated to be full for much of the year, as outlined in **Section 5.6**);
- The (temporary) recirculation of cooler water within tanks / raceways; and
- Artificial water cooling via 'water chillers' associated with Abalone tanks and raceways.

Note that additional insulation can be retrofitted to buildings and pipelines if required.

In order to minimise electricity demand, the use of renewable energy sources (such as solar power) will be explored and implemented where appropriate.

## 5.19 Existing Uses of the Port & Navigational Safety

The Port Stephens waterway is utilised by a range of people for varying recreational and commercial purposes. Depending on the specific location within the Port, these uses include:

- Recreational fishing, snorkelling and diving;
- Conservation (i.e. Marine Park);
- Charter (estuary) fishing;
- Commercial fishing (including hauling, crab trapping and mesh netting);
- Commercial dolphin watching and sightseeing operations;
- Recreational swimming, sailing and boating activity;
- Estuarine research projects;
- General boating vessel transit; and
- Aquaculture (including use of oyster leases).

While no formal data is available with regard to the extent of activities that occur in the vicinity of the subject site, in particular where the pipelines are to be located, the following is noted:

- The foreshore adjacent to the site comprises a narrow sandy beach (about 5m width) bordered by vegetation (i.e. terrestrial forest on the landward side and mangrove vegetation within the waterway). The beach in this location and immediately west adjoins only private land and accommodates low levels of pedestrian traffic and use. There are *very few public facilities that would attract tourists or day trippers* to this area (Umwelt 2009);

- A shallow intertidal sand flat extends approximately 200m from the foreshore. This area accommodates mangroves (and formerly accommodated *Zostera* seagrasses), as indicated **Figure 30** in this EA;
- Oyster lease areas were formerly present in the location of the proposed pipeline, however no infrastructure remains. 'Priority oyster aquaculture areas' have been identified several hundred metres east of the subject site, directly south of the village of South Pindimar (see **Figure 16** in this EA) although no leases are currently in use. No other marine aquaculture facilities are known to be located in close proximity to the site; and
- The waters immediately adjacent to Pindimar are generally not heavily trafficked, and are significantly less developed with tourism infrastructure than other areas of the Port (such as Nelson Bay and Shoal Bay). Two navigational beacons are present within the vicinity of the site ('Lit South Cardinal Beacons' No. 128 and 129, as shown in **Figure 40** below), to the east and west of the proposed pipe locations. Boat traffic travelling to and from the west channel of the Myall River, including fishing vessels, generally remains south of these beacons due to the presence of shallow waters. A boat ramp is present on the southern side of Curlew Avenue, about 1.5km east of the site, which can only be utilised by small / shallow-bottomed boats during the highest tides (when the water covering the pipelines will also be at its highest).

As outlined in **Section 3**, the only works proposed to occur within Port Stephens comprise the placement of two Intake Pipelines and two Outlet Pipelines. The pipelines will be buried underground within the foreshore and intertidal area, and will emerge underwater south of the Indian Spring Low Tide Mark. From this point, the pipelines will be raised on low supports (i.e. 50cm) over areas of seagrasses and unvegetated seabed.

As the pipelines will be buried within the intertidal sand flat, there will be no impacts on visual amenity or public access in this area. The public will still have free access for recreational swimming and other activities. Due to the shallow depth of the water and the presence of mangroves, seagrasses and navigational beacons, most boats generally will not access this area (navigational impacts are discussed further in **Section 5.19.1** below).

Over time, the pipelines are likely to result in an increase in local marine flora and fauna biodiversity, due to the increased plant / sessile animal anchorage opportunities and enhanced fish habitat values (see **Section 5.9** for further discussion). This will provide enhanced marine habitat-viewing opportunities for divers / snorkelers. It is noted that the farm's water inlets will be at a depth of 15-20m, where few divers are likely to be present.

Regardless, there is negligible risk of divers or their equipment being drawn into the water inlets due to the very low water intake velocity proposed, and the presence of relatively fine filters at the terminals of each pipe. A maximum water current of about 0.5m/sec is recommended to allow safe and easy movement of a diver in proximity to water inlets (The International Marine Contractors Association 1991). The farm will have a water intake velocity of about 0.1m/sec.

The following sections provide additional information on relevant key uses in the Port near the proposed farm, encompassing:

- Navigation;
- Marine Park impacts - Sanctuary Zone;
- Oyster industry impacts; and
- Recreational / commercial fishing & dolphin watching impacts.

### 5.19.1 NAVIGATION

Between the Indian Spring Low Tide Mark to the pipeline terminals (inlets and outlets), there is some risk of potential conflict between the pipelines and boat anchors or vessels which sit low in the water. The area with the greatest potential for conflict (i.e. shallowest pipe position) is where the pipes emerge from underground and extend south-east into the Port. This area is also the main habitat area for *Posidonia* seagrasses, as indicated in **Section 5.9** of this EA. Accordingly, boats should generally not be driving over or setting anchor in this area due to the potential to damage seagrasses, as recommended in the NSW Government's *Boating Handbook* (2012).

However, even if boats should drop anchor directly over pipelines, the rounded profile of the pipelines is unlikely to result in tangling. Accordingly, the only structure which presents a significant entanglement risk comprises the inlet structures (i.e. passive fish screens). These will be at 15-20m depth, and boats are unlikely to drop anchor this deep.

Nevertheless, to mitigate the risk of entanglement, it is proposed to position 3 navigational buoys in the vicinity of the pipelines at the following locations:

- between the pipelines at a depth of approximately 2m at low tide (i.e. to ensure buoys will always remain afloat, even during low tide periods).
- the pipe outlets; and
- the pipe inlets.

The approximate locations of the proposed buoys are shown as yellow dots associated with the proposed pipelines in **Figure 40**.


**Figure 40: NSW Maritime Boating Map (Port Stephens) – Extract, Showing Position of Proposed Pipelines and Navigational Buoys**

The buoys are envisaged to be similar to those shown in **Plate 39**, below. These are typically utilised to indicate *special features or areas such as …underwater pipes* (p44), as described in the *Boating Handbook* (2012), and will clearly advise vessels to avoid the potential hazard. The buoys may be lit via a pulsing (solar-powered) yellow light at night. Details of the exact position of the buoys is anticipated to be negotiated with NSW Maritime should the Project be granted approval.

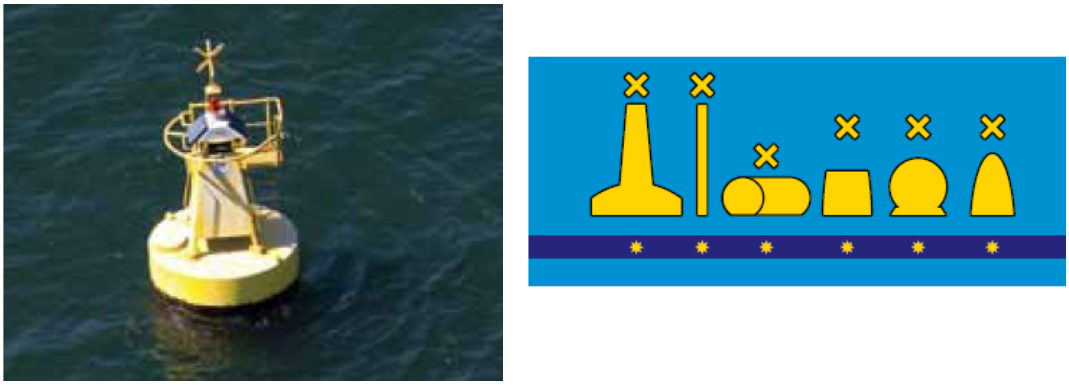


**Plate 39: Examples of navigational buoys proposed to mark the location of pipelines**
**(*Source: NSW Transport [Maritime] 2012)***

### 5.19.2 MARINE PARK IMPACTS - SANCTUARY ZONE

The potential for the farm to have detrimental impacts on the nearby Sanctuary Zone are addressed at **Section 5.9** of this EA. In summary, there are not likely to be any detrimental impacts on the Sanctuary Zone.

### 5.19.3 OYSTER INDUSTRY IMPACTS

As discussed in detail at **Section 4.2.3.4**, the proposal is unlikely to have any detrimental impacts on the viability of the oyster industry in the Port, including any oyster leases that may be established within the nearby 'Priority oyster aquaculture areas'.

### 5.19.4 RECREATIONAL / COMMERCIAL FISHING & DOLPHIN WATCHING IMPACTS

Commercial dolphin watching is a significant tourism industry within Port Stephens, involving a number of operators and numerous vessels. According to the Port Stephens Commercial Dolphin Watch Association's Voluntary Code of Conduct (cited in Allen, Smith *et al*, 2007), activities generally involve tourist boats approaching dolphin pods

around the Port and observing them for a maximum of 30 minutes from a distance of at least 50m. It is expected that these activities occur in the vicinity of Pindimar on occasion, most likely on the deeper (southern) side of the Port in order to avoid traversing shallow seagrass beds.

With regard to recreational and commercial fishing, a range of activities are permitted in the vicinity of the farm with or without a permit (in accordance with the regulations governing General Use zones within the *Port Stephens - Great Lakes Marine Park*). No formal data on the extent of fishing activities in the area was publicly available at the time of writing. Further information on the type and extent of fishing activities in the vicinity of the farm was sought from various government and public stakeholders in mid-2013 (refer to **Section 6.3.1.4** of this EA for further details). While little information was gained, anecdotal advice indicated that the area in the vicinity of the farm and pipes was considered unlikely to be a popular recreational or commercial fishing location.

Regardless, it is considered that any recreational fishing in the area is likely to involve pedestrian access around the intertidal area or via the Pindimar beach, or the use of smaller boats through shallow waters. In addition, dolphin watching and commercial fishing activities are likely to involve the use of larger boats in deeper waters. Fishing may or may not include the use of nets or traps.

As outlined in **Section 5.18** above, the proposed pipes will be buried underground throughout the intertidal area and will not have any impacts on pedestrian access or amenity. Navigational beacons will be positioned in the vicinity of the pipes where they emerge from underground (around 200m from shore) and near outlets / inlets, to ensure any shallow-bottomed boats avoid colliding with the pipes, or entangling anchors, nets or traps. In the same way, the buoys will warn anglers of the potential for fishing line snags on the pipes.

Deeper-hulled / larger boats will similarly be warned of the presence of the pipes and inlet / outlet structures via the navigational buoys. It is considered unlikely that any anchors will be set to the depths of the inlet structures (at 15-20m depth), so the risk of anchor entanglement on these structures is low.

As outlined in **Section 5.4** the farm is not likely to have any impacts on the water quality of the Port, and accordingly there are not likely to be any detrimental impacts on populations of commercially or recreationally important marine species. Conversely, the construction of 'artificial reef structures' (such as the proposed pipelines) are well known for enhancing local fish and invertebrate biodiversity within estuaries, as outlined in **Section 5.9** of this EA.

As discussed in **Section 5.9**, the farm is not expected to have any impacts on the existing dolphin populations within the Port, or on their activities. The presence of the pipes will not result in any disruptive influences (such as the emission of heated water or noise) which may deter the presence of dolphins or other species from the area,

In summary, as the farm is not likely to result in any significant constraints or risks to boat or pedestrian movement throughout the Port, nor on the health or viability of important marine species, there are not likely to be any detrimental impacts on recreational / commercial fishing or dolphin watching activities.

## 5.20 Social & Economic

### 5.20.1 SOCIAL & ECONOMIC OVERVIW - PINDIMAR & BUNDABAH

The closest population centres to the subject site comprise the villages of Pindimar and Bundabah, both within the Great Lakes LGA. The Australian Bureau of Statistics defines the boundaries of these suburbs as shown in **Figure 41** below.

Key social and economic statistics for these suburbs, derived from the 2011 Census, are provided in **Table 44** below.

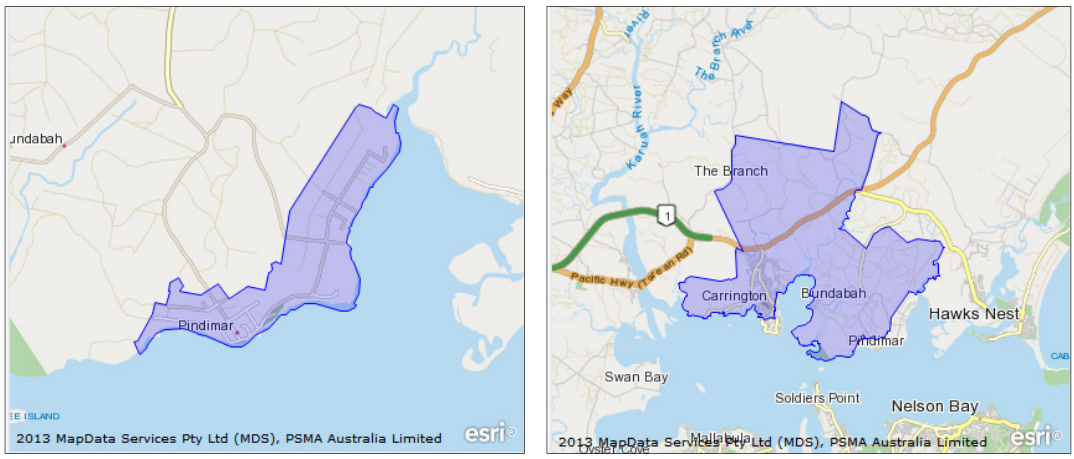



**Figure 41: State Suburb Catchments of Pindimar (*Left*) & Bundabah (*Right*)**

***(Source: Australian Bureau of Statistics 2011)***

In summary, there were approximately 521 people in the Pindimar / Bundabah area in 2011. Pindimar accommodated a significantly higher than average proportion of residents

aged over 55 years, at 53.4% of the population compared to the NSW average of 26.4%. Bundabah accommodated a higher than average proportion of young people under 14 years of age, at 29.7% compared to the NSW average of 19.2%.

Both Pindimar and Bundabah had a comparatively low proportion of people who worked full time (i.e. 46.3% and 42.4% respectively, compared to the State average 60.2%), but a higher proportion of people who worked part time (40% and 39.1%, compared to NSW's 28.2%). Pindimar and Bundabah had significantly lower median weekly household incomes than the NSW average of $1,237 ($680 and $866 respectively). People in Pindimar / Bundabah held a wide variety of qualifications, with most qualified people holding Certificate Level qualifications.

**Table 44: Key Social & Economic Statistics - Pindimar & Bundabah (2011 Census)**

| Statistic | Pindimar | Bundabah | NSW Average |
|---|---|---|---|
| Total population | 230 | 291 | - |
| Percentage aged 14 years and younger | 9.1% | 29.7% | 19.2% |
| Percentage aged between 15 - 54 years | 37.5% | 33.1% | 54.4% |
| Percentage aged 55 years and older | 53.4% | 37.3% | 26.4% |
| Percentage of people attending an educational institution (primary, secondary or tertiary / technical institution) | 19.7% | 34% | - |
| Percentage of people (aged over 15 years) who worked full time | 46.3% | 42.4% | 60.2% |
| Percentage of people (aged over 15 years) who worked part time | 40% | 39.1% | 28.2% |
| Percentage of people (aged over 15 years) unemployed | 7.4% | 7.6% | 5.9% |
| Number of people with a Postgraduate Degree qualification | 3 | 3 | - |
| Number of people with a Graduate Diploma or Graduate Certificate qualification | 0 | 0 | - |
| Number of people with a Bachelor Degree qualification | 18 | 22 | - |
| Number of people with an Advanced Diploma or Diploma Level qualification | 21 | 18 | - |
| Number of people with a Certificate Level qualification | 54 | 48 | - |
| Median weekly household income | $680 | $866 | $1,237 |

## 5.20.2 POTENTIAL IMPACTS OF THE PROJECT

The social and economic impacts of a development relate to the effect that it may have on people's way of life, their employment and financial prospects, the character, cohesion and demographics of a community or its customs and values. The social impacts of the farm have been considered through a quantitative and qualitative assessment of likely impacts in relation to demographic data and an anecdotal understanding of the character of the area.

It is noted that representatives of the local community have had the opportunity to provide comment on the design and assessment of the farm through public consultation exercises, as outlined in **Section 6** of this EA. This process has made the community aware of the proposal from early on in the process, and has allowed the community to highlight key queries or issues of concern. These issues have been taken into consideration and addressed within this EA wherever possible.

The potential **negative** social and economic impacts of the Project are discussed below:

- **Inconvenience and nuisance to residents due to construction traffic, dust or noise.** Potential impacts arising from construction traffic or noise will be temporary and are not likely to cause significant disturbance or nuisance to nearby residents or the local road network. The site is significantly separated from neighbouring development by mature vegetation, which will help to mitigate impacts. These issues are addressed in detail in **Sections 5.12** and **5.15** of this EA. Appropriate construction management procedures will be implemented to minimise impacts on residents throughout the construction period.
- **Inconvenience and nuisance to residents due to operational traffic or noise**. An assessment of the likely noise impacts of the farm (see **Section 5.12**) indicate the farm will not have any significant impacts on nearby residents. A review of likely traffic generation impacts (see **Section 5.11**) indicates the farm will generate in the order of 12 x 2-way vehicle movements a day during operation. This is not likely to have any significant impact on the quiet character, safety or functionality of the existing local road network.
- **Changes to the 'quiet' and 'rural' amenity and character of the area**. The subject site is physically separated from the nearest existing development by approximately 300m and will be visually screened by mature vegetation. It is unlikely that any part of the farm will be readily visible from outside the site. The traffic volumes anticipated to and from the farm are low, as discussed above, and no disturbing noise is likely to be audible outside the subject site. The farm will

comprise an agricultural activity, which is in keeping with the rural zoning and character of the site. Accordingly, the farm is unlikely to detrimentally affect the amenity or character of the area.

- **Impacts on the quality of the natural environment, and subsequent impacts on the tourism and recreational opportunities of Port Stephens**. As outlined throughout this EA, the proposal is not likely to have any significant detrimental impacts on the marine or terrestrial environment of the area. The proposal incorporates a range of mitigation measures to manage risk and to minimise impacts beyond the site. Accordingly, there are not likely to be any impacts on the recreational attractiveness of the area, nor on the tourism potential of Port Stephens.

The potential **positive** social and economic impacts of the Project are discussed below:

- **Creation of construction jobs.** The Project is anticipated to create up to 35 jobs during the construction phase.
- **Flow-on economic impacts to the local economy during construction.** The Project is likely to result in flow-on economic benefits to local businesses during construction, through the purchase of materials, goods and services. There are likely to be further multiplier effects through construction worker income expenditure in the local area. The nearest commercial / industrial centres to the subject site are at Hawks Nest / Tea Gardens.
- **Creation of operational jobs**. The farm is likely to generate up to 15 full-time equivalent employment positions. These positions will interest people from a range of industries with differing qualifications such as administrative staff, electrical, mechanical and hydraulic engineers, biotechnicians, and students / trainees. Jobs are anticipated to encompass full-time, part-time and casual positions. Considering the relatively low proportion of people in the Pindimar / Bundabah area who had full-time positions in 2011, and the relatively high number of people who worked part-time, the range of positions generated is likely to be appealing to some local residents. The farm proposes to promote equal opportunity employment opportunities, with applications invited from all demographics, including those currently under-represented in the workforce (e.g. Aboriginal people, young people etc.). People of working age (i.e. 15- 54 years) are currently under-represented in Pindimar / Bundabah, as outlined in **Table 44**. This may be partially as a result of inadequate employment opportunities in the area. The creation of a number of permanent employment positions within the farm may attract some younger people to live in the area.

- **Flow-on economic impacts to the local economy during operation.** The Project is likely to result in flow-on economic benefits to local businesses during operation, through the purchase of goods such as feed, equipment and other farm supplies. Further, the farm will generate demand for local services and trades, such as electricians, telecommunications and security services. There are likely to be further multiplier effects through operational worker income expenditure in the local area.
- **Potential for educational opportunities.** The farm will incorporate technical and operational components unique to the Port Stephens area, and is therefore likely to be of professional and educational interest to a range of people. There may be the potential for the development of trainee employment positions, work experience or other educational experiences.
- **Potential for aquaculture research and development opportunities**. Into the future, there is the potential for the farm to incorporate best practice aquaculture research and development activities. Any such activities will be governed by planning legislation and the obtaining of relevant permits or consents.

It is noted that a recreational fishing benefit may also arise from the farm, as the construction of 'artificial reef structures' (such as the proposed pipelines) are well known for enhancing local fish biodiversity. They have been *used extensively around the world to create fish habitat, regenerate damaged ecosystems and to enhance angler catch* (DPI n.d.*d*).

On balance, the farm is not considered likely to result in any significant changes to the existing quality of life for people in the surrounding area. The farm is likely to generate a range of employment and educational opportunities for people in the local community, and there are likely to be some flow-on economic benefits to the wider local economy.

In order to mitigate any negative social impacts that may arise from the farm, the farm proposes to implement the mitigation measures outlined in **Table 45** below.

**Table 45: Proposed Mitigation Measures - Social & Economic Impacts**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Complaints from Neighbours | Should any conflicts with or complaints from neighbours arise, during construction or operation, the farm manager shall undertake to resolve issues through actions including the following:<br>- The keeping of records of all complaints or compliments;<br>- The undertaking of meetings or other forms of consultation in order to identify issues of | Construction & Operation |

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| | conflict and to work towards possible solutions;<br>- The implementation of ameliorative strategies to resolve conflicts fairly and promptly. | |

## 5.21 Impacts on Wild Abalone Populations

### 5.21.1 BROODSTOCK COLLECTION

As outlined in **Section 3.7.5.1**, a number of Abalone individuals will be sourced to act as broodstock for the farm. They will provide a production base for the breeding of juvenile production stock, and will assist in the on-going maintenance of genetic diversity throughout the farm's operating life. It is anticipated that the following will be required:

- **At farm establishment**: approximately 120 individuals (at a ratio of two males to every three females); and
- **Each subsequent year of production:** approximately 24 replacement individuals, in order to maintain genetic diversity.

Broodstock will be sourced either directly from wild NSW locations (i.e. harvested by divers) or will be purchased from licensed re-sellers within NSW, depending on the availability of appropriate stock at the time required. It is assumed that licensed re-sellers will source their Abalone from the NSW commercial Abalone fishery.

Regardless, both options will ultimately involve the taking of Abalone individuals from wild NSW populations, either by the farm staff directly or by licensed commercial fishers. These two options are discussed below in relation to their potential impacts upon the viability of wild Abalone populations.

#### 5.21.1.1 *Purchase Option*

As outlined within **Section 3.4**, Blacklip Abalone have been commercially harvested from NSW coastal waters for over 50 years. Due to the decline in wild Abalone stocks in recent decades the NSW commercial Abalone fishery has become increasingly regulated and strict Total Allowable Commercial Catch (TACC) limits are now in force. The fishery is now a *limited entry, share managed fishery* with fishers required to be in possession of appropriate shares in order to take Abalone (Department of the Environment & Heritage 2006). The harvest and sale of all Abalone in NSW is carefully monitored and regulated

in accordance with the NSW *Fisheries Management (Abalone Share Management Plan) Regulation 2000*, which is a statutory plan in force under the NSW *Fisheries Management Act 1994* and *Fisheries Management (General) Regulations 2002.*

It is noted that all Abalone taken from NSW waters by commercial fishers are recorded as part of the National Docketing System, which allows for the tracking of particular Abalone batches from capture until final retail sale.

Due to the stringent regulation of the commercial fishery in NSW, it can be reasonably assumed that any Abalone purchased from licensed re-sellers have been harvested sustainably and in accordance with TACC conditions. Accordingly, the proposed purchase of Abalone for the farm's broodstock is not likely to have any impact upon the sustainability of wild Abalone populations in NSW.

#### 5.21.1.2 *Wild Collection Option*

For the wild collection option, as outlined in **Section 3.7.5.1**, Abalone will be preferentially sourced from the northern-most NSW Abalone Assessment Region in which collection is permissible at the required time of harvest. In order to gain an understanding of the significance of the proposed collection numbers (i.e. maximum of 120 individuals in a single year), the legislative Abalone harvest limitations for recreational fishers are considered below.

The NSW Department of Primary Industries (DPI) sets recreational 'bag limits' for marine and freshwater species in NSW, meaning the *maximum number of fish per person in possession*. The daily bag limit for the taking of wild Abalone by recreational fishers in unrestricted areas of NSW is two individuals (DPI n.d.*c*). Accordingly, a single recreational fisherperson may take up to 730 individual Abalone per year.

In areas affected by partial recreational closures, as outlined within **Section 3.7.5.1** recreational fishers can only take Abalone on weekends and on public holidays directly adjacent to a weekend. Accordingly, a single fisherperson may still take approximately 210 Abalone from closure areas every year.

It can be reasonably assumed that the bag limits set by DPI have taken into account the sustainability of wild Abalone populations. As the proposed taking of Abalone for broodstock purposes comprises only a small fraction of what a single recreational fisher may take in a year, it is considered unlikely that such harvest will have a significant impact on the viability of wild NSW populations. As outlined within the *Aquatic Ecology Assessment* at **Appendix 16** of this EA:

> *These numbers are insignificant in terms of what will be removed from the natural wild population and there would be no indirect impact on other subtidal marine assemblages. Natural mortality and predation would be far greater in the wild as they are constantly preyed upon by rays and other fishes as well as marine invertebrates such as starfish, lobsters and octopus…* (p43).

It is noted that all appropriate licenses and approvals will be obtained from regulatory authorities in order to permit broodstock collection from the wild, such as a Broodstock Collection Permit pursuant to the *Fisheries Management [Aquaculture] Regulation 2007*. Individual Abalone will then be hand selected and removed from the wild by the proponent's licensed divers, in accordance with regulatory requirements.

### 5.21.2 RISKS OF ESCAPE OF GENETIC MATERIAL FROM THE FARM

As noted in **Section 3.7.5.1**, broodstock will be sourced preferentially from the northern-most NSW Abalone Assessment Region in which collection is permissible. Accordingly, the farm's Abalone may have slight genetic differences to the nearest wild Abalone populations (i.e. outside Port Stephens, approximately 10km east of the farm).

There is therefore the potential for viable 'exotic' genetic material to escape from the farm and compromise the genetic integrity of domestic wild Abalone stocks. For example, larvae may conceivably escape from the farm, survive, mature, reach existing Abalone populations outside Port Stephens and then breed with wild stock resulting in an exotic or hybrid Abalone biotype (Hawkins & Jones 2002).

There are 2 potential avenues for genetic material (i.e. Abalone larvae) to be produced within the farm:

- **Intentionally**, as part of farm breeding processes (i.e. within hatchery facilities in the Broodstock Shed); or
- **Unintentionally,** such as via a spontaneous spawning event within the Growout Sheds.

In relation to intentional breeding processes, the risk of viable larvae escaping from the hatchery facilities is negligible, as all water released from the Broodstock Shed is treated in several comprehensive ways before release to the Settlement Ponds (i.e. via fine filtering, ozone and UV treatment - refer to **Section 5.4** for further details). This treatment would almost certainly kill any escaped larvae before reaching the Settlement Ponds, let alone wild populations outside Port Stephens.

In relation to unintentional spawning events, research indicates that there is very little chance that larvae could survive various risk factors in order to breed outside the farm. A study titled *Larval escape through Abalone culture effluent systems: an analysis of the risk* (Hawkins & Jones 2002) analysed risks associated with an unintentional spawning event. The study noted that any fertilised eggs (larvae) that escape a farm system are subject to several events which they must survive, comprising:

- Settlement (see **Section 3.7.5.4** of this EA for further details);
- Survival through the first year; and
- Survival to sexual maturity.

The likelihood of an unintentional spawning event occurring, and viable larvae subsequently escaping and surviving through the phases mentioned above, is minimised in the proposed farm by several factors:

- **Outlet location**: water outlets will be positioned in areas of extensive marine sediment (e.g. sand), which are not conducive to Abalone larvae survival. There is minimal chance of larvae finding a suitable (rocky) habitat on which to settle.
- **Settlement Ponds**: as noted in the study, the *presence of a settling pond reduces the quantity of larvae escaping if a spawning event occurs* (p807).
- **Distance from wild populations**: the significant separation distance between the farm and wild populations (i.e. 10km) and associated dilution effects would reduce the potential for viable larvae to survive the journey and successfully encounter wild populations.

Regardless of the above, Hawkins & Jones found that *the probability of a spawning event leading to larvae escaping, maturing and spawning again in the wild is in the order of 3.7 x $10^{-6}$ per production cycle (about 3 years).* This equates to less than a 'four in one million' chance, which may be considered negligible.

The study concluded that *based on the results of this modelling exercise, the source of broodstock for land-based farms is of little importance in terms of genetic impact on wild populations* (p808).

## 5.22 Food Production & Health

Abalone are proposed to be harvested and transported from the farm as live product. With the exception of depuration (i.e. *allowing Abalone to eliminate waste products before transport*), no on-site post-harvest processing will occur.

Unlike bivalve molluscs (e.g. oysters) Abalone are not filter-feeders (which *feed by filtering small particles out of the water*). Bivalve molluscs are known to accumulate

bacteria and viruses present in the water column from sewage or other sources, and can present significant risks to human health if contaminated animals are eaten.

As outlined in **Section 3.7.7.3** mature Abalone will be fed a commercially-prepared dry feed based on milk proteins and wheat, which has a very low risk of contamination. Research indicates that the consumption of Abalone has lower human health risks than with bivalve molluscs (Legg 2010).

Regardless, there is the potential for Abalone to become contaminated and present food safety risks if handled incorrectly.

The NSW seafood industry is regulated by the *Food Act 2003* and the *Food Regulation 2010*. The Food Act brings into force the *Australia New Zealand Food Standards Code* which sets out provisions related to seafood production which the farm must comply with. In particular, the farm must comply with Standard 4.2.1 *Primary Production and Processing Standard for Seafood.* It is noted that the farm will require licenses from the NSW Food Authority with regard to seafood production and food transport vehicles.

In order to maximise food safety, the farm proposes to prepare and implement a Food Safety Program guided by the NSW Food Authority's *Food safety program for seafood processing* guideline (undated) and the *General guidelines for the development and implementation of a food safety program* (NSW FA 2005), as outlined in **Table 46** below.

The Food Safety Program will be based on the Hazard Analysis & Critical Control Point (HACCP) system as outlined by the Codex Alimentarius Commission. The HACCP system clearly identifies hazards and establishes controls that will prevent, eliminate or reduce risks to an acceptable level. It forms part of many food businesses' quality assurance systems and is increasingly being included in food safety legislation.

Potential impacts on the water quality of the Port as a result of farm activities are addressed in **Section 5.4** of this EA. Farm activities are not considered likely to affect the Port's water quality variables such that they exceed ANZECC water quality guidelines for human health or other values (including primary or secondary contact).

**Table 46: Proposed Mitigation Measure - Food Production & Health**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Food Production Safety | A *Food Safety Program* shall be prepared for the farm before operation, and shall be implemented throughout the operational period. It shall be prepared with regard to best practice and relevant guidelines, including the principles of HACCP. | Pre-Operation |

## 5.23 Pond Safety & Integrity

The proposed design of the Settlement Ponds is indicated in the development plans attached at **Appendix 2**. The ponds will be constructed via excavating the soil and lining the excavation with an impermeable pond liner to prevent seepage of marine water into the soils.

The Ponds are proposed to be designed in accordance with engineering best practice at the time of construction. Should the integrity of the Ponds be breached (e.g. pond liner perforated during cleaning activities) action will be taken to undertake repairs as soon as possible (see **Section 5.7** of this EA). As a worst case scenario, should a catastrophic rupture of the pond liner occur due to a major accident, any lost water will percolate through the sandy soils and migrate to the Port. As the Ponds will contain only treated marine water, and the site is already likely to be affected by salt to some degree (e.g. through wind-blown salt spray), such an (improbable) event is unlikely to result in any significant or long-lasting impacts on the environment. It is noted that many other Australian aquaculture facilities, such as prawn farms, do not have *any* liners providing a barrier between marine water and the soil, as a general practice.

The ponds have been designed to allow for heavy rainfall events. Any rainwater that falls will generally sit on top of the marine water layer. The ponds will be continuously releasing water to the Port, anticipated to be via a standpipe outlet positioned approximately 30cm below the top of the pond walls. Even if the rainfall event was so intense that the water volume in the ponds temporarily increased (i.e. there was a back-up of water release via the standpipe) the additional 30cm of pond wall height above the outlet will comfortably allow for at least an additional 160,000L of water in each pond before the ponds are at risk of overflowing. Accordingly, the risk of marine water overflowing due to intense rainfall is considered to be very low.

With regard to safety, the Ponds will have an average depth of approximately 2m. The sides of the Ponds will be sloped, which will allow for easier escape for people or animals should they fall in. Regardless, all visitors to the site will be required to sign in and will be made aware of occupational health and safety issues related to the site. Note that, as discussed within **Section 5.8** of this EA, ponds will be designed to prevent the drowning of Koalas and other animals.

There are not likely to be any significant risks associated with Pond safety or integrity. Nevertheless, it is recommended that the mitigation measures outlined in **Table 47** be implemented.

### 5.23.1 POND CLEANING & MAINTENANCE

As for all such aquaculture ponds, it is expected that various species of marine organisms will naturally establish within the Settlement Ponds over time (e.g. algae, various filter feeders, detrivores and herbivores). These organisms will play a small but beneficial role in water quality management by consuming some of any excess organic matter, nutrients, algae and other vegetative biomass. However, over an extended time, there may be an excess in growth of algae or other fouling organisms which needs to be managed, along with a general build-up of organic matter.

As required, built-up sludge in the base of the Ponds (comprising dead algal matter, bacteria etc) will typically be removed via the use of a 'sludge pump', involving the pumping of sludge into a land-based receptacle. Excess algal growth and other organisms lining the base and sides of the Ponds will be manually removed. Water will typically not be required to be drained from the Ponds to allow these processes to occur, although water movement into / out of the relevant Pond will be ceased during cleaning and only the remaining Pond will be used during this time (typically less than 2-3 hours). The complete draining of ponds and the use of shovels / scrapers would not typically be required.

The cleaning of ponds is expected to be required only rarely due to the slow build-up of matter (perhaps once a year). All waste matter will be stored in secure bags or containers within the Bin Storage Area until pick-up by a licensed waste removal contractor. Disposal is anticipated to occur at the Bedminster Advanced Resource Recovery Facility (ARRF) at Raymond Terrace. It is anticipated that the vast majority of the pond's waste will be suitable for composting within this facility. While no formal data is available with regard to the likely volume of waste material to be produced within each pond, it is estimated that up to around 1.5m$^3$ of waste may need to be removed from each pond on a yearly basis.

**Table 47: Proposed Mitigation Measures - Pond Safety & Integrity**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Pond Design | Settlement Ponds shall be designed and constructed in accordance with best practice at the time of construction. | Pre-Construction & Construction |
| Pond Safety | Visitors to the site shall sign in and be advised of any hazards and management issues in relation to pond safety. | Operation |

## 5.24 Fuels, Chemicals & Pharmaceuticals

As outlined in **Section 3.7.7.9**, various fuels, chemicals and pharmaceuticals are considered likely to be necessary for the operation of the farm from time to time, although most will only be used on rare occasions. These substances, listed at **Appendix 7** along with any relevant Australian Dangerous Goods Code Classes or Safety Phrases, are typically used in Australian aquaculture situations. Their expected dosage amounts and frequency of use are also provided.

Like all chemicals, there are risks associated with their improper use or storage. Accordingly, a range of measures are proposed to minimise risks to human health and the environment, as discussed below.

Material Safety Data Sheets (MSDS) for all chemicals will be displayed in appropriate areas of the farm, as required. Access to chemicals will be available to a limited number of senior staff, and the key to locked chemical storage areas will remain in the possession of the farm's management staff. Storage and work practices outlined in the MSDS will be strictly adhered to, including the appropriate use of gloves, eye and airway protection. Occupational Health & Safety training will be provided to all relevant staff.

Ozone will not be stored on site; it will be generated within an on-site commercial unit on an on-demand basis (see **Section 5.4**). All marine water disinfected with ozone will be subsequently treated with a de-ozonisation unit (i.e. UV treatment) immediately after application to break down any residual ozone levels in release water. Ozone generation and use will be strictly governed by the manufacturer's directions.

All chemicals will be stored adjacent to the predominant area of use, and first aid and emergency wash stations will be positioned nearby. Emergency wash stations, first aid cabinets and fire control cabinets will be located in all relevant buildings. Emergency procedures and phone numbers will also be displayed in appropriate areas.

Any chemical spills will be managed in accordance with the relevant MSDS. HAZCHEM Spill Control Kits (i.e. 'wheelie bins') will be positioned in the Facility Shed, Pumphouse and generator shed to manage any incidents.

These recommended mitigation measures are summarised in **Table 48** below.

The potential hazards and risks associated with the use and storage of these substances has been assessed within the risk assessment at **Section 5.2** of this EA. Provided the recommended mitigation measures are implemented, there is not likely to be a significant risk to human health or the environment from the use or storage of these substances.

**Table 48: Proposed Mitigation Measures - Fuels, Chemicals & Pharmaceutical Use**

| Issue | Proposed Mitigation Measure | Development Phase |
|---|---|---|
| Chemical Use & Emissions Management | All chemicals, fuels and pharmaceuticals shall be stored and used in accordance with relevant Material Safety Data Sheets. Occupational Health & Safety training shall be provided to all relevant staff. | Operation |
| Chemical Storage | All chemicals shall be stored adjacent to the predominant area of use, and first aid, emergency wash stations, emergency procedures and spill control kits will be maintained nearby. | Operation |
| Ozone Use | All marine water treated with ozone will be subject to a de-ozonisation treatment before release (e.g. UV treatment). | Operation |
| Chemical Spills | Appropriate HAZCHEM Spill Control Kits will be positioned in key areas proposed to store and use chemicals, including fuels. | Operation |

## 5.25 Abalone Translocation

As discussed in **Section 3.7.5.1,** a number of Abalone individuals will be sourced from wild NSW populations, either via purchase or wild harvest, to act as broodstock for the farm. The preferred source locations for these individuals are the northern areas of the NSW coast. Accordingly, the farm's broodstock may have a slightly different genetic makeup to the local wild Abalone populations (i.e. outside Port Stephens); and may be associated with parasites or pathogens 'foreign' to local Abalone.

It is emphasised that no translocation of Abalone from interstate is proposed, only from wild NSW populations.

The 'translocation' or movement of organisms from one place to another, regardless of distance, typically involves some level of risk. The *National Policy for the Translocation of Live Aquatic Organisms - Issues, Principles & Guidelines for Implementation* (Ministerial Council on Forestry, Fisheries & Aquaculture 1999) provides guidance on risk assessment and the management of aquatic organism translocation. The key risks associated with translocation are listed below. A brief comment in relation to how the farm proposes to address each risk is also provided:

- **Genetic shift in wild populations** (*from farm Abalone escapees breeding with wild populations*) - the potential for Abalone to escape the farm and breed with wild populations is considered negligible, due to the reasons outlined in **Section 5.21** of this EA.

- **Establishment of feral populations** *(from the establishment of farm escapee populations in the wild*) - as above, the risk of Abalone escape and establishment in the wild is considered negligible, particularly due to the lack of suitable habitat in the Port in proximity to the farm (see **Section 5.21** for further details). The risk of a secondary organism associated with Abalone (e.g. a parasite) escaping the farm and establishing in the wild is also considered very low due to the proposed biosecurity and water disinfection measures outlined in **Section 5.3**.
- **Environmental impacts from escaped organisms** *(environmental impacts associated with farm escapees surviving in the wild*) - due to the biosecurity protocols proposed, there is an extremely low risk that Abalone or associated organisms could escape the farm, survive for any length of time, and have a detrimental impact on the environment - refer to **Sections 5.3** and **5.21** for further details**.**
- **Translocation of associated species** *(accidental translocation of associated organisms such as parasites*) - due to the biosecurity protocols outlined in **Section 5.3**, including quarantine and inspection procedures, there is a very low risk that associated species could escape the farm, even if they should be accidentally transported (e.g. on Abalone shells). All parasites discovered during the quarantine process will be destroyed and securely disposed of.
- **Disease & parasite introduction** *(introduction of pathogens 'foreign' to the local environment*) - due to the biosecurity protocols outlined in **Section 5.3**, including quarantine and water disinfection measures, there is a very low risk that disease pathogens could escape the farm.
- **Chemical release & management** *(from undesirable chemicals transported in the transport medium*) - as Abalone will be sourced from wild populations, there is a negligible risk that harmful chemicals will be accidentally imported along with Abalone individuals.

Due to the management measures proposed for the farm, the risks associated with translocation are considered to be negligible. The proposal therefore complies with the principles and guidelines of the National Translocation Policy.

# 6 STAKEHOLDER CONSULTATION

## 6.1 Formal Consultation Pursuant to Part 3A

In May 2010, Director-General's Environmental Assessment Requirements (DGRs) were issued with regard to this Project. The DGRs were prepared by DP&I in consultation with relevant government agencies and have guided the preparation of this EA. The DGRs are listed in **Appendix 10,** including the section of the EA in which each DGR is addressed.

Further consultation with government agencies occurred upon the submission of this EA (in draft form) to DP&I in 2013. At that time, DP&I reviewed the draft EA in consultation with relevant agencies to determine if it adequately addressed the DGRs. A number of queries were raised as a result of that process. Each issue was subsequently addressed by the proponent (often in consultation with the relevant stakeholder), resulting in amendments to the draft EA and the production of the current (final) version. A detailed response, outlining how each of the issues raised has been addressed in the EA, is provided at **Appendix 11**.

Part 3A of the EP&A Act also requires the public exhibition of the EA after 'adequacy assessment', for a period of at least 30 days. Accordingly, this EA is anticipated to be exhibited, and any submissions made will be taken into consideration by the Director-General and the proponent. The Director-General may request that the proponent respond to issues raised in any submissions received during the exhibition period.

Should such submissions result in any proposed changes to the Project, Section 75H(6)(b) provides for the lodging of a *Preferred Project Report* outlining any proposed changes to minimise the Project's environmental impacts. This *Preferred Project Report* may be required to be exhibited to the public, and may include a Revised Statement of Commitments.

## 6.2 Additional Consultation with Government Agencies

Throughout the design of the Project and the environmental assessment process, consultation has been undertaken with various government agencies, both formally and informally.

Formally, letters and emails were sent to key government agencies, corporations, committees and related groups in July 2012. These letters provided information on the Project and sought suggestions or comments on key issues that the agency wished to see addressed. An example of the letter is attached at **Appendix 24**. The recipients of

the letters and the responses received are summarised in **Table 49** below, and copies of received emails / letters are attached at **Appendix 25**. Each of the issues raised during consultation have been addressed within the EA. Note that separate consultation has been undertaken with the Rural Fire Service, as outlined in **Appendix 22** of this EA, and is not included here. Separate, detailed consultation was also undertaken with key Aboriginal stakeholders, as outlined in **Section 5.10.1.1**.

Informally, government agencies and groups have been contacted from time to time seeking advice and comment with regard to specific issues. For example, representatives of Great Lakes Council have provided specific assistance with regard to key assessment issues for the proposed boardwalk. In addition, further informal consultation with certain agencies (including the NSW Office of Water, Rural Fire Service, DP&I and Office of Environment & Heritage) was undertaken by the proponent in relation to 'adequacy review' issues in mid-late 2013, as outlined in **Section 6.1** above.

The proponent has kept an informal register of all such consultation, and this process has contributed towards the design of the Project and the preparation of the EA.

**Table 49: Summary of Formal Consultation - Key Government Agencies (July 2012)**

| Government Agency / Group | Response Received | Summary of Government Agency Response |
|---|---|---|
| Hunter - Central Rivers Catchment Management Authority | Nil | - |
| Hunter Water Corporation | Phone 27/07/12 | Pindimar is out of HWC's area of operations - therefore no interest. |
| Maritime NSW | Phone 26/07/12 | Maritime don't comment on plans until a DA/ EA has been lodged. Its only concern at this stage will be navigation safety in the area e.g. depth that the pipes emerge from underground. |
| Mid Coast Water | Letter 08/08/12 | Has no objection to the proposal. Notes that it does not provide reticulated water or sewerage services to the site, nor could these currently be made available. Should they become available in future, it is likely that only domestic waste will be accepted for disposal into a sewerage scheme. |
| National Parks & Wildlife Service (Nelson Bay) | Nil | - |
| NSW Advisory Council on Recreational Fishing | Email 06/08/12 | Generally supportive - with stringent safeguards in place, appears there will be little impact on recreational fishing in the Pindimar region - has no objection or concern. Recommends continual monitoring of the Project. |

| Government Agency / Group | Response Received | Summary of Government Agency Response |
|---|---|---|
| NSW Department of Primary Industries - Crown Lands | Nil | - |
| NSW Department of Primary Industries - Fisheries | Nil | - |
| NSW Environmental Protection Authority | Email 25/07/12 | EPA's issues are as per the DGRs. |
| NSW Food Authority | Phone 27/07/12 | Authority will not comment at planning stage - only at licensing stage. |
| NSW Marine Parks Authority | Email 17/08/12 | A detailed list of environmental assessment issues was provided (*note - each issue raised is addressed within the various sections of this EA*). |
| NSW Marine & Estuarine Recreational Charter Management Advisory Committee | Nil | - |
| Port Stephens & Myall Lakes Estuary Management Committee | Nil | - |

## 6.3 Community Consultation

In addition to required consultation under Part 3A, the proponent elected to undertake voluntary consultation with the local community early in the design and environmental assessment process. The purpose of this consultation was to ensure that the community was made aware of the proposal early on, so they could be involved in identifying key issues of concern and could provide constructive input into the design and assessment process based on local knowledge and experience. Details of this consultation are provided in the following sections.

### 6.3.1 COMMUNITY CONSULTATION METHODOLOGY

The key stakeholders for the Project were identified as those being potentially directly impacted by the proposal. This was assumed to comprise property owners / tenants in close proximity to the subject site, as well as key interest groups associated with Port Stephens. However, as the resident community within the vicinity of the subject site is relatively small, and community interest in the Project was anticipated to be high, it was considered feasible that most residents within the local area could be contacted individually.

The following sections provide more detailed information on community consultation undertaken to date,

#### 6.3.1.1 *Letterbox Drop - June 2012*

An information letter (titled *Community Feedback Request*) was prepared, containing the information listed below:

- A description of the proposed Project, including a discussion on the environmental assessment process and links to further information on the Project, located online, as well as a contact phone number;
- A Location Plan and Site Plan, demonstrating the proposed location and layout of the farm;
- An invitation to a Community Feedback Session (see below);
- Advice and tips on how to provide feedback about the Project.

A copy of the Request is attached at **Appendix 26** of this EA.

On 25 June 2012 the Request was hand-delivered to mailboxes (i.e. those visible / accessible from public roads) of approximately 250 residential dwellings within the suburbs of South Pindimar, North Pindimar and Bundabah, in addition to selected businesses within Tea Gardens and Hawks Nest. Public notices were also posted on the display boards of the Pindimar - Bundabah Community Association (on the main road into Pindimar / Bundabah); the Friendly Grocer (Tea Gardens); Hawks Nest Newsagency; Tea Gardens Shopping Centre community notice board; and Jeff's Quality Meats (Tea Gardens). Posting of the notice was refused at several commercial / community locations, including the Great Lakes Library, Tea Gardens Bi-Lo and Tea Gardens Department of Ageing, Disability & Home Care. The approximate distribution area of these deliveries is indicated at **Figure 42,** below.

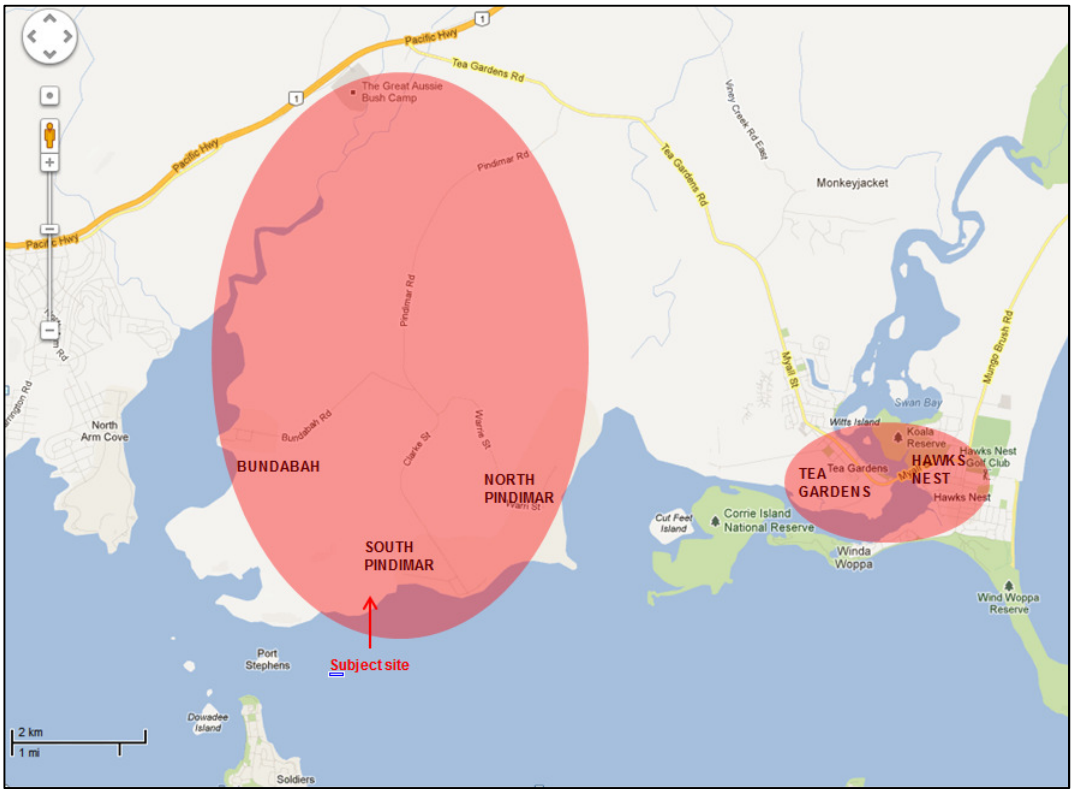



**Figure 42: Community Consultation - Letterbox Drop (Approximate Catchment)**

In addition, copies of the Request for Information were mailed / emailed to representatives of the following key stakeholder groups:

- Pindimar - Bundabah Community Association;
- Myall Coast Chamber of Tourism & Commerce;
- Tea Gardens Community Technology Centre;
- Port Stephens Commercial Dolphin Watch Association;
- EcoNetwork Port Stephens Inc;
- Port Stephens Tourism Limited;
- Myall Lakes Aquatic Club;
- NSW Oyster Farmers Association;
- Nelson Bay Chamber of Commerce;
- Royal Volunteer Coastal Patrol - Port Stephens;
- Coast Guard Port Stephens;
- Mr Craig Baumann - Member for Port Stephens;
- Mr Stephen Bromhead – Member for Myall Lakes;
- Mr Bob Baldwin - Federal Member for Paterson;
- North Arm Cove Residents Association;

- Commercial Fisherman's Co-Operative;
- TransGrid; and
- Telstra.

#### 6.3.1.2 *Community Feedback Session - July 2012*

As advertised within the *Request for Information*, a Community Feedback Session was held at the Pindimar - Bundabah Association Community Hall at Koree Street, Pindimar, from 6:30pm on Wednesday 11 July 2012. A detailed presentation on the proposed Project was provided, accompanied by a PowerPoint presentation, and attendees were invited to ask questions. During the presentation, attendees were invited to provide feedback on the Project via phone, mail or email.

#### 6.3.1.3 *Letterbox Drop - April 2013*

An additional information letter (titled *Community Information Notice*) was prepared, including the information listed below:

- A description of the proposed Project, including a discussion on the environmental assessment process and an update on its status. Links to further information on the Project, located online, were also provided;
- Information in response to key issues / concerns recently circulated throughout the community by a local objector;
- An invitation to a Community Feedback Session to be convened once the EA was publicly exhibited; and
- An invitation to register for the proponent's mailing list, in order to receive notice of the EA's public exhibition dates and details of the community information session.

A copy of the Notice is attached at **Appendix 27** of this EA.

The Notice was hand-delivered to a similar catchment as the June 2012 letter.

#### 6.3.1.4 *Fishing Grounds Query - May 2013*

In order to seek specific advice on use of the Pindimar area by recreational and commercial fishers (see **Section 5.19.4** of this EA), a notice titled *Fishing Grounds Query* was prepared, including the information listed below:

- A description of the proposed Project, including a copy of the April 2013 *Community Information Notice*;

- A location plan, identifying the location of proposed pipelines and buoys over a waterways map;
- Details about the proposed pipelines and buoys; and
- A request for any information on fishing grounds or fishing ground access in the vicinity of the pipelines, including any access concerns as a result of the proposed farm.

A copy of the Query is attached at **Appendix 28** of this EA.

The Query was distributed to representatives of the Tea Gardens and Nelson Bay Fishing Co-operatives; and it was requested that the notice be publicly posted at both Fishing Co-op facilities.

Further, the proponent held discussions with the following people with regard to the query:

- Two Port Stephens Fisheries Management Officers;
- Two Port Stephens Fisheries Compliance Officers;
- A well-known local recreational fishing identity; and
- A local professional fishermen's representative to the Department of Primary Industries.

### 6.3.2 COMMUNITY CONSULTATION RESPONSE

In response to the community consultation actions detailed in **Section 6.3.1** above:

- 5 phone queries were received;
- 36 people attended the Community Feedback Session (July 2012);
- 7 submissions were received (via phone, email, letter and fax); and
- 9 households / individuals / group representatives requested to be registered on the proponent's mailing list.

A summary of the issues raised during consultation (including during the Community Feedback session), and a brief comment in response, is provided in **Table 50** below. Copies of written submissions are attached at **Appendix 29**. No formal responses were provided in response to the Fishing Grounds Query (May 2013).

As discussed in **Section 4.2.1.1** above, the community will have additional opportunities to comment on the Project during the public exhibition phase.

**Table 50: Summary of Issues - Community Consultation**

| Issue Raised During Consultation | Comment |
|---|---|
| Concerns about the length of the outlet pipe and associated nutrients issues | The currently proposed pipe lengths have been determined based on ongoing research. A discussion on nutrient and other water quality issues is provided at **Section 5.4** of this EA. No significant detrimental impacts to the existing water quality of the Port are anticipated. |
| Concerns about increased traffic on Cambage Street | Only a small increase in traffic will occur as part of the Project, in the order of 12 x 2-way movements per workday during operation. This is not likely to negatively impact on the safety, functionality or amenity of the local road network. See **Section 5.11** of this EA for more information. |
| Queried location - may be too close to homes | The reasons why the farm location is considered most appropriate are outlined in **Section 3.5** of this EA. Note that the farm area is separated from the nearest dwelling-house by approximately 300m and screened by mature vegetation. |
| Queries how water will be treated and monitored | The proposed water treatment and monitoring measures are outlined in **Section 5.4**. |
| Queried what employment will result | A discussion on anticipated employment creation is provided at **Section 5.20** of this EA. Up to 35 construction jobs and 15 full-time equivalent operational positions are expected. |
| What are the community benefits? e.g. mines have to pay for local infrastructure | Likely benefits for the community include employment and education opportunities and the potential for flow-on economic benefits for local businesses. These issues are discussed further in **Section 5.20**. |
| What is the selling price of Abalone per tonne? | The selling price is dependent on markets at the time and place of sale. |
| The development plan should be overlaid onto an aerial photo | Such a plan is provided at **Figure 10** and **Figure 11** and **Appendix 3** of this EA. |
| Why is the development not located further into the bush, away from houses? | The farm precinct maximises the use of already-cleared areas and existing access roads. To relocate the farm further west more vegetation would need to be cleared. |
| Note that the shoreline is changing - sand migration is occurring | Noted. Coastal processes are addressed in **Section 5.17**. |
| What will the total traffic movements from the farm be? | Approximately 12 x two-way movements per workday. See **Section 5.11**. |
| How much water will the farm use each day? | Up to 50ML of water is expected to pass through the farm within a typical 24 hour period. |
| How many days does the water need to settle? Concern there is not enough volume in the retention ponds | Marine water will flow into the Settlement Ponds after passing through the farm facilities, and will be released continuously from the Ponds into the Port. Water is generally estimated to have a residency time within the ponds of around 2 hours, although a settlement time of |

| Issue Raised During Consultation | Comment |
|---|---|
| | only 15 minutes is required in order to effectively remove the majority of particulates. A detailed discussion on water quality management is provided at **Section 5.4**. |
| Concerns about tidal movements washing effluent onto private properties | Water will be discharged from the farm at a depth of approximately 6m. No separable 'effluent' (such as foam or other substances that sit on the water surface) will be released from the farm. Water quality is addressed at **Section 5.4**. |
| Concerns about impacts on seagrasses | Potential impacts on seagrasses are addressed in **Section 5.9**. No significant impacts on existing seagrasses are anticipated. |
| Concerns about acid sulphate soils | Acid sulphate soils are addressed at **Section 5.5**. There are not likely to be any issues associated with ASS management. |
| Concerns about jellyfish around the water intake pipes | Water inlets will be at a depth of 15-20m. There are unlikely to be any jellyfish at this depth. Regardless, potential entrainment / impingement issues are addressed at **Section 5.9**. Appropriate mitigation measures (e.g. passive fish screens) are proposed. |
| How will the pipes be cleaned and maintained? 'Pigging' is not possible | Pipes will be cleaned when required via 'pigging', which is a proven and effective technique for this type of pipe. Refer to **Section 3.7.7.7**. |
| Concerns about proximity of pipes to nearby no-go areas in Marine Park | The farm is unlikely to have any detrimental impacts on the nearby Sanctuary Zone. Refer to **Section 5.9**. |
| Concerns about flushing times for Port Stephens waters - waters are slow moving - effluent could be in water for 10-12 days. References to Manly Hydraulics report 913 | Dilution and flushing issues are addressed at **Section 5.4** and in more detail at **Appendix 19.** Water in this area is rapidly flushed to the continental shelf. |
| Concerns about the location of the Pumphouse - it will be affected by groundwater, during floods and at king tide. How will pumps work if inundated? | A submersible bilge pump will be utilised to drain the Pumphouse should it be inundated during a flooding event. The farm is able to operate for short periods without the intake of marine water (i.e. recirculation). However, the Pumphouse walls will comprise impermeable material and will generally not be affected by groundwater. |
| What happens if farm fails - what provision will be made for clean-up / rehabilitation of the site? E.g. security bond. What happens in other states? | As for all developments, alternative uses to the approved use will be explored should the development cease to operate. A discussion on potential re-use or rehabilitation options is provided at **Section 3.7.7.10**. |
| Concerns about visual amenity impacts of the proposal from the water and the other side of Port Stephens (e.g. impacts of slope elevation, materials, colours etc.) | The proposal is unlikely to be readily visible from any part of the Port or the southern shores. Refer to **Section 5.14** for further discussion. |

| Issue Raised During Consultation | Comment |
|---|---|
| Concerns about visual amenity impacts of the proposal from nearby properties and streets | The proposal is unlikely to be readily visible from nearby properties and streets. Refer to **Section 5.14** for further discussion. |
| Why will this farm be allowed to discharge into the Port when no other land-based aquaculture farms are allowed? | There are no prohibitions on approved land-based marine aquaculture farms discharging into the Port (note- SEPP 62 places restrictions on *freshwater* discharge- see **Section 4.2.3.4**). The farm proposes marine water discharge only. All proposed developments are assessed by consent authorities on their individual merits. |
| Concerned about possible introduction of Abalone Viral Ganglioneuritis - many people and a significant part of the local economy depend on the Port | A detailed assessment of disease risk is provided at **Section 5.3**. |
| Who are the principals / owners / investors for the development - from overseas? | Austasia Leefield (the proponent) is a small, locally owned company. Landowners are identified at **Section 2.2**. |
| The applicant should consult with the Port's oyster growers | A consultation letter was sent to the NSW Oyster Farmers Association in July 2012. No response has been received to date. |
| Concerned that there may be uncovered tanks outside (i.e. fill with leaves, etc.) | All outdoor tanks will be covered with shade cloth or similar material to protect from falling debris. |
| What other specific sites have been examined for feasibility? Why does the farm have to be here? | Alternative sites considered are outlined in **Section 3.6**. The subject site was considered to be most appropriate for the farm. |
| What other communities get the opportunity to comment on the proposal? | All members of the public have the opportunity to provide comment on Part 3A Projects. The Project documentation will be exhibited on the NSW DP&I website. |
| The maps / plans should more clearly indicate the position of the shoreline | Detailed development plans are attached at **Appendix 2**. An overlay of the farm onto aerial images is attached at **Appendix 3**. |
| How will the nutrients and other residue from the farm be disposed of? E.g. spread out over the ground? | A discussion on solid waste management is provided at **Section 3.7.7.8**. No solid waste or sludge will be applied to the land. |
| Concerns about adding nutrients to the water | Nutrient production and management is addressed at **Section 5.4**. |
| Wants clarification on the access road into the site | Vehicular access to the site is described in **Section 3.7.8**. |
| How will flooding affect marine water pipelines? | Flooding is not anticipated to have significant impacts upon pipelines. Any deterioration in marine water quality within the Port as a result of regional flooding will be monitored and responded to as the need arises (e.g. the farm will temporarily cease water extraction until the |

| Issue Raised During Consultation | Comment |
|---|---|
| | Port's water quality improves). |
| There is no clearing on the subject site - the kaffir lime trees are on the site next door | The clearing associated with the Kaffir Lime orchard straddles the boundary with the land to the west- see the aerial image at **Figure 10**. |
| Concerns that, if approval given for this, some other type of development will be built instead | Any development approved on the site must comply with specific conditions of approval. Such conditions will not allow for the undertaking of any activities not proposed within this EA or other accompanying documentation. |
| This is 'long overdue' and the jobs it will create are badly needed in this particular area | Noted. |
| The conditions on the approval should allay the concerns of the Project's objectors - can see no reason to object | Noted. |
| Concerns with lack of detail on proposal - plans should show location of wetlands, marine sanctuary, wildlife refuge, creek, shoreline, trees to be removed, mangroves and seagrass expanses. | The various plans, figures and sections provided within the EA encompass the issues raised. Note that the 'wildlife refuge' is located on private property to the north-east of the subject site. |
| Queries if 'those who may be affected by pollution' of Port Stephens have been notified of the proposal e.g. those on the southern shore, fishing groups, oyster farmers, tourism operators, maritime services etc. | The EA documentation will be publicly notified and exhibited in accordance with DP&I guidelines. Many stakeholders have already been consulted with regard to the proposal, as outlined above in this section. |
| Concerns with access via Cambage Street - amenity and property values will be affected | Very little traffic is anticipated to result from the Project-in the order of 12 x two-way movements per workday. This is not likely to have any impact on the amenity or capacity of the street, nor on property values. |
| Property owners in Carruthers Ave and Challis Ave will be disadvantaged in their attempts to develop their land | The farm is not anticipated to have any significant impacts upon the amenity or environmental values of the surrounding land, nor upon the development potential of such land. Any development proposal, including for development on surrounding land, will be assessed by the consent authority on its own merits. |
| Why can't access to site be from Clarke Street? | Access from any other route than that proposed will result in the need for further vegetation clearing and greater environmental impacts than the use of the existing road network. |
| Why should approval be granted when no other development in the area is allowed? | Permissible development is guided by the *Great Lakes Local Environmental Plan* and other planning legislation. All proposed development is assessed by the consent authority on its own merits. |

| Issue Raised During Consultation | Comment |
|---|---|
| Are there other land based aquaculture projects in Port Stephens that pump water / effluent into / out of the port? | The proponent has no specific knowledge of the presence of other aquaculture farms accessing water from Port Stephens. |
| Are there similar successful Abalone farms on NSW coast? Fisheries Department trial at South Head failed, plus others | No Abalone farms have yet been established in NSW. A DPI Fisheries research project which involved Abalone was in operation at Tomaree Head for several years. It is understood that this facility did not 'fail', but completed its program and achieved its research objectives. |
| How is this proposal an improvement on the previously withdrawn DA? | The current Project is based on up-to-date and ongoing research and development. The proposal provides a detailed assessment of the Project's impacts in relation to the current, and arguably more stringent, assessment guidelines. |
| What studies will be made of seagrasses, marine animals, tidal flows, prevailing winds, acid sulphate soils? | The identified issues are addressed within this EA. Prevailing winds were not considered to be a key assessment issue. |
| Concern about effluent washing up on private properties. Farm discharge could increase the amount of dead weed washed up | Water will be discharged from the farm at a depth of approximately 6m. No separable 'effluent' (such as foam or other substances that sit on the water surface) will be released from the farm. Water quality is addressed at **Section 5.4**. There are not likely to be any impacts on seagrasses which would result in an increase in dead weed washing up on properties. |
| Will screening be placed over pipe entries to decrease danger to marine life? Won't they need continual cleaning? | Passive fish screens will be fitted to pipe inlets- see **Section 5.9**. Screens will be cleaned on occasion, as required. |
| The creek is a fish breeding area - why is it not shown on plans? | The creek is shown on development plans at **Appendix 2** and on aerial overlays at **Appendix 3.** |
| Why is shoreline not shown on plans? | The shoreline is shown on development plans and on aerial overlays at **Appendix 2** and **Appendix 3.** |
| The proposed access road accommodates children walking to catch schoolbuses - access on this road is not acceptable | Very little traffic is anticipated to result from the Project - in the order of 12 x two-way movements per workday. This is not likely to have any impact on the safety of the street. |
| Concerns about children swimming at South Pindimar beaches - may be affected by polluted water - how will you guarantee their safety? | Marine water quality is addressed at **Section 5.4**. The farm is not likely to cause a change in the Port's water quality so that it exceeds ANZECC Guidelines, including with regard to primary or secondary contact (e.g. swimming). |
| How will noise from 24 hour operation of pumps be managed? | Noise impacts are addressed at **Section 5.12**. There are not anticipated to be any impacts from noise on the surrounding community. |

| Issue Raised During Consultation | Comment |
|---|---|
| What bond moneys will be held to safeguard the people of Pindimar - where will this be held and by whom? | The Project will be guided by any conditions which support a project approval by the DP&I. |
| How can an Abalone farm 'factory' be allowed on or near middens and wetland areas? | The anticipated impacts of the proposal on wetlands and Aboriginal heritage issues are discussed in **Sections 4.2.3.1** and **5.10** respectively. There are not anticipated to be any detrimental impacts on these values. |
| Concerns about bushfire affecting the farm - needs a bushfire plan | A *Bushfire Protection Assessment* has been prepared for the farm - see **Section 5.13** for further discussion. |
| Access via Clarke Street is the only acceptable access | Access via Clarke Street is not considered viable as it would result in further clearing and greater environmental impacts. |
| The pipes into the bay will be the equivalent of a groyne which will cause scouring of the foreshore (South Pindimar Foreshore Erosion Study for GLC) | Proposed pipelines will be buried underground within the intertidal area, and will only emerge underwater outside of the intertidal zone. The potential for scouring impacts is addressed in **Section 5.17**. |
| Requests copies of the EA be available at Great Lakes Council at Tea Gardens for residents to access (who don't have internet connections) | The proponent does not have authority to require that such copies are held by Council, however a copy of the EA can be provided to Council for viewing by the public on request. |
| Abalone need saltwater with little silt or pollutants - has there been a study of water and silt movements in Port Stephens? Water coming into PS from the Karuah River during floods can carry a lot of silt - this fresh water will flow along bottom of original valley submerged by rising sea levels since last ice age - near where Intake pipe will be. Not suitable for Abalone | Proposed intake pipes will be located in an area of marine sediments. The water quality in this area is considered appropriate for the farming of Abalone. See **Section 5.4.1** for a discussion on the existing marine environment. |
| How did the Abalone experiments at Tomaree fail? | A DPI Fisheries research project which involved Abalone was in operation at Tomaree Head for several years. It is understood that this facility did not 'fail', but completed its program and achieved its research objectives. |
| Queried if there would be issues with pumps for water intake being 4m underground i.e. 2-3m below water table. | No, potential issues associated with flooding and groundwater impacts have been assessed throughout this EA. |
| What noise will pumps generate that will be heard in the residential village? | Noise impacts are addressed at **Section 5.12**. There are not anticipated to be any impacts from noise on the surrounding community. |

| Issue Raised During Consultation | Comment |
|---|---|
| Will a road be built to Challis Avenue from Clarke St? Cambage Street is residential and unsuitable for heavy traffic. | No road is proposed from Clarke St, as it would involve additional vegetation clearing and subsequent environmental impacts. Very little traffic is anticipated to result from the Project - in the order of 12 x two-way movements per workday. This is not likely to have any impact on the amenity, safety or functionality of Cambage Street. |
| Requests an audit on village to ascertain the number of dwellings, permanent residents, holiday homes, investment homes used by long term tenants / holiday rentals | Such an audit is not considered necessary or helpful, and would not normally be conducted to support a Project application. A discussion on the social context of the local area is provided at **Section 5.20.1**. |
| Requests a traffic count from Bundabah Road onto Pindimar Road, Warri St onto Clarke St, Clarke St before the influence from Warri St, for at least 2 weeks to determine road usage | Due to the very low volumes of traffic anticipated from the farm, such traffic surveys are not considered necessary or helpful for the purposes of this EA. |
| Requests estimated road usage by the farm during construction and operational periods | Traffic impacts are discussed at **Section 5.11**. |
| Proponent must not use Clarke St during construction phase when school bus timetable states the four bus journeys are in operation - narrow, steep, winding, dangerous road | Like any vehicles, construction vehicles may need to utilise the public road system during hours which may coincide with school bus movements. All construction vehicles will be expected to adhere to the road rules. |
| Requests a bushfire management plan with consultation with the Council and the local bushfire brigade | A *Bushfire Protection Assessment* has been prepared for the farm - see **Section 5.13** for further discussion. |
| Requests an independent report from a Marine & Fisheries Authority to indicate impacts on sea grass, the Marine Park Sanctuary Zone, the nearby oyster lease, the sandy beach area, the quality of the swimming water and the general marine environment of the area impacted by the discharge | A detailed assessment of potential impacts on aquatic ecology has been prepared by an expert consultant (see **Appendix 16**). Marine water quality issues are addressed at **Section 5.4**. |
| Requests an independent report on the likely chemical analysis of the discharge material into the bay | Marine water quality issues are addressed at **Section 5.4**. |
| Requests justification on the proposed access / exit from Cambage St when an access exists on Clarke St. | Access via Clarke St would require additional vegetation clearing and therefore greater environmental impacts, see **Section 5.11**. |

| Issue Raised During Consultation | Comment |
|---|---|
| Should the Project be approved - proponent should install road and speed advisory signs on Clarke St according to Council's requirements | The farm is likely to result in very little additional traffic. Such an increase is not likely to result in the requirement for the installation of any speed advisory signs. However, the Project will comply with the conditions that accompany any project approval. |
| Proponent must have a Rehabilitation Plan, and a rehabilitation bond provided to Council in case the farm fails | A discussion on options for rehabilitation should the farm cease operation are provided in **Section 3.7.7.10** of this EA. |
| Proponent must be supportive of formation of a Community Consultative Committee set up and chaired by Council to oversee conditions of consent | The proponent would be willing to discuss the formation and facilitation of such a Committee. |
| Proponent should take out Indemnity Insurance to cover any serious impacts on the Bay | The proponent will obtain all necessary insurances which are typically required for an aquaculture farm. |
| Proponent should prepare a Beautification Plan and indicate colour of sheeting on buildings will be environmentally friendly | Visual amenity impacts are addressed at **Section 5.14**. The farm is not likely to be easily visible from outside the site. |
| Proponent must show individual plans on A4 size and show changes on the foreshore | Development plans are provided at **Appendix 2**. |
| Proponent should arrange another meeting with residents of South Pindimar only and ensure all questions can be answered after release of the EA | The proponent is happy to discuss the potential for additional meetings with the community, as required. |
| Recommends continual monitoring of the project | Monitoring of various aspects of the farm operation are proposed throughout this EA, and summarised in the Statement of Commitments (see **Section 7.3**). |

# 7 STATEMENT OF COMMITMENTS

This section of the EA comprises a Statement of Commitments, outlining the environmental management and monitoring measures proposed as part of the Project. These commitments are in addition to the intrinsic environmental impact mitigation and management measures which form part of the farm design.

The proponent commits to the implementation of the environmental management commitments outlined in the following sections.

## 7.1 Approvals, Permits & Licenses

The Project requires approval from the Minister for Planning, pursuant to Part 3A of the EP&A Act.

In addition, a number of licenses and permits will be required in relation to certain aspects of the Project. Such licenses and approvals are likely to include the following:

- A license to occupy Crown Land pursuant to the *Crown Lands Act 1989;*
- An approval to operate a sewage management system pursuant to the *Local Government Act 1993;*
- A permit for the collection of broodstock and an aquaculture permit pursuant to the *Fisheries Management (Aquaculture) Regulation 2007;*
- An Environment Protection License pursuant to the *Protection of the Environment Operations Act 1997;* and
- Licenses with regard to seafood production pursuant to the *Food Act 2003.*

Such approvals, licenses and permits will be sought from the relevant authorities at the appropriate time. The requirement for any additional permits or licenses will be confirmed with the relevant authorities should the Project be granted approval.

Note that the requirement for particular approvals in relation to Part 3A of the EP&A Act is discussed in **Section 4.2.1.3** of this EA.

## 7.2 Environmental Management Plan

An *Environmental Management Plan* (EMP) is a project specific plan developed to ensure that appropriate environmental management practices are followed during a project's

construction and / or operation. As outlined within the *Guideline for the Preparation of Environmental Management Plans* (DIPNR 2004), EMPs are valuable tools to:

- define details of who, what, where and when environmental management and mitigation measures are to be implemented;
- provide government agencies and their contractors, developers and other stakeholders better on-site environmental management control over the life of a project;
- allow proponents to ensure their contractors fulfil environmental obligations on their behalf; and
- demonstrate due diligence.

As part of this Project, an EMP is proposed to be prepared to address each stage of the Project, namely construction and operation. The proposed EMPs will be prepared in accordance with the Statement of Commitments (i.e. all of **Section 7** of this EA) and with any conditions which may support Project approval, as well as any licensing or other regulatory conditions which may apply.

A key component of each EMP is the proposed impact mitigation measures summarised in **Section 7.3** of this EA, which include ongoing monitoring requirements in relation to certain aspects of the Project. These measures include the requirement for the preparation of specialist management plans (such as a *Vegetation Management Plan* and *Bushfire Evacuation Plan*). These plans will be prepared and incorporated into each EMP as appropriate.

The structure of the EMPs would be guided by the (former) DIPNR's guidelines (2004), and would generally incorporate the following elements:

- **Background:** including introduction, project description, environmental policy;
- **Environmental Management:** including environmental management structure and responsibility, approval and licensing requirements, emergency contacts and response;
- **Implementation:** including risk assessments, environmental management activities and controls, and environmental schedules; and
- **Monitor and Review:** including environmental monitoring measures, corrective actions and provisions for EMP review.

The timing of the preparation of each Plan is anticipated to be as follows:

- **Construction EMP**: developed in association with any outstanding detailed design activities, prior to any construction or site works; and
- **Operational EMP**: developed before commencing operation of any farm activities.

It is noted that an EMP is *a 'living' document that should be focused on continual improvement and should be updated as necessary…making changes to an EMP is an important aspect of improving a project's environmental management* (DIPNR 2004).

## 7.3 Summary of Proposed Mitigation Measures

In addition to the measures described as forming part of the Project description and design, various environmental mitigation measures or 'safeguards' have been proposed throughout this EA to further ameliorate environmental impacts of the farm. As part of the Statement of Commitments, these measures are proposed to be incorporated into EMPs and implemented should the Project gain approval.

**Table 51**, below, provides a summary of these mitigation measures.

**Table 51: Summary of Proposed Mitigation Measures**

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| **Disease Risk** | | |
| Disease Risk & Biosecurity | The farm shall operate in accordance with the recommendations of the *Biosecurity and Disease Management Plan.* | Operation |
| **Marine Water Quality** | | |
| Water Quality Monitoring | A detailed *Water Quality Monitoring Plan* shall be prepared and implemented before construction works begin. The Plan shall incorporate monitoring and reporting measures required by regulatory agencies. | Pre-Construction |
| Water Quality Contingency Measures | Should water quality monitoring results exceed nominated trigger values, appropriate contingency measures shall be implemented as outlined within the EA and the *Water Quality Monitoring Plan.* | Operation |
| **Terrestrial Flora & Fauna** | | |
| Conservation Area | The identified *conservation area* shall be maintained in perpetuity for conservation purposes. The legal mechanism to manage this land shall be determined with government agency stakeholders should the Project gain approval. | Pre-Construction |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| Vegetation Management | A *Vegetation Management Plan* shall be prepared, outlining protocols for the management of retained vegetation within the site, including the conservation area. This plan shall encompass measures applicable during the construction and operational phases. | Pre-Construction |
| Vegetation Management | An arborist shall be consulted before and/or during construction of the pipelines to advise on methods of reducing impacts on root zones of nearby trees. | Pre-Construction & Construction |
| Impacts on Nocturnal Species | Artificial lighting used to operate at night or for security purposes shall be minimised and confined wherever possible to minimise impacts on nocturnal fauna. | Construction & Operation |
| Koala & Wallum Froglet Impacts | Consideration shall be given to retaining known Koala Feed Tree species within the development footprint wherever possible. | Pre-Construction & Construction |
| Koala & Wallum Froglet Impacts | No barriers which will impact the safe movement of Koalas or Wallum Froglets shall be put in place. Terrestrial pipelines (outside the main farm precinct) will be either raised a minimum of 200mm above the ground or buried underground and the natural ground levels reinstated. | Pre-Construction & Operation |
| Koala & Wallum Froglet Impacts | Structures containing water shall be designed to avoid the unintentional drowning of Koalas. | Pre-Construction |
| Habitat Trees | Wherever possible, hollow bearing trees shall be retained. Any removal of hollow bearing trees shall be supervised by a suitably qualified ecologist. | Pre-Construction & Construction |
| Habitat Trees | Hollow bearing trees that are required to be removed shall be compensated by the placement of suitable nest boxes at a ratio of 2:1. | Construction |
| Habitat Values | Strict controls shall be applied to the development to prevent any future degradation to surrounding native habitat in the form of stormwater runoff and sedimentation. | Construction & Operation |
| Weed Management | All infestations of invasive weed species, particularly Lantana and Bitou Bush, shall be controlled within proximity to the farm. | Construction & Operation |
| **Emergency Egress Boardwalk** | | |
| Boardwalk Location- Cadastral Discrepancy | Before construction of the boardwalk, a detailed survey of the area shall be undertaken to confirm the boardwalk's location within the road reserve of Cambage Street (in the ownership of Great Lakes Council). | Pre-Construction |
| Boardwalk Construction | Detailed engineering design, material specifications and methodologies for the construction of the boardwalk shall be prepared before construction activities | Pre-Construction |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| | commence. | |
| Boardwalk Construction | For construction of the proposed boardwalk, the auger holes shall be the same diameter as the pylons to minimise the amount of sediment to be removed. Spoil from such excavations shall be removed from the site and disposed of at an appropriately licensed landfill. | Construction |
| Boardwalk Construction | To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic shall not be used. | Construction & Operation |
| Blocking Fish Passage (Pig Station Creek) | A detailed boardwalk construction methodology, aimed at avoiding the blocking of fish passage in Pig Station Creek, shall be prepared and implemented prior to construction. | Pre-Construction & Construction |
| Emergency Egress | The emergency egress boardwalk across Pig Station Creek shall be clearly sign-posted with a gate provided for security at the site boundary. A key to the gate shall be located in a 'break glass' enclosure on the development side of the boardwalk. | Construction |
| **Aquatic Ecology** | | |
| General Construction Impacts | All trenching and piping works shall be supervised by an appropriately qualified and experienced marine ecologist with an established record in mangrove and seagrass ecology, as outlined within the *Aquatic Ecology Assessment*. | Construction |
| Mangrove Impacts | All possible care shall be taken during trenching works to minimise impacts on mangrove root systems. Should the mangrove specimen (identified within the *Aquatic Ecology Assessment*) die as a result of trenching, the tree shall remain in-situ to serve as habitat. | Construction & Post-Construction |
| Mangrove Impacts | Any small mangrove seedlings (<1m) within the trench footprint shall be transplanted to another location within the existing mangrove habitat using appropriate techniques referenced within the *Aquatic Ecology Assessment*. | Construction |
| Mangrove Impacts | A *Mangrove Monitoring Plan* shall be prepared and implemented, as outlined within the *Aquatic Ecology Assessment*. | Pre-Construction & Operation |
| Seagrass Impacts | A survey for *Z.capricorni* specimens within the trenching footprint shall be undertaken prior to any trenching works. Should specimens be located, they shall be transplanted in accordance with the methods outlined in the *Aquatic Ecology Assessment*. | Pre-Construction & Construction |
| Seagrass Impacts | SCUBA divers shall be in place to ensure pipe footings are settled onto the seabed without causing undue damage to *P.australis* leaves outside the footing | Construction |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| | placements. | |
| Seagrass Impacts | A *Seagrass Management Plan* shall be prepared and implemented prior to construction works, incorporating appropriate measures to reduce impacts on seagrasses from the construction of the pipelines, as outlined within the *Aquatic Ecology Assessment.* | Pre-Construction |
| Seagrass Impacts | A *Seagrass Monitoring Plan* shall be prepared and implemented, as outlined within the *Aquatic Ecology Assessment*. | Pre-Construction & Operation |
| Scouring Impacts | Once pipelines are in place, there shall be regular inspections by divers to identify potential scouring impacts. If impacts are identified, appropriate erosion controls shall be put in place (e.g. hessian matting). | Operation |
| Impingement / Entrainment | Appropriate passive fish screens shall be installed on pipe inlets, and inspected and maintained on a regular basis. | Construction & Operation |
| **Aboriginal Heritage** | | |
| Aboriginal Heritage | A post-approval *Aboriginal Heritage Management Plan* shall be prepared for the conservation of the midden as per Aboriginal community requirements, with on-going consultation with the Aboriginal community throughout the development process.<br>It shall be prepared in consultation with the Aboriginal stakeholders to address the preservation and protection of key Aboriginal heritage values, and to deal with measures to be taken in the event that new Aboriginal objects of significance or a nature not anticipated (such as burials or ceremonial items) are discovered during construction. This plan is to generally include:<br>c) The bagging, tagging and collection of any artefacts that may be unearthed during the construction process and kept with the Karuah LALC until an appropriate keeping place is determined by the management plan; and<br>d) An *Aboriginal Cultural Education Program* developed by the proponent for the induction of personnel involved in the construction activities in the project area in consultation with the Karuah LALC. | Pre-Construction |
| **Noise** | | |
| Construction Noise | All plant, equipment and vehicles shall have appropriate noise attenuation apparatus fitted, as required. | Construction |
| Construction Noise | All plant, equipment and vehicles shall be well maintained and regularly serviced. | Construction |
| Operational | All plant, equipment and vehicles shall be well | Operation |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| Noise | maintained and regularly serviced. | |
| **Bushfire Risk** | | |
| Defendable Space | A *Fire Management Plan* shall be prepared, identifying protocols for the management of vegetation within the farm precinct and surrounding defendable spaces (as outlined within the *Bushfire Protection Assessment*), prior to construction. | Pre-Construction |
| Construction Standards | Detailed design of proposed buildings shall incorporate the recommended building construction standards provided within the *Bushfire Protection Assessment*. | Pre-Construction |
| Evacuation Plan | An emergency *Evacuation Plan* shall be prepared prior to construction works, and copies shall be submitted to Great Lakes Council and the NSW Rural Fire Service. | Pre-Construction |
| Access for Firefighting Operations | Access roads within the site, including passing bays and turning heads, shall be maintained to the parameters outlined within the *Bushfire Protection Assessment*. | Construction & Operation |
| Water Supplies | A dedicated static water supply and suitable connections shall be provided, as outlined within the *Bushfire Protection Assessment*. The water shall be reserved for firefighting purposes only, and maintained at the tank's full capacity. | Operation |
| Emergency Procedures | A *Bushfire Emergency Procedures Plan* shall be prepared, identifying protocols for protection of the farm during bushfire emergencies. This will include the designation of an onsite 'Safe Refuge' within the Office complex. | Pre-Occupation |
| Smoke Alarms | Smoke alarms shall be fitted to and maintained within all buildings. | Operation |
| **Soils** | | |
| Potential Acid Sulphate Soils | Appropriate ASS management techniques shall be implemented during construction as outlined in the *Acid Sulphate Soil Preliminary Assessment*. Measures shall include the prompt reinstatement of soils after excavation and the application of neutralising agents where appropriate. | Construction |
| Sedimentation & Erosion | Appropriate sedimentation and erosion control measures shall be implemented, as outlined in the *Acid Sulphate Soil Preliminary Assessment* and within the *Sediment Control Plan* (within the development plans). Additional measures can be outlined within the proposed *Construction Management Plan* for the site. | Construction |
| Soil Profile | Excavation activities shall be managed to minimise impacts to the soil profile. For example, topsoil shall be stockpiled, reinstated and revegetated where | Construction |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| | appropriate, as outlined within the *Acid Sulphate Soil Preliminary Assessment*. | |
| **Surface Water Management** | | |
| Surface Water Management | Appropriate surface water management controls will be implemented, as conceptually outlined within the *Stormwater Management Plan*. These controls will be regularly inspected for effectiveness and maintained throughout the operational life of the farm. | Construction & Operation |
| **Groundwater** | | |
| Marine Water Seepage | Settlement Ponds shall be lined with a heavy duty, impermeable liner suitable for aquaculture uses (e.g. HDPE) before the introduction of marine water. | Construction |
| Marine Water Seepage | The integrity of pond liners and plastic channels shall be checked on a regular basis, and any tears, cracks or perforations repaired as soon as possible. | Operation |
| **Visual Amenity** | | |
| Screening | The density of native vegetation between the farm and Carruthers Avenue shall be maintained to provide a sufficient visual screen. Existing vegetation shall be supplemented with native vegetation species if required. | Construction & Operation |
| Revegetation | Disturbed areas visible from outside the site (e.g. in pipe burial locations) shall be revegetated as soon as practicable. | Construction |
| Building Colours | Appropriate building colours (i.e. compatible with surrounding bushland) shall be utilised. No reflective materials shall be used. | Construction |
| **Air Quality & Odours** | | |
| Dust Emissions | The *Construction Management Plan* prepared for the Project shall include the following provisions:<br>a) Disturbed surfaces and excavated fill shall be watered to minimise dust generation during dry and windy conditions.<br>b) Traffic movements on disturbed areas shall be minimised and limited to those necessary to undertake works.<br>c) Material stockpiles shall be covered or otherwise stabilised if in place for more than 20 days.<br>d) Trucks or other equipment leaving the site shall be clean and have dust covers in place.<br>e) Earthworks shall cease when wind speeds exceed about 10 metres per second (approximately 36km/hr) unless the Site Manager can ascertain that dust | Construction |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| | controls are operating effectively and dust generation is not creating a nuisance. | |
| Vehicle Emissions | All vehicles shall be fitted with appropriate anti-pollution devices, as required under the *Protection of the Environment Operations (Clean Air) Regulation 2010.* | Operation |
| Odour | All potentially odorous farm waste shall be stored in appropriately sealed containers until collection and disposal off-site. | Operation |
| **Social Impacts** | | |
| Complaints from Neighbours | Should any conflicts with or complaints from neighbours arise, during construction or operation, the farm manager shall undertake to resolve issues through actions including the following:<br>- The keeping of records of all complaints or compliments;<br>- The undertaking of meetings or other forms of consultation in order to identify issues of conflict and to work towards possible solutions;<br>- The implementation of ameliorative strategies to resolve conflicts fairly and promptly. | Construction & Operation |
| **Food Production & Health** | | |
| Food Production Safety | A *Food Safety Program* shall be prepared for the farm before operation, and shall be implemented throughout the operational period. It shall be prepared with regard to best practice and relevant guidelines, including the principles of HACCP. | Pre-Operation |
| **Pond Safety & Integrity** | | |
| Pond Design | Settlement Ponds shall be designed and constructed in accordance with best practice at the time of construction. | Pre-Construction & Construction |
| Pond Safety | Visitors to the site shall sign in and be advised of any hazards and management issues in relation to pond safety. | Operation |
| **Chemical Use & Storage** | | |
| Chemical Use & Emissions Management | All chemicals, fuels and pharmaceuticals shall be stored and used in accordance with relevant Material Safety Data Sheets. Occupational Health & Safety training shall be provided to all relevant staff. | Operation |
| Chemical Storage | All chemicals shall be stored adjacent to the predominant area of use, and first aid, emergency wash stations, emergency procedures and spill control kits will be maintained nearby. | Operation |
| Ozone Use | All marine water treated with ozone will be subject to a de-ozonisation treatment before release (e.g. UV | Operation |

| Issue | Proposed Mitigation Measures | Development Phase |
|---|---|---|
| | treatment). | |
| Chemical Spills | Appropriate HAZCHEM Spill Control Kits will be positioned in key areas proposed to store and use chemicals, including fuels. | Operation |

# 8 CONCLUDING STATEMENT

The potential impacts of the proposed Abalone farm have been assessed. As demonstrated throughout this EA, the Project is not likely to have significant detrimental impacts on the physical or social environment. Any potential impacts are proposed to be adequately managed through the implementation of recommended management and mitigation measures as outlined in the Statement of Commitments (**Section 7**).

As demonstrated in **Section 3**, a number of alternative sites and processes were considered. However, the subject site and proposed design provided the best fit with the project objectives, process and biophysical requirements, and environmental acceptability considerations.

The Project, as described, is considered to satisfy the objectives and requirements of the *Environmental Planning & Assessment Act 1979*. It satisfies the project objectives outlined in **Section 3.2**.

The farm is anticipated to result in a number of benefits to the local community, including the creation of a number of construction and operational jobs and flow-on economic effects. It is anticipated that the Project will help to meet the growing demand for sustainably-produced seafood in NSW.

For the reasons outlined throughout this EA, the Project is considered to be justifiable on environmental, economic and social grounds.

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