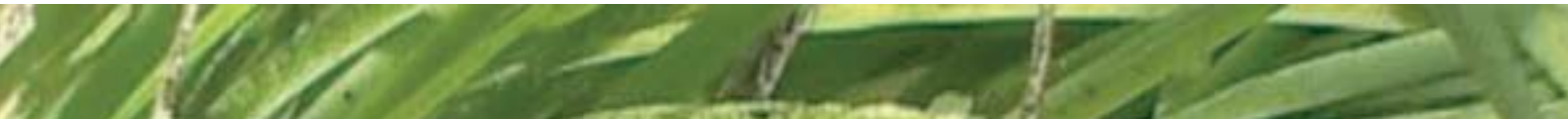
eis

RESPONSE
to submissions

cape jaffa anchorage

september 2005

cape JAFFA ANCHORAGE



eis

RESPONSE to submissions

cape jaffa anchorage

september 2005

prepared for
Kingston District Council
and
Cape Jaffa Development Company Pty Ltd

prepared by
Masterplan SA Pty Ltd

TABLE OF CONTENTS

Water

Management

General

FIGURES

APPENDICES

A copy of all Government and Public Submissions including Late Submissions is contained in a separate document and for exhibition purposes is available for distribution in electronic form. A display copy is available at Planning SA and at the offices of the Kingston District Council.

1.0 INTRODUCTION

This document is the response to the submissions made to the Cape Jaffa Anchorage EIS which was prepared in accordance with Section 46B (7) of the Development Act 1993 as the formal response to the matters raised during the period of public and agency consultation as set out in Section 46B (5) and 46B (8).

The response document also sets out a description of the Project Status in relation to the legislative process undertaken thus far and the remaining actions, the submissions received and reference to the request for delegation by the Governor to the Development Assessment Commission for further application consideration.

The structure of the detailed response document is explained, identifying the issues raised and setting out the response consistent with the issues as set out in the Guidelines.

Reference is then made to the amendment to the proposal as presented in the EIS and a description of the proposal in terms of the components for which Development Authorisation is sought.

The response to the submissions is set out in tabular form followed by the supporting appendices.

None of the issues raised in the submissions cause the proponent to review or modify the proposal in any material respect that is the proposal stays the same. The proponent does however provide further information, explanation and clarification.

2.0 PROJECT STATUS

The Minister for Urban Development & Planning declared the Cape Jaffa Anchorage proposal as a Major Development on 19th December 2002. Following the preparation of the Issues Paper dated March 2003, Guidelines for the preparation of an Environmental Impact Statement (EIS) were issued by the Major Developments Panel in June 2003.

The EIS was prepared in accordance with the Guidelines determined by the Major Developments Panel, as required under Section 46B (3) of the Development Act 1993, and provides statements as to the expected environmental, social and economic effects of the development. The EIS also provides statements as to the extent to which the expected effects are consistent with the Development Plan and the Planning Strategy, as required in Section 46B (4) of the Development Act 1993.

The EIS was placed on public exhibition from 23rd February to the 7th April 2005 and during that period a public hearing was held on the 9th March. Government Agencies were also afforded the opportunity to comment on the proposal.

There were a total of 43 submissions, 13 of which were Government Agency submissions and 30 private submissions, the last of which was received on the 5th May 2005. The EPA submission G 13 comprises several agency components and incorporates submissions G 7 and G 8.

It is noteworthy that public submissions P 15 and P 22 are identical. An additional 3 public submissions were received after the prescribed period. A list of submission authors is included in **Appendix A**.

This response document is the formal written response as required by Section 48B (8) of the *Development Act* 1993 and includes responses to those submissions received during the prescribed period and in addition, those submissions received after the prescribed period.

This document together with the EIS is to be assessed and an Assessment Report is prepared taking into account any submissions, the proponent's response to those submissions, and comments from any other authority or body as the Minister thinks fit. The assessment report clarifies matters related to the proposed development to assist in the decision making process. The Response Document and the Assessment Report are made available for inspection and purchase at a place and period determined by the Minister and this information is notified by advertisements in The Advertiser newspaper and local press. Under Section 48 of the Development Act 1993, the Governor is the decision maker; and in arriving at a decision, the Governor must have regard to:

- provisions of the appropriate Development Plan and Regulations;
- if relevant, the Building Rules;
- the Planning Strategy;
- EIS and Assessment Report;
- the *Environment Protection Act* 1993.

In accordance with The Governors powers to delegate authority to the Development Assessment Commission for further decisions and review of the EIS including applications for variation and amendment as may be necessary, the proponent has requested that the necessary delegations be made.

3.0 RESPONSE STRUCTURE

The response to the submissions, made as part of the public consultation process, is structured according to the topics and issues set out in the Guidelines for the preparation of an EIS for this proposal and are consistent with the general arrangements and issues as set out in the EIS. Where common themes of submissions are presented, the response provides a collective commentary setting out further investigations undertaken where necessary, clarification of issues, confirmation of the proposal and rebuttal to submissions.

This information is tabulated for ease of identification of the topic and issue relevant to the EIS Guidelines and the EIS, the relevant submission reference, including a distinction between

Government and Private submissions, the submission or comment made, and the response. Where issues and comments from several submissions are the same or similar they have been answered collectively. Accordingly the issues should be read collectively and likewise the response. Accompanying the table are supporting documents in Appendices which provide the original authors response documentation or relevant reference documents to assist in understanding the response. As most submissions made multiple comments, these have been further recorded as comment numbers in addition to the submission number designated by Planning SA and are marked accordingly on the Submissions document produced for exhibition purposes as an electronic file.

The document also sets out in **Appendix A** a summary table titled Submission Authors which identifies the designated submission number, the relevant comment number(s) and the author of the submission.

4.0 THE PROPOSAL

Following the consultation process and discussions with Planning SA, further clarification was necessary in relation to the land abutting the beach in between the breakwaters depicted as Future Development on Figure 3.6 Concept Plan of the EIS. The proposal has therefore been amended to incorporate additional allotments to indicate conceptually the development of this area, as shown on the accompanying Figure R1 Amended Concept Plan. This area is not exposed to the open sea as it is protected by the breakwaters and will be at or above building platform height of 2.4 mAHD.

Further information regarding the provision of a site camp and the infrastructure service area was also sought. There will at most be a short term seasonal need for accommodation during the start up period of the development until a local workforce is established. Further detail is provided in this response document. The concept for this area is shown on the accompanying Figures R2 and R3 which includes site office and associated facilities.

All other matter contained in this response reinforces the proposal concept, clarifies the proposal or provides additional information.

The proposal remains in its substantive form as presented in Section 3 of the EIS, as further explained in the various sections of the EIS and is arranged to enable the following main elements and features:

- Breakwaters;
- Channel and associated navigational features;
- Main Harbour Basin for the berthing and passage of vessels;
- Boat Ramp, travel lift or similar facilities and other vessel management related equipment;
- Fishing and Aquaculture Industries Service Area including warehouse, store and related industrial activities;

- Fuel and Waste Management Facilities including petrol filling station;
- Boat Washing and Hull Cleaning;
- Maintaining and Repairing Vessels and related industrial activities;
- Public Marina Berths and associated club, and on-shore facilities;
- Commercial Berths and related industrial activities;
- Commercial Wharf and related industrial activities;
- Waterways for the berthing and passage of vessels;
- Retail including hotel/tavern, restaurant, café, shop, service trade premises;
- Offices, consulting rooms and personal service establishments including sales and display facilities;
- Residential Allotments to accommodate a range of dwelling types;
- Private Marina Berths and related on shore facilities;
- Apartment, Motel and Cabin Accommodation and tourist accommodation generally;
- Motor Repair Station – Marine Servicing and Hardstand and related industrial activities;
- Recreation Facilities and Open Space;
- Landscape Buffers;
- Reticulated Mains Water Supply and associated infrastructure;
- Effluent Treatment and Water Reuse and related infrastructure;
- Stormwater Management and related infrastructure;
- Reticulated Power and related infrastructure including an electricity substation and/or fuel depot;
- Telecommunications and related infrastructure;
- Division of Land;
- Design Guidelines to guide the development of land; And
- Development policy to be incorporated into the Development Plan via a Plan Amendment Report in accordance with Section 24 (1) (a) of the *Development Act* 1993.

To implement and manage these features there are various associated approvals and licences required. Of these the following form part of this application:

- Development Approval (Provisional Development Plan Consent) for the establishment of the proposal as defined;
- Amendment to the Council boundary;
- EPBC Referral - determined to be not a Controlled Action (EA), refer EIS Appendix 1;
- Marine Construction and licence for use of the area (TSA);
- Seagrass Wrack management (PIRSA/CPB);
- Coastal Sand Bypass (CPB);
- Vegetation (Native Vegetation Council);
- Confined Aquifer Water (taking) Licence (DWLBC) refer EIS Appendix 7.

These features and facilities will be reflected in the Development Plan policies for the Kingston District Council whilst the area for Land Not Within Councils will be amended to reflect a new Council boundary that will follow the outer edges of the breakwaters. A draft of the policy will be provided in accordance with the procedures set out in the Development Act 1993. .

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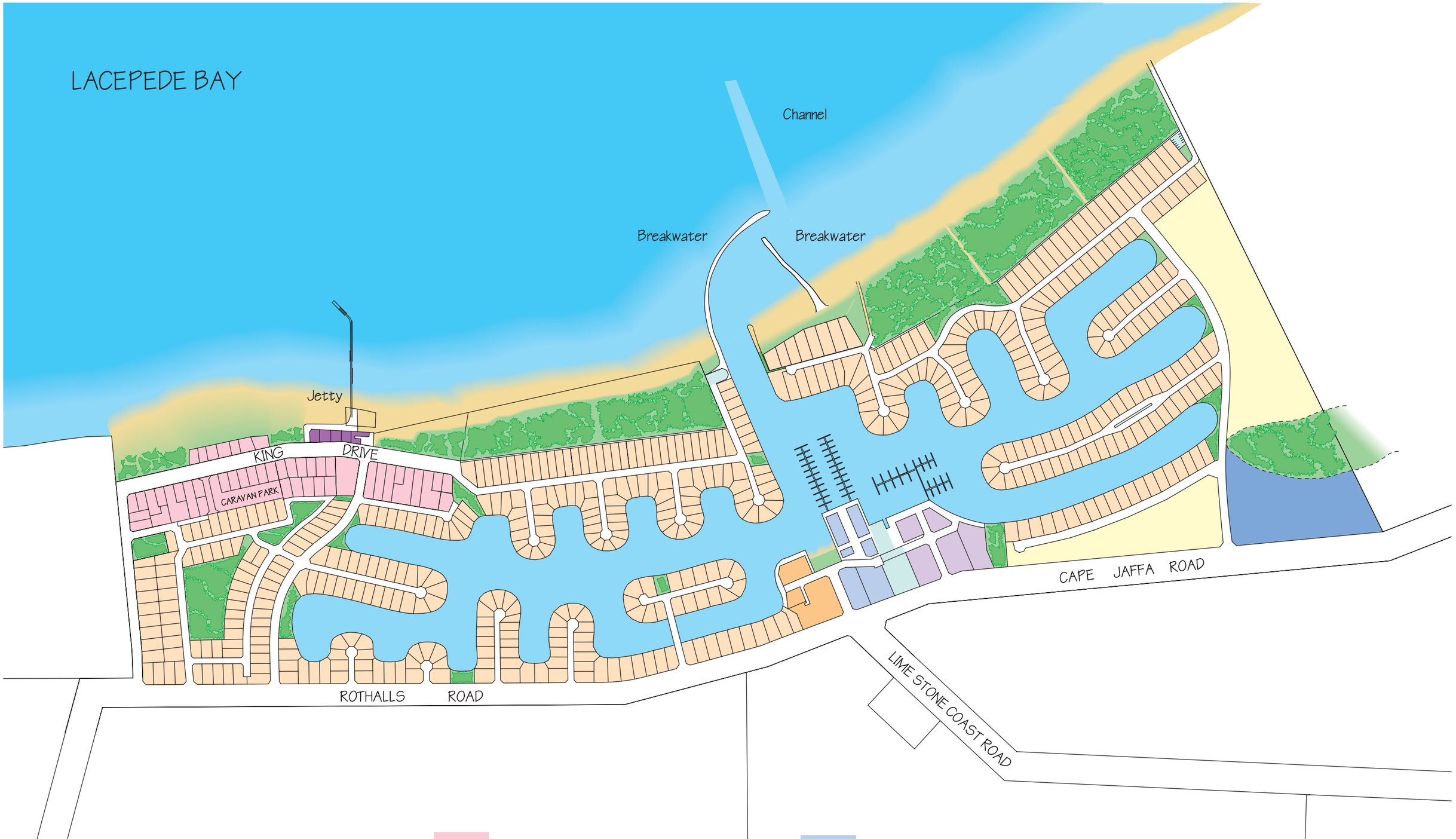

Scale 1:7,500

0 150m

MasterPlan
Town & Country Planners

- Existing Residential
- Proposed Residential
- Existing Industry
- Proposed Industry
- Tourist Accommodation
- Proposed Commercial
- Reserve
- Public Facilities & Boat Ramp
- Future Development
- Infrastructure

Figure R1

CONCEPT PLAN
CAPE JAFFA ANCHORAGE

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Scale 1:2000 @ A4

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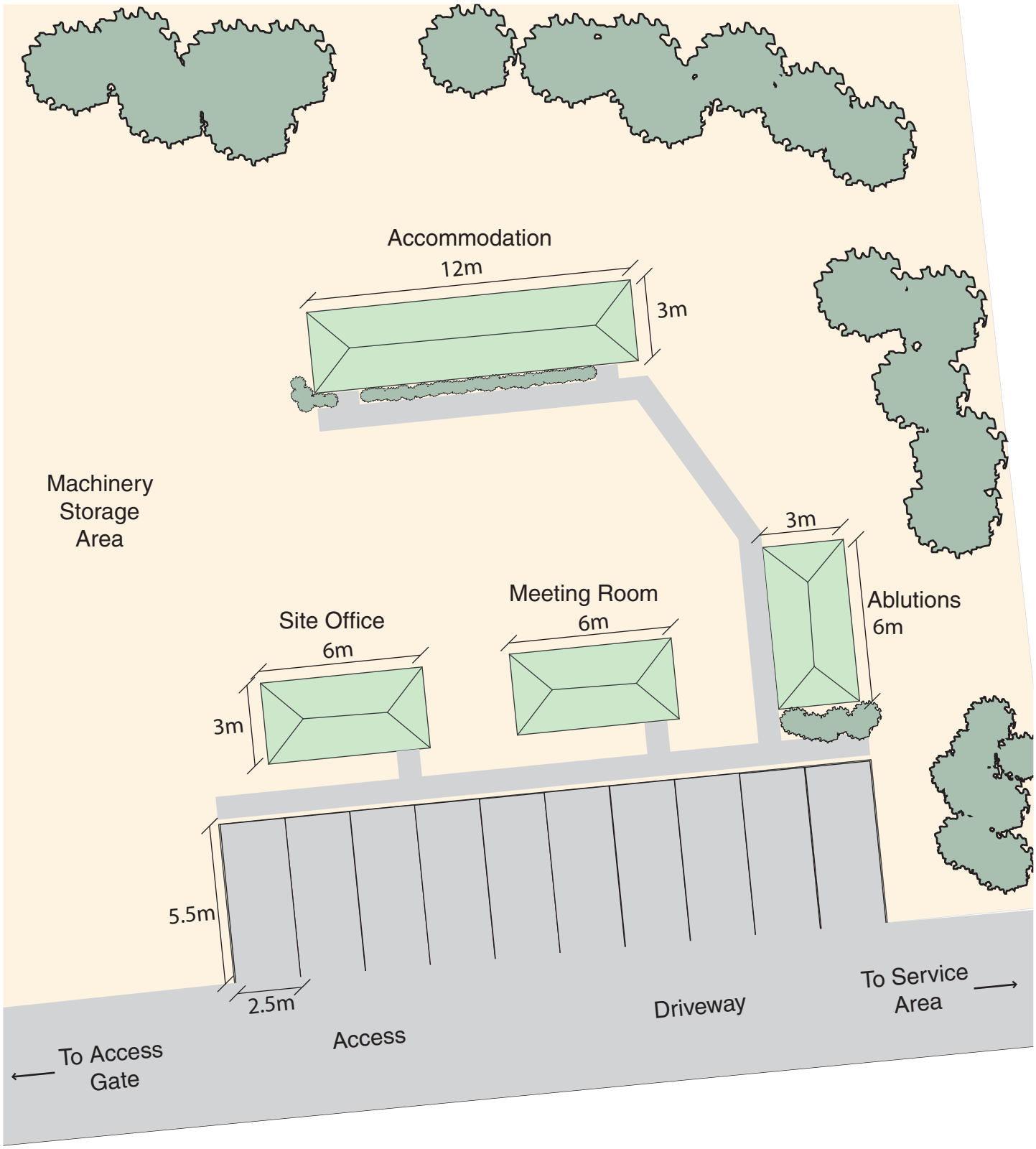
MasterPlan
Town & Country Planners

Figure R2

Infrastructure Area Concept

CAPE JAFFA ANCHORAGE



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MasterPlan
Town & Country Planners

Figure R3

Site Camp Concept

CAPE JAFFA ANCHORAGE

5.0 RESPONSE TO SUBMISSIONS

The tables on the following pages, together with the supporting sections of this report and appendices provide the proponents detailed response in accordance with Section 46 B (8) of the *Development Act* 1993. These are supported by appendices incorporating original author's reports and assessments.

Issue/Submission Reference	Description of Comment/Issue Raised in Submission	Outline of Response
5.1 Need for the Proposal		
5.1.1 Need for and Benefits of the Proposal		
Government		The submissions from various government agencies summarise the numerous benefits of the development as identified in the EIS. These include: • general economic benefits for the region; • increased employment during and after construction; • tourism industry; • growth in the fishing and aquaculture industries, including value adding opportunities; • provision to the fishing industry of appropriate wharf infrastructure to facilitate servicing and refuelling; • improving efficiencies and providing possibilities for expansion and diversification of the fishing and aquaculture industries, as envisaged in the recently revised Lacepede Bay Aquaculture Management Policy (8th July 2004). The Policy establishes zones that allows and provides for the growth and expansion of the aquaculture industry at Cape Jaffa; • the opportunity to use all weather, safe, commercial berths within the development, thus contributing to increased safety in the fishing industry; • contribution to the future diversification of a regional economy that has been predominantly reliant upon traditional primary industries; and • increasing of the population in this locality in a well planned and orderly manner.
Gov Submission 1, DTED, Comment 1	The Department of Trade and Economic Development (DTED) sees obvious economic benefits for the region including increased employment during and after construction, tourism industry, growth in the fishing and aquaculture industries and possible value adding opportunities. The development provides the fishing industry with appropriate wharf infrastructure to facilitate servicing and refuelling of vessels while improving efficiencies and providing possibilities for expansion and diversification of the industry.	
Gov Submission 2, Dept. of Health, Comment 1	The proposal will provide the existing commercial fishing fleet with the opportunity to use all weather, safe, commercial berths within the development thus contributing to increased safety in the fishing industry. This would contribute to the South Australia Strategic Plan Objective 2 Improving Well-being, Target 2.10, Greater Safety at Work.	
Gov Submission 3, PIRSA, Comment 1	PIRSA supports the Cape Jaffa Anchorage as: • In 2000/2001, aquaculture in the South East contributed approximately $3 million directly and $3.7 million in flow-on business to the State's economy (49 and 27 jobs respectively). • The Lacepede Bay Aquaculture Management Policy establishes zones that allow growth and expansion of the aquaculture industry at Cape Jaffa, however the present infrastructure is inadequate to cope with any real expansion of the industry. • Cape Jaffa Anchorage represents a major regional project, contributing to the future diversification of a regional economy that has been predominantly reliant upon traditional primary industries. It has the potential to generate a new range of business and employment opportunities for the region and to significantly contribute to the State's economy.	

Gov Submission 10, SECWMB, Comment 1	The South East Catchment Water Management Board (SECWMB) recognises the significant investment in the EIS and agrees that it provides a very comprehensive assessment. The Board look forward to the comments and issues raised throughout the consultation period adding to the objectivity of the EIS.	Refer to response above.
Gov Submission 9, OFID, Comment 1	The South Australia Strategic Plan identifies the provision of "marine facilities to support the fishing/aquaculture industries" as an ongoing need. The Cape Jaffa development includes the provision of a safe harbour for boating and the commercial fishing fleet and delivers improvements for tourism, the fishing fleet and boating generally. The Office for Infrastructure Development (OFID) supports the development.	
Gov Submission 11, SENRCC, Comment 1	South East Natural Resources Consultative Committee (SENRCC) considers that the EIS is a comprehensive document and the project proponents are to be commended for the information provided for the various issues identified. It is considered that the development of the proposed marina at Cape Jaffa would be of significant benefit to the local area and the region as a whole, and as such, SENRCC supports the proposal.	
Public		
Public Submission 3a Comment 6	We hope to see the Cape Jaffa Anchorage proceed as we think that it is a forward thinking project and will only enhance the Cape Jaffa and surrounding areas.	
Public Submission 30 Comment 1	The development is needed to increase the population in this locality in a well planned and orderly manner. The proponent states a desire to care for the environment and tourism and industry are heavily reliant on the environment. Therefore any development must be 'green' or it will fail. It is clear that the current facilities are inadequate for growth in the area and also the land is not great rural land and could be better used for other purposes including conservation, particularly the wetlands.	

Public		The development is aimed at providing facilities to meet the growing needs of the community in the region and to support the viability and growth of the existing service centres, in particular Kingston and Robe.
Public Submission 1 Comment 1	Kingston has developed as a successful service centre to the surrounding area servicing agriculture, fishing and the growing tourism industry. The affluence of the area is reflected in the value of real estate and increasing number, size and sophistication of boats.	
Public Submission 2 Comment 8	All facilities required for boats and yachts are available at the natural lake harbour at Robe.	Lake Butler does not satisfy the needs for boating activities at Cape Jaffa, nor can it accommodate and moor the boats used by recreational fishers, commercial fishers or the aquaculture industry at Cape Jaffa. The provision of facilities at Cape Jaffa is in accordance with the Governments intentions as set out in the various strategies identified in Section 2.3 of the EIS and the Lacepede Bay Aquaculture Management Policy (8th July 2004). Lake Butler is currently the subject of a development proposal to improve boat mooring facilities, however if this development proceeds then boat servicing and hardstand facilities at Lake Butler will be diminished. Accordingly the proposed facilities at Cape Jaffa will meet the express identified needs of the commercial and recreational boating fraternities.
Public Submission 11 Comment 9	EIS mentions 30 fishing vessels, when there are 20 or less.	The fleet at Cape Jaffa has varied over the period of investigations however this is not material to the registrations of interest or the design or availability of a safe and convenient harbour facility. As a consequence of a number of consultations with commercial fishers, both collectively and individually, Council received registrations of interest from 21 commercial fishers in the knowledge that further discussion would take place in relation to the location and commercial arrangements for commercial berths. The viability of the project in relation to the residential component is satisfactory given the registrations of interest. Facilities for commercial purposes will only be developed on a needs basis.
Public Submission 8 Comment 3	Section 5.3.13 of the EIS states that 21 fishers have registered their interest in a marina berth, whereas there are only 19 vessels operating out of Cape Jaffa and some may move to Robe. 21 would certainly have shown interest and I was one of those. My decision to purchase will depend on cost.	
Public Submission 18 Comment 15	Section 5.3.13 of the EIS states that 21 fishers have registered their interest in a marina berth, whereas there are only 19 vessels operating out of Cape Jaffa. An updated survey is required to determine if fishermen will want to go into the marina at a cost of a rateable $50,000.	
Public Submission 27 Comment 1	The EIS states that the need for the proposal centres on growing needs and pressures of the fishing industry, development of the aquaculture industry and a growing public demand for coastal living. The reality is that the fishing fleet is slowly declining. There are now only 18 commercial fishing vessels moored at Cape Jaffa. If there was spare capacity at Robe more could relocate as Robe is closer to the fishing grounds. It further appears that some commercial fisherman have indicated that they will	

	remain on the existing swinging moorings. The support facilities are also in decline with one fish processing factory closing last year.	
Public Submission 28 Comment 6	There is a great difference between registering an expression of interest and purchasing a mooring. Several professional fishermen have expressed to me that they would move, but definitely at a price sensitive figure. The Cape Jaffa Development Company needs to release some costings before work begins. The public may think they cannot afford suggested pricing, which may make the project unviable.	
Public Submission 29 Comment 16	Only 19 vessels operate from Cape Jaffa. One is for sale and there is no guarantee that it will remain at Cape Jaffa, thus reducing the fleet to 18. There are no Atlantic Salmon and Ocean Trout ventures conducted. The need for the marina is questionable. At least 6 owners have indicated they are not interested in mooring facilities, one of the reasons being the cost. It is difficult to believe that vessels from Robe would consider moving to Cape Jaffa as it would add to the travelling time to their fishing grounds and considerably reduce engine life, which represents a $100,000 investment.	The southern rock lobster fishery comprises an extensive area extending north along the Coorong and south to the Victorian border. The area is depicted on the "Southern Zone Rock Lobster Fishing Areas" plan on the SARDI Aquatic Sciences web site www.sardi.sa.gov.au. Significant parts of the zone are readily accessible from Cape Jaffa. The provision of land based facilities will mean that vessels will not have to steam long distances to undertake major works. This may also result in reduced risks of marine pest plant introduction to the area.
Public Submission 29 Comment 33	The planned redevelopment of Lake Butler to accommodate more moorings means it is possible that several of the existing fleet could migrate to Robe. This maybe not so much because of the planned marina, but because Robe is closer to their fishing grounds. On these grounds, it is unlikely that any of the Kingston fishermen who fish out of Robe will return to Cape Jaffa.	
Public Submission 9 Comment 1	Kingston and Robe are the service centres for the area and have all major facilities. People who reside at Cape Jaffa do so because it is their wish to have a quiet lifestyle without the hustle and bustle of a busy township.	It is clearly the intent that the Cape Jaffa development be subservient to the service functions of Kingston and Robe. Cape Jaffa has also been identified in various strategic plans at Federal, State, regional and local levels as the most suited location for the development/expansion of a township and specifically, for updated infrastructure associated with the rock lobster, aquaculture, tourism and residential interests. It is also noteworthy that a significant area is already zoned for residential and commercial/industrial purposes, thus expansion and development of the settlement is inevitable, as is change in the character and nature of the existing township and activities. The areas abutting the existing Robe and Kingston townships along the coast are, in the main, heavily vegetated and are therefore unlikely to be available for development purposes without significant effects on existing habitat. Recent investigations to identify suitable areas for expansion of Robe have revealed
Public Submission 16 Comment 5	If more housing is needed why can't more rural land along the coast north and south of Kingston and Robe be rezoned as residential areas?	
Public Submission 27 Comment 4	Cape Jaffa is one of the windiest sites in the state and during winter can be most unpleasant. It is unlikely that many will make this their permanent residence. In testament to this, a seafront house at Cape Jaffa did not sell at auction recently and the only bid was from the developer.	
Public Submission 29 Comment 10	The population at Cape Jaffa has remained at around 30 to 50 for the last 34 years. All of the existing residents are happy and live or holiday here because it is small, quite and unspoiled. We maintain that small, undeveloped	

	towns like this are essential for real wellbeing, free from the stressful life of large urban developments.	significant limitations for residential development around the town and certainly none along the coast.
Public Submission 29 Comments 3 & 14	A large number of Kingston residents oppose the project as major infrastructure and other problems in the town are being ignored by the Council in favour of the development.	The assertion that "*a large number of Kingston residents oppose the project*" is unsubstantiated. In addition, it is considered that review of Council's broader obligations and priorities is beyond the scope of this assessment. In accordance with its statutory obligations, Council, as the relevant planning authority for the district, is required to undertake investigations to guide future development in the district. In order to satisfy this requirement, several investigations have been conducted together with regional, state and commonwealth bodies. These include a Section 30 Review, a Plan Amendment Report, the South East Coastal Management Strategy and a review of boating needs within the region. These investigations included community consultation and they all acknowledge Cape Jaffa as the appropriate focus for development. Refer to Section 2.3 of the EIS for further information. As a result, Council's facilitation of this development accords with its obligations to the community. Similarly, various State Strategies and Plans reinforce the need for improved facilities and development at Cape Jaffa to satisfy the aims and objectives of these strategies and for the general benefit of the wider community.
Public Submission 29 Comment 24	The project is about feathering the developer's nest. There is no real need for a project of this sort at Cape Jaffa. There has been no community call for this development and it has little support either in Kingston or Cape Jaffa.	
Public Submission 29 Comment 32	Cape Jaffa's best interests have not been considered in selection of a location for this development.	
Public Submission 29 Comment 34	The housing development will neither reinforce nor enhance the existing settlement. Instead, it will adversely affect it. Cape Jaffa is a quaint little backwater offering a carefree, restful escape from the stress of city living.	
Public Submission 29 Comment 6	The claim that a marina at Cape Jaffa would impact the wellbeing of Adelaide's residents and quality of life is disingenuous. As most of the visitors to Cape Jaffa come from interstate for the sole purpose of fishing and boating, this development will not improve their quality of life any more than for the local residents.	The statement in the EIS regarding wellbeing and quality of life was made in the context of the State's Strategic Plan, which recognises the benefits to the general community, including Adelaide residents, from improved facilities and economic advantages that collectively improve the well being of all South Australians. See Section 2.3.2 of the EIS. The improved well-being derives from improved infrastructure and facilities for residential, retail, commercial, industrial and tourist activities and the economic benefits associated with these activities. These features enhance choice for many as a destination for recreation, vacation and residency and with growth locally there is an enhanced economic base for South Australia's capital city to support. It is well established and acknowledged in many of the Government submissions that the project will contribute to the well-being of South Australians.
Public Submission 29 Comment 8	As no fishing is undertaken in unfavourable weather, the only risk to operators well-being is land based and a marina is unlikely to influence occupational health and safety. There has only been one sea rescue in 10 years and a marina is unlikely to have any influence.	The harbour facilities provide a protected area as a refuge from poor weather and a safe place to load, unload, launch and retrieve vessels. These facilities provide enhanced safety to the commercial fleet, recreational boat users and passage making vessels. Not all of the vessels at sea have the opportunity to choose the weather in which they operate, particularly if they are already at sea when weather

	The fishing fleet currently provides emergency vessels as required. If the weather is too rough they will not risk going to sea, which is the case for most of the months between May and October. The same applies to recreational vessels so what is the point of safe launching when you cannot access the fishing grounds because the sea is too rough.	conditions deteriorate. Provision of a wharf with proper lifting facilities and a secure protected area to tie up, as opposed to the risk of lighting and alighting from dinghies, together with the risks associated with vessels potentially breaking moorings and the subsequent rescue and recovery, all highlight the advantages to Occupational Health and Safety that will result from the development. Detailed assessment of the weather conditions at Cape Jaffa is provided in the EIS in Section 4 and Appendix 15.
Public Submission 29 Comment 15	To claim the development will provide safe all weather facilities shows a lack of knowledge of local weather conditions.	
Public Submission 29 Comment 31	Tourists come to Cape Jaffa to fish from boats or the jetty, however the weather does not permit these activities during the off season.	
Public Submission 29 Comment 9	TAFE facilities could just as easily be located at Robe, Beachport or Southend, which have larger fishing fleets. As there is no aquaculture activity here, such a facility would be pointless.	The aquaculture activities have not ceased at Cape Jaffa but rather have been winterised for a season with clear intentions to continue to operate from Cape Jaffa with the advantages of the harbour facilities. The TAFE facility discussed is under investigation, as this location is identified as highly suited to aquaculture, unlike Robe. The existing fishing activities will prevail at Cape Jaffa and therefore there is a greater critical mass and broader fishing and aquaculture base on which to establish education facilities.
Public Submission 29 Comment 12	Accepting change for the good of the community is fine, but we do not want to be forced to accept change purely for monetary gain by a developer.	It is well established that this project will satisfy identified community needs. A detailed assessment of the development, in the context of various Commonwealth, State, regional and local strategic plans is presented in Sections 2.3 and 5.1 of the EIS.
Public Submission 29 Comment 25	Demand for coastal property is waning. Two properties have recently been passed in after failing to meet the reserve price, one at Kingston and one at Cape Jaffa.	There is extensive evidence of ongoing demand for coastal properties around the whole of the South Australian coastline, whether marina or non-marina based. This is evidenced at Port Lincoln, along the coast of Yorke Peninsula, the Copper Coast, and the Southern Fleurieu as relevant examples. An assessment of the demand for coastal housing in the area is presented in the EIS. The availability of coastal properties at Kingston, Cape Jaffa and Robe is limited and this has been the case for several years. As a consequence, property prices have increased considerably over this time. In terms of the failure of auctions, expectations of individual owners when setting prices and timing is a private consideration and not relevant to this assessment. The interest shown in relation to this proposal is significant and well established. See Section 4.3.8 of the EIS.
Public Submission 29 Comment 37	In order to attract buyers for land, there will need to be infrastructure in already in place, eg a supermarket, cafes, restaurants, hotels, motel, doctor etc.`	The existing registrations of interest for the purchase of land are sufficient to seed the initial stage of the development.

	Business people will not invest the necessary capital will not invest in this infrastructure until the permanent population reaches critical mass, which is unlikely for considerable time, if ever, particularly with interest rates increasing, which will also affect thinking re a decision to purchase a holiday home.	The development will then proceed in an orderly fashion, whereby progressive development of facilities will occur in conjunction with progressive uptake of land for housing, as is quite normal for developments of this type. Staging has been planned so that the development occurs in an orderly and progressive manner in response to market needs. It is noteworthy that as Cape Jaffa grows it is expected that it will continue to build on the attributes of a coastal town, comprising a mixture of permanent residents, holiday homes, tourist facilities, industry and associated basic support services.
Public Submission 29 Comment 55	Some retirees choose to live on or near the coast, however they are not prone to retire a long way from families. To afford housing in this development they would have to be wealthy avid fishers who don't mind not being able to pursue their interests for 9 months of the year. To pursue other interests (eg family or theatre) they would have to have other accommodation. They also expect health care in the community in which they live. This development will not satisfy their immediate needs, as it will take half a century to reach critical mass.	The proposal provides the opportunity to create a variety of allotment types to accommodate a range of residential and tourist needs. To suggest that fishing is not possible for 9 months of the year is erroneous. There are numerous periods during autumn, winter and spring when conditions are suitable for fishing and fishing during these periods will become significantly more viable with the provision of improved harbour facilities. The development of residential allotments is expected to occur over a 10 year period. A staging and development schedule is presented in Section 3 of the EIS.

5.2	**Environmental Issues**	
	Groundwater	
5.2.1	**Groundwater - Scope and Methodology of Assessment and Modelling**	
Government		The extensive investigations conducted as part of the EIS have enabled a practical assessment of the effects of the development on the groundwater environment and the results are presented in Sections 4.14, 5.2.2 - 5.2.10, 5.2.22 and Appendix 14 of the EIS. Further investigations, including survey of bores, additional groundwater sampling and ongoing measurement of groundwater levels, are being undertaken as part of the project's Environmental Monitoring and Management Plan (EMMP). The proposed ongoing monitoring and management of groundwater effects was outlined in the EIS and is further discussed later in this Response Document in Section 5.5 titled Construction and Operational Management.
Gov Submission 7/13, DWLBC, Comment 22.1	Scope of the Studies: The EIS has made an extensive assessment of the current condition of the unconfined aquifer and likely impacts of the development through modelling that seems to adequately cover the scope of the investigations required. Nevertheless, DWLBC would like to see further investigations undertaken on the unconfined aquifer to ensure the adequacy of the scope of the EIS.	
Gov Submission 7/13, DWLBC, Comment 22.2	Methodology of Assessment: Unconfined aquifer: An assessment is needed on the various assumptions used in the conceptual hydrogeological model and a groundwater flow model to determine consistency with what is known about the aquifers and determine whether the models are adequate to estimate the likely impacts of the development on both aquifer systems. DWLBC requests: • that more detailed investigations be carried out on the confined aquifer to determine all possible impacts of the development; and • a detailed assessment of the assumptions used in the conceptual hydrogeological model and groundwater flow model. Confined aquifer: a more limited assessment has been carried out on the confined aquifer as it is considered the development will have less significant effects on the confined aquifer compared to the unconfined aquifer.	Section 4.14 of the EIS sets out details of what is known of the aquifers, both locally and within the region. Section 5.2.2 sets out the modelling and the parameters used in the modelling and further details can be found in Appendix 14 of the EIS. Below is additional assessment of the assumptions made in preparing the model and the validity of these assumptions in comparison with what is known of the unconfined aquifer. Assessment of the confined aquifer is discussed later in Section 5.2.14. The assessment of the methodology presented below includes discussion of: • layer thicknesses; • recharge rates; • seasonal/transient effects; • hydraulic conductivity; • effects of existing groundwater extraction; and • homogeneity of the unconfined aquifer. <u>Layer Thicknesses</u> The model layers and their thicknesses were based on a regional cross section developed by DWLBC (2002/10). The cross-section transverses approximately east-
Gov Submission 10, SECWMB, Comment 2	SECWMB supports DWLBC comments (Gov Submission 13 Comment 22.2) that an assessment of consistency of the groundwater models with what is known about the aquifers is needed.	

Gov Submission 11, SENRCC, Comment 3c	There are some concerns over the modelling, specifically: • the use of vertical recharge to the unconfined aquifer of 100 mm is considered likely to be too high, underestimating the extent of groundwater level lowering. Sensitivity analysis is recommended; • transient modelling to examine seasonal fluctuations in groundwater levels would have some merit; and • the thickness of the layers does not appear to match some of the available hyrostratigraphic information.	west through Cape Jaffa and Naracoorte and is presented as Figure 4.65 of the EIS. The adopted thicknesses of the different layers were based on the information available at the time the model was constructed. It is also noted that bore 6824-2075, referred to in Gov Submission 14 Comment 1a, was installed by the proponent for the investigations into the confined aquifer and that the modelling exercise was completed before the information from this bore was available. Since installation of this bore, the information collected has been compared to the model assumptions. The regional stratigraphic profile (Brown et al. 2001, presented as Fig 4.66 of the EIS) indicates that the lower Tertiary confining bed comprises marl and dolomite, glauconitic fossiliferous marl). The drill cutting lithological log from bore 6824-2075 (Appendix 23 of the EIS) indicates that the upper beds of the confining layer commence at a depth of 46 metres BGL (below ground level) and are described by the presence of "marly limestone". Further, the geophysical logs conducted on bore 6824-2075 confirmed this finding. The depth of the unconfined aquifer encountered in this bore is therefore similar to the modelled thickness of this layer. The drill cutting log presented in Appendix 23 of the EIS describes numerous bryozoal and marly limestone confining layers that in places include flints fragments and are glauconitic. Deeper, below about 144 mBGL, clay layers exist. Although the confining layer appears to be thicker than what was modelled, this is not expected to have a significant effect on the model results as the leakage between the aquifers is expected to be very small in comparison to the lateral components of flow. <u>Recharge Rate</u> The recharge rate of 100mm/year, which is mentioned in Volume 3 of Appendix 14 of the EIS, was the initial estimate of recharge prior to calibration of the model. Tonkin Consulting has advised that the final calibrated recharge rate applied in the model was 85 mm per year. This was based on a sensitivity analysis of this parameter in accordance with standard modelling practice as documented in Groundwater Flow Modelling Guidelines (Murray Darling Basin Commission, 2000). The calibrated recharge rate is considered appropriate given the: • sandy nature of soils and dunal topography; • lack of surface drainage paths on site; • shallow water table (1 to 4 m); and • minimal vegetation and hence low evapo-transpiration.
Gov Submission 12, Planning SA, Comment 53	Clarify the methodology used to define the hydraulic conductivity used in the model, particularly within the zone of higher permeability in the central western part of the site. What are the implications for the modelling results if the conductivity is less?	
Gov Submission 12, Planning SA, Comment 63b	The groundwater modelling assesses the potential impact on water levels without incorporating the existing groundwater use in the area. Comment is required on whether inclusion of the existing uses will affect the conclusions of the modelling.	
Gov Submission 14, DWLCB, Comment 1	In the groundwater flow model design, what is the basis for assigning of the model layers and their thickness? Description of data from the well drilled to investigate the confined aquifer for water supply purposes (well # 6824-2075 located at the eastern edge of the project area) shows that the TLA (unconfined aquifer) is about 136m (from 6m to 144m). Although the log interpretation is poor and describes this section as "different coloured limestone", this thickness is substantially different from the 50m assigned to layer 1 in the model.	

Gov Submission 14, DWLCB, Comment 2	The average estimated vertical recharge value for the area is about 50mm/year using watertable fluctuation method. Applying a 100 mm/year could be a high value.	The appropriateness of the adopted recharge rate is indicated by noting that, in calibrating a model for the Upper South East, the CSIRO generally used a recharge rate of 40 mm/year, although where the water table was less than 2 metres in depth, as applies over parts of the site, used a recharge rate of 100% of rainfall, that is between about 400 and 600 mm/year. Refer to Kennett-Smith, Nayaran and Walker (1996) Calibration of a Groundwater Model for the Upper South East of South Australia, CSIRO Division of Water Resources, Canberra. Transient Modelling and Seasonal Effects Transient analysis is not considered necessary to assess the groundwater conditions or the potential effects on the existing groundwater users. The existing model is calibrated to Spring conditions, that is the conditions during the period of higher seasonal groundwater levels and flow rates and therefore at the higher end of the seasonal range of effects, which provides a conservative assessment. An analysis of seasonal variations has been performed and is presented in Section 5.2.4 and Appendix C of this Response Document. Hydraulic Conductivity Hydraulic conductivity was measured in the field by rising and falling head tests. This analysis provides an order of magnitude indication of the hydraulic conductivity of the unconfined aquifer. The zones of hydraulic conductivity used in the model were generated using the rising/falling head results, review of lithological logs and observed hydraulic gradient. The measured hydraulic conductivities within the zone referred to in Gov Submission 12 Comment 53 ranged between about 10 and 30 metres per day. The hydraulic conductivity of 25 metres per day adopted in the model for this zone was determined during the model calibration process as that which provides a satisfactory match between the observed and modelled water levels. This process of model calibration was undertaken in accordance with standard modelling practices and the Groundwater Flow Modelling Guidelines (MDBC 2000) and the adopted hydraulic conductivity was within the range encountered in the region. If the adopted hydraulic conductivity for the above zone was less then model calibration would not have been achieved. Nevertheless, if a lower hydraulic conductivity was adopted in a model then that model would predict reduced groundwater flow to the waterways from this area and reduced extent of groundwater drawdown. Therefore, the adoption of the higher hydraulic conductivity, as was used in the model, provides a conservative assessment of the potential effects. See also Sections 5.2.1, 5.2.2, 4.14.8 and Appendix 14 of the EIS.
Public		
Public Submission 2 Comment 6	Experts over time have made errors, which will continue as a result of this development.	
Public Submission 5 Comment 2	Concerned that the experts are unable to provide a guarantee in relation to groundwater effects.	
Public Submission 7 Comment 1	EIS is irresponsible and contains misinformed assumptions.	
Public Submission 20 Comment 1b	We are told that the effect on water levels will be minimal and local but we are concerned that little is known about the groundwater movement.	
Public Submission 27 Comment 14	The EIS appears to have been prepared based on a largely fabricated need to develop a marina. It has been built on flawed modelling, erroneous statements, incorrect data, false premise and innuendo.	

		Existing Extraction Continuous groundwater level loggers have been installed near Cape Jaffa. These wells have indicated a significant tidal and seasonal influence on water level but there was no discernible evidence of groundwater drawdown due to extraction over the summer periods since mid 2003. In addition, the groundwater flow model was calibrated to October 2003 data. At this time of the year, the level of extraction and therefore the drawdown due to irrigation is not significant. Therefore, the inclusion of existing use within the model is unlikely to have affected the conclusions of the modelling.
Government		The focus of the assessment of the unconfined aquifer has been on the limestone unit. The presence of the clay layers in some areas and the overlying sand is considered to be of minimal relevance given that: • the waterways extend to a depth below the top of the limestone so where it is present the clay will be removed as part of the excavation of the waterways; • most, if not all of the existing groundwater wells in the area penetrate and extract water from within the limestone unit; • the groundwater levels are such that the unconfined aquifer only extends marginally into the overlying sands and the majority of the unconfined aquifer exists within the tertiary limestone unit. About 90% of the thickness of the unconfined aquifer is within the limestone unit and thus the majority of groundwater through-flow is within the limestone; • the modelling that has been used to assess the effect of the waterways has been based on data collected from monitoring wells drilled into the limestone and thus reflects the properties of this unit; and • the model has been calibrated to groundwater levels measured from monitoring wells drilled into the limestone unit of the unconfined aquifer and a reasonable calibration of the groundwater model has been achieved. As a result, the presence of clay in places is expected to have little effect on the modelling of groundwater level changes, groundwater flow to the waterways, and on the conclusions that have been made on the basis of the modelling.
Gov Submission 12, Planning SA, Comment 51	Clarify connectivity of the Quarternary / Tertiary limestone units of the unconfined aquifer. The EIS indicates that the Quaternary aquifer is contiguous with the Tertiary Limestone aquifer and not impacted by the clay layer indicated across the middle section of the site. There is limited information to conclude this.	
Public		
	No public submission received on this issue.	

Government		The model has been used to assess the groundwater levels in October 2003, at the time of model calibration. Comparison of the measured and modelled groundwater levels at that time provides assessment of the validity of the model calibration as it tests the model's ability to reproduce the measured groundwater levels. The calibration plot presented in Section 5.2.2 of the EIS as Figure 5.5 compares the modelled and measured levels at the location of each monitoring well and shows that a good calibration has been achieved. The mean of the residuals (average differences between modelled and measured groundwater level) is 0.001 metres and the mean of the absolute differences is 0.092 metres. At some bore locations, the residual is greater, up to a maximum of approximately 0.2 metres. The greatest residual was observed at the wells closest to the coast, which is expected to be a result of tidal influence on the groundwater levels near the coast during the gauging event. Tidal effects result in groundwater level fluctuations near to the coast and in CJ01 the tidal fluctuations were up to about 0.2 metres during the period August to October 2003, as shown in Figure 4.84 of the EIS. The most appropriate method to the use model for analysis of the potential reduction in groundwater levels is to apply the modelled drawdown to the actual groundwater levels at any location, in accordance with normal modelling practices. The modelled drawdown is presented as Figure 5.9 of the EIS, which depicts the difference between the modelled pre-development and post-development conditions. It has been calculated in this fashion as it is a like-for-like comparison between two modelled conditions using the same model parameters and minimises the potential influence of the residual differences on the analysis results. It would be inappropriate to simply add the maximum residual to the modelled drawdown results as it would shift the results and overestimate the extent of the drawdown.
Gov Submission 12, Planning SA, Comment 54	It is indicated that there is a difference of 0.2m in the measured and modelled groundwater levels. Has this been considered in the analysis of the total potential reduction in water levels as a result of the development?	
Public		
	No public submission received on this issue.	
Public		Significant investigations have been conducted, particularly in relation to the groundwater environment. Further investigations are proposed to be undertaken on the confined aquifer at the site and the proponent will seek permission from the owner of nearby bores within the confined aquifer to participate in the monitoring program associated with these investigations. Information on existing bores in the region is presented in Section 4.14.14 of the EIS. Figure 4.99 shows the operational groundwater wells within approximately 20 kilometres of the site, based on information provided by Primary Industries and Resources SA, and highlights the wells known to be greater than 60 metres deep as an indication of wells that are possibly intersecting the confined aquifer. If a closer bore or bores exist into the confined aquifer it is expected that they are either less than 60 metres deep or accurate information is not available from Primary Industries
Public Submission 14 Comment 1b	The EIS is poorly researched and inadequate. The information on the proximity of artesian bores is incorrect. The EIS claims that the closest is at Noolook forest, however this bore has been plugged. We have a flowing bore on our land and no one has done recent tests on it.	
Public Submission 23 Comment 3	The EIS states that the closest artesian bore is 10km away. We have a free flowing bore situated 6.4 km from Cape Jaffa that is used for stock water. The bore referred to in the EIS has been plugged and is therefore no use for water testing.	

		and Resources SA.
Public Submission 23 Comment 4	From reading the EIS, I believe that a lot more research must be done as much of it is incomplete. There is no mention of research from the already existing Margret Brock Reef (Marine Sanctuary) bores or existing bores in the surrounding pastoral area, only reference to bore that they have sunk themselves.	In undertaking the investigations for the EIS, in addition to the wells installed by the proponent, consideration has been given to information held by DWLBC from existing groundwater monitoring wells located in the region, in order to gain a general understanding of regional groundwater properties. In addition, regional groundwater data has been used in developing the groundwater model that has been used to assess the potential effects of the development.
Public Submission 27 Comment 8	We contend that the modelling used to obtain daily outflow of 900 cubic metres is seriously flawed. For example, the EIS indicates that monitoring well 22 (Appendix A) has a flow rate of 1440 litres per hour, whereas a registered well 50 metres away has a measured flow rate of 4000 litres per hour.	The groundwater monitoring wells installed by the proponent were designed to monitor groundwater levels and to extract small quantities of water for sampling purposes. The rate of extraction during collection of samples is not an indication of potential yield or of the magnitude of groundwater flow in the region, as the rate of extraction is dependent on well construction and the pumping equipment used during sampling.
5.2.2 Groundwater – Soil and Groundwater Contamination Status		
Government		The initial groundwater sampling and analysis was performed in July 2003 to detect potential compounds of concern across the site. It showed elevated levels of various compounds in CJ15 and CJ15A, but also showed elevated salinities, thus it was uncertain whether the elevated readings were the result of evapo-concentration of the background levels, or the result of a potential source of groundwater contamination in the vicinity of CJ15/15A. Evapo-concentration occurs when water is removed from the aquifer by either direct evaporation or via plants by evapo-transpiration, but the compounds remain within the groundwater and become concentrated, as does the salinity. Evapo-concentration is usually significant when the depth to the water table is less than 2 metres, as is the case at CJ15 / CJ15A. To further complicate the assessment, elevated groundwater salinities can result in errors in the laboratory analysis such that the reported concentrations are too high, unless special “saline waters” procedures are followed during the analysis. In the initial round of sampling these procedures were not followed as, based on the regional data, elevated salinities were not expected. To alleviate these concerns, a second round of groundwater sampling was performed in October 2004 and saline waters procedures were used to reassess the compounds that were recorded at elevated levels in the initial sampling. This assessment showed reduced concentrations and all of the concentrations measured were less than the EPP Marine Criteria. As there is no EPP Marine Criteria defined
Gov Submission 12, Planning SA, Comments 52, 60 & 63a	Investigations into potential soil contamination in the vicinity of CJ15 & CJ15A should be conducted as elevated levels of arsenic, cyanide and phosphorus have been recorded in these bores and historical spreading of piggery effluent is reported. If any soil contamination is identified, appropriate management measures should be implemented. Comment on the potential need for soil remediation to ensure there is no ongoing source of groundwater contamination. The lateral extent and area of highest groundwater contamination have not been determined.	
Public		
	No public submissions received on this issue.	

		for total cyanide, comparison was made to the EPP Criteria for potable water (0.08 mg/L). It showed that all of the measured concentrations of total cyanide were less than the EPP Potable criteria, although they exceeded the NEPM Marine investigation level of 0.005 mg/L. Note also that the measured salinities in the two sampling rounds were similar, except in CJ15A where salinity was significantly less in the second sampling event (about 7,600 mg/L verses the previous 14,900 mg/L). Nevertheless the measured salinities were still higher than that considered suitable for potable water. In addition, the second sampling round assessed both total cyanide and free cyanide concentration. Free cyanide is the form of cyanide of greatest potential concern and comparison of the measured total cyanide and free cyanide concentrations indicates that any cyanide that does exists is predominantly in the form of the less toxic metallo-cyanide and inorganic complexes. Free cyanide was less than the detection limit of 0.005 mg/L in two wells and just above the detection limit at 0.006 mg/L in one well. The concentrations identified can result from natural sources such as soil or rock minerals or from plant production, particularly in cases where evapo-concentration has occurred. The identified concentrations of several compounds correlated reasonably with salinity, which is consistent with evapo-concentration as the cause of the elevated readings in the initial sampling. Nevertheless, it was considered appropriate to conduct additional investigations to determine if a source of potential contamination exits. Contamination can result from anthropogenic sources such as the historical application of pesticides or stock parasite treatment. Historical spreading of piggery effluent has been reported, although further consultation with the land owner indicates that this has not occurred within the site, but further to the east on the remainder of the same parcel of land, that being Section 92, Hundred of Mount Benson. It should also be noted that elevated nutrient concentrations were recorded generally across the site and also off the site within the Cape Jaffa region. Again, these can result from natural sources such as degradation of organic matter, but can also be as a result of potential anthropogenic sources such as the application of fertilisers. <u>Soil Sampling Results</u> Nine soils samples (and one duplicate sample) were taken adjacent and surrounding wells CJ15 / CJ15A in order to determine if a source of soil contamination is contributing to the levels of compounds recorded in the groundwater and whether any contamination might be likely to pose a risk to the health of future land users.

		The results are presented in Appendix B of this Response Document. The sampling focused on surface soils horizons as these are the horizons most likely to exhibit elevated concentrations as a result of anthropogenic sources such as pesticides, parasite treatment or fertiliser application. The samples were collected and transported to a NATA accredited laboratory using industry standard procedures. The samples were assessed for a range of compounds including heavy metals (arsenic, cadmium, chromium, lead, mercury, nickel and zinc), total cyanide, nutrients (total phosphorous, total nitrogen and total organic carbon) and soil pH. In addition, the sample collected adjacent to the boreholes CJ15/CJ15A (BH5) was assessed against the full VicEPA screen, which includes assessment of hydrocarbons (total petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylenes, polycyclic aromatic hydrocarbons), total cyanide, heavy metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel selenium, tin & zinc), phenols, organochlorine pesticides and soluble fluoride. The results were compared to the NEMP 1999 (National Environmental Protection Measure 1999) residential health investigation levels and interim urban ecological investigation levels. These levels are investigation levels that are intended as a guideline to trigger further investigation, should they be exceeded. None of the results exceeded the health or ecological investigation levels for any of the samples. As a result, there are no indications of a soil source of contamination and confirming that the initial groundwater results are most likely a result of the effects of evapo-concentration on naturally occurring compounds. In addition, comparison of the results to the residential investigation levels indicates that there are minimal risks to health for future users of the land.
5.2.3 Groundwater – Effects on Groundwater and Existing Users of Groundwater		
Government		The concern over lowered water levels and increased salinity of bores very near to the waterways is both valid and acknowledged. The results of the investigations set out in the EIS indicate that in almost all areas, bores are unlikely to be adversely effected although some bores within the existing township may experience increased salinity, particularly deeper bores at the eastern end of the township. Outside of the existing settlement, the effects are unlikely to disadvantage users and are expected to be limited to minor lowering of levels. This may require some modification of pumping equipment and although this is unlikely, if required this will be performed at
Gov Submission 2, Dept. of Health, Comment 5	The EIS states that some of the existing residents' bore water may become saline due to intrusion by seawater. Apart from the ability to be connected to the proposed water scheme, it is unclear how this loss is to be accommodated, at what expense and who's cost. This is of added importance as the population at Cape Jaffa in 2001 had almost three times the South Australian average for people on nil or negative income (14% compared with 5% respectively).	

Gov Submission 10, SECWMB, Comment 7	What options are available if salt-water intrusion affects stock and domestic bores in the vicinity of the development? The concept of a cost sharing scheme may be a useful mechanism in regard to impacts on public stick and domestic wells	no cost to the existing users. Details of the expected effects are set out in Section 5.2.3 and Appendix 14 of the EIS. The proponent acknowledges and agrees with the view expressed in submissions that existing groundwater users who are adversely affected by demonstrated groundwater changes as a result of the waterways should not be financially or otherwise disadvantaged. It is considered that the potential groundwater changes of concern are both groundwater quality (i.e. salinity) changes and groundwater quantity (i.e. level) changes. It is proposed that affected bores are replaced, relocated, modified or otherwise refurbished in order to allow the continued operation of the well in accordance with its existing function. This program will be implemented at no cost to the owner, that is at the expense of the proponent, regardless of the income status of the individual. For bores located in the existing township, should it not be practical to refurbish a bore satisfactorily then access to the town water supply will be provided and no cost of connection will apply. It is considered reasonable that the user the pay for water in the normal manner, which is similar to the maintenance and pumping costs associated with the operation of a bore. The proposed groundwater monitoring and management plan will include discussion regarding assessment and ongoing monitoring of existing groundwater wells in order to identify quality or quantity effects of the waterways on existing groundwater users. The plan includes the provision of a comprehensive bore survey, which will establish details of potentially effected bores and baseline data including the quality and quantity of groundwater being utilised. This baseline data will form the benchmark against which future data will be assessed in order to determine if a demonstrated groundwater change is affecting the continued use of the bore. Property owners located within the Cape Jaffa settlement or within the wider locality of the 0.2 m drawdown area will be invited to participate in the program. The area of modelled 0.2 metre drawdown is shown in Figure 5.9 of the EIS. With regard to the submissions that promote the provision of “free” water, it is considered that none of the residents enjoy a free water service today and there should be no expectation to be afforded a free service. The existing supplies have costs associated with the maintenance, pumping costs (energy costs) and storage of water. There is also the potential cost to health in the use of the groundwater for human consumption that is acknowledged by DH to be a risk. The proponent has committed to a monitoring programme and the provision of connection to a meter at the allotment boundary from a reticulated water supply at no cost, should residents agree to connect prior to construction, in order to facilitate
Gov Submission 11, SENRCC, Comment 4	As indicated in the EIS, the lowering of levels in the unconfined aquifer will have a permanent impact on the position of the saltwater interface. Water supply bores may experience loss of suitable water quality either permanently or seasonally, depending on the rate of extraction, depth of bore and proximity to the marina. A bore survey would assist in better determination of these impacts. It is SENRCC’s view that existing groundwater users who are adversely impacted by demonstrated groundwater quality changes should not be financially or otherwise disadvantaged, particularly if there is a need to connect to the proposed reticulated water supply.	
Gov Submission 12, Planning SA, Comment 47	Is there any provisional plan for compensation if unexpected groundwater impacts arise?	
Public		
Public Submission 4 Comment 1	Concerned about loss of domestic water from our bore, which is 7 meters deep in close proximity to the waterways.	
Public Submission 7 Comment 4	The breaking into the aquifer and flooding with saltwater will create terrible and irreversible effects. The EIS state the country around will be drained 40cm, effecting thousands of hectares ($50 million of almond plantations and vineyards). Who is going to pay compensation if the salt goes inland as has occurred at Virginia.	
Public Submission 7 Comment 6	Heavy pumping of the aquifer for development will affect local farmers by loss of water rights.	
Public Submission 7 Comment 9	The quality of life for existing residents at Cape Jaffa will change with dying gardens, added expense of buying water and water connection fees. They have already paid for bores and pumps and will not be compensated for any loss.	

Public Submission 8 Comment 1	How long will dewatering during construction take place and what happens if our bores turn salty or dry up during this process? Will water be supplied to existing residents before dewatering or do residents wait to see what happens to their bores?	efficient construction of the service. Those who wish to be connected later will be charged for the cost of the service connection but not the headworks and reticulation infrastructure. By comparison, standard SA Water practice is that where services are supplied to an area and pass a property, that property is automatically charged a service fee and connection fees . Most grasses tend to prefer to get their moisture from close to the surface as it is difficult for them to raise water from depth to the leaf. Lowering of the water table in winter could have a beneficial effect on winter-active grasses such as Phalaris and the lower water table over summer may have little effect because they are not actively growing. Summer-active grasses like Fescues may be more affected by lower water table over summer. There has been some work done in the Upper South East regarding affects on pastures from drainage and landowners have generally accepted the changes because the decrease in summer productivity is offset by an increase in winter productivity. Accordingly, management factors may have a much greater effect on productivity than engineering factors. Section 5.2.6 of this Response Document further discusses the potential effects of groundwater changes on land use nearby the development.
Public Submission 13 Comment 1	Concerned about the effect on supply and quality of groundwater, particularly for stock water on my property. Water in this area is very good quality (re salinity) and should not be put at risk.	
Public Submission 14 Comment 4	I reserve the right to seek compensation if any loss of production is incurred from effects on groundwater.	
Public Submission 15/22 Comment 4	We reserve the right to seek compensation if any loss of production is incurred.	
Public Submission 17 Comment 4	The bank needs to have significant funds set aside for compensation/claims if damage occurs to the precious fresh water.	
Public Submission 18 Comment 2	We reserve the right to seek compensation for any detrimental effect on our stock water and the lowering of soil moisture which will effect pasture production, including: • cost of reconstruction of water points if the watertable is lowered or salinity increased; • the deepening of irrigation bores effected; • replacement of stock water should the water quality be destroyed; Ongoing monitoring and assessment needs to be undertaken for all stages and for up to at least 10 years thereafter. At present, we have fresh green flats during summer and lowering the soil moisture will substantially reduce our farming viability.	
Public Submission 20 Comment 1a	We are concerned about the effect of the development on groundwater. What will happen if there is a problem after much of the housing has been constructed?	
Public Submission 20 Comment 2	We are told that the unconfined aquifer is fully allocated within our area. Will the new residents tap into this water to maintain gardens as happens in Kingston?	

Public Submission 23 Comment 6	I reserve the right to seek compensation if any loss of production is incurred.	Refer to response provided above.
Public Submission 29 Comment 46	It is claimed that groundwater outflow will be redirected and not increased, although this cannot be guaranteed. If digging the waterways causes the aquifer to either drain or loss most of its water, who will compensate farmers for degradation of their land and loss of livelihood?	
Public Submission 26 Comment 4	If the groundwater is effected and larger pumps are necessary will there be any compensation and from whom?	
Public Submission 28 Comment 2	Through no fault of their own, the established people at Cape Jaffa will be forced to joint the reticulated water supply. There existing bores will become saline. The developer should connect residents at no costs and provide several years of service before charges are made. This is especially the case for the residents who are pensioners or on low incomes, when combined with other potential increases in living costs.	
Public Submission 28 Comment 3	The EIS states there may be increased likelihood of bore becoming saline. I believe that dewatering of the later stages will lower the levels in existing bores and they will begin to draw in saline water which will be left behind and take years to remove. The developer should make water available at no cost to the residents and provide free connection to the reticulated water supply.	
Public		Assessment of the potential effects of the groundwater changes on land use and vegetation is presented in Section 5.2.5 of the EIS, which concludes that adverse effects are unlikely and further information is presented later in Section 5.2.6 of this Response Document. In addition, later sections discuss further the groundwater and vegetation monitoring and management plans, which incorporate measures and monitor and manage any potential effects.
Public Submission 7 Comment 3	All large trees and shrubs will die of salt poisoning as they draw on ground water.	
Public Submission 16 Comment 2	Seawater entering the marina and the water table will kill existing planted trees and large native trees, decimating the population of bird life and leading to the extinction of species unique to the area, including the Orange Bellied Parrot.	
Public Submission 16 Comment 6	The proposal will destroy the watertable and ecology of Cape Jaffa.	

Public		The modelled drawdown about 1500 metres south of the waterways is in the range 0.2 to 0.4 metres. It is acknowledged that the change in groundwater levels that result from establishment of the waterways is in addition to the seasonal changes in levels. The discussion in the EIS makes a comparison between seasonal changes and the changes that result from the waterways for information purposes only. As discussed above, if it is necessary to lower or otherwise alter pumping equipment in order to maintain existing groundwater use then this will be at no cost to the user.
Public Submission 10 Comment 1	Our property is 1500 metres south of the main basin and our borewater is used for drinking and irrigation of orchards and pasture. Section 5.2.5 of the EIS states a drop of 0.6 metres will occur in our bores, which is small compared to the seasonal fluctuations. The fluctuations will continue, so 0.6 metres of water will be gone forever. Due to the nature of our pumps, only a small drop in the watertable will mean that our pumps will not pull up water any more. Will the developer compensate or install new pumping equipment/bores if necessary?	
Public Submission 11 Comment 1	Our borewater is used for drinking and irrigation of orchards and pasture. The EIS states our bores will drop 0.3 metres, which is small compared to the seasonal fluctuations. The fluctuations will continue so we will be pumping from lower down, which could effect our centrifugal pumps as they are close to their limit. We reserve the right to expect compensation if we suffer financial loss if we are unable to use centrifugal pumps or bores need deepening. Who is responsible?	
Public		The extent of changes to the unconfined aquifer is set out in various sections of the EIS and has been further discussed above. It shows that active seawater intrusion into the aquifer cannot occur once the waterways are established as the groundwater levels are not lowered to below sealevel. See Sections 4.14, 5.2.3 and Appendix 14 of the EIS for further details. The high quality of groundwater in the region is acknowledged. The EIS presents regional and local salinity data in Section 4.14. The waterways are established to a depth of -3.5 mAHD, which is below the watertable in the unconfined aquifer. They will not however damage low lying flats in the area. The effects on nearby land, land use and vegetation are assessed at length in Section 5.2 of the EIS, particularly Section 5.2.5 and Appendices 11 and 14. See also the discussion regarding effects on land use, wetlands, lakes and periodically inundated land in Sections 5.2.5, 5.2.6 and Appendix E of this Response Document. The seawater does not “enter” the land, but the existing interface between fresh groundwater and saline seawater in the aquifer beneath the coast will re-establish and stabilise at a new location around the waterways. The seawater interface, the
Public Submission 1 Comment 4	The sea provides an effective salt seal along the coast preventing the loss of groundwater to the sea. Excavation of the waterways 25 feet down into the unconfined aquifer will result in an enormous loss of fresh water from the unconfined aquifer. It is difficult to believe that a liner could provide a long term solution to this problem.	
Public Submission 2 Comment 3, 5	Waterways dredged into the watertable may pollute inland water with salt. My water quality is Classed A1 (0.78PH 08 Salt).	
Public Submission 3 Comment 1	Dredging of waterways deep enough to moor local sized fishing boats would go well below the present watertable and damage our low lying flats, change the way water is raised by windmills and pumps and be very costly to all concerned.	
Public Submission 9 Comment 2	Digging into the aquifer will turn the natural underground water to salt, affecting farmers’ and Cape Jaffa residents’ bores.	

Public Submission 17 Comment 1 & 2	The area is only suitable for normal subdivision because there is danger of damage to the aquifer. The salt water seal, which has built up over years, should not be broken to allow fresh water and sea to mix.	potential for seawater intrusion and the expected effects of the waterways is described in detail in the EIS in Sections 4.14.11 and 5.2.3 and Appendix 14. The is no evidence to suggest that a salt water seal or any sort of a seal exists within the aquifer and the detailed investigations presented in the EIS conclude that the overall quantity of outflow of groundwater to the sea will not change as a result of establishing the waterways.
Late Submission 1 Comment 1	This will cause the end of useable groundwater to the surrounding area. A 2 metre variation from groundwater to sea level will cause an absolute catastrophe.	
Late Submission 2 Comment 1	The channels will flood seawater into and over the groundwater, creating risk of increased salinity and contamination of the groundwater.	
Public		Significant time, effort and cost has been invested in detailed research, investigation and assessment of the effects of the waterways on the groundwater system. The EIS establishes clearly that the waterways will not result in ruining hundreds or thousands of acres of valuable land. The effects of the waterways on land, land use and vegetation in the vicinity of the waterways has been described in Section 5.2.5 of the EIS. The seawater does not "enter" land, but the existing interface between fresh groundwater and saline seawater in the aquifer beneath the coast will re-establish around the waterways and stabilise at a corresponding new location. The seawater interface, the process of seawater intrusion and the expected effects of the waterways is described in detail in the EIS in Section 4.14.11, 5.2.3 and Appendix 14. The ongoing monitoring and management of groundwater in the vicinity was outlined in the EIS and is described in Section 5.2.9 of this Response Document. A Groundwater Monitoring and Management Plant (GWMMP) is being prepared to include monitoring and management requirements.
Public Submission 12 Comment 1	Have sufficient tests been conducted along the complete length of the land that is proposed to be a waterway and will be inundated by seawater? If not, and there are underground streams present that can be contaminated, how far will the salt travel inland? It is essential that every avenue of research be used to ensure that seawater cannot enter and ruin hundreds, maybe thousands of acres of valuable land. I know of large variation in groundwater salinity over short distances (10 metres).	
Public Submission 14 Comment 1a	Further investigation into the effect of the development on underground water should be performed before the project is allowed to proceed. My major concern is the destruction of our underground fresh water, which will effect pasture growth, stock and domestic water supply, property value and our lifestyle.	
Public Submission 18 Comment 3	We are concerned that the basin will allow an unrestricted flow of water out to sea via the channel. At present the water is restricted to natural seepage through the limestone rock and sand dunes.	
Public Submission 23 Comment 1	I have grave concern about the impact of the development may have on groundwater by draining freshwater into the sea and lowering the watertable. Pine plantations established over the last 40 years have lowered the watertable in the region significantly and it would be a disaster if bores dried up or become unusable because of lowering of the watertable. The cost of replacing bores would be astronomical.	

Public Submission 24 Comment 1	We are concerned that our water supply will dry up and/or go salty. We pump groundwater for domestic purposes, our water table is 7 m below ground level and the proposed channel is to be build directly behind our property. What will happen to our domestic supply? Our tress and native vegetation will be destroyed.	Refer to response provided above.
Public Submission 27 Comment 7	Most existing domestic supplies in the settlement are drawn from an aquifer under a limestone sheet approx 5 metres below groundwater, salinity averages 500 ppm with pH of 7.2. When many of the south east drainage channels were constructed, breaking into this limestone sheet resulted in water from the underlying aquifer running continuously into the drains, which is ongoing and unrepairable. In our view, to allow further escape of underground water, our most precious resource, to the sea is a blatant act of wilful damage to the environment.	
Public		Water is not being destroyed. It currently flows to the bay via the groundwater system and this will continue to be the case, albeit via an altered route. In addition, the overall rate of groundwater flow to the bay will be unchanged; rather it will flow with some local alteration to the distribution of outflow to the sea along the length of the coast. See Section 5.2.6 and Appendix 14 of the EIS for detailed discussion. The establishment of the waterways will have no impact on the confined aquifer. Potential effects on the unconfined aquifer is discussed in detail in Section 5.2.3 and Appendix 14 of the EIS.
Public Submission 7 Comment 8	The government on TV promotes water as a precious resource, therefore why is it being destroyed.	
Public Submission 16 Comment 7	No more water licences are being issued in the Congorong-Lacepede confined aquifer area, so how can this proposal be given permission to cut a channel and waste our precious water?	
Public Submission 18 Comment 7	We live in a prescribed water area where we are required to pay for restricted amounts of water from the unconfined aquifer. It is a mockery if this development is allowed unlimited water wastage due to unrestricted flow out to sea via the channel.	
Public Submission 18 Comment 10	The southeast rarely suffers drought. Water is a valuable commodity and should no risk the resource for a marina.	
Public Submission 23 Comment 5	The local landowners, including me, are not against the development but are against the destruction of our environment and livelihood. We must be sure of not only the impact on the township, but also the surrounding district.	
Public Submission 26 Comment 5	I do agree with progress in the region but with great care to our main resource, the water.	

Public Submission 27 Comment 9	On 26/02/05 Dept Water Land and Biodiversity Conservation issued a notice prohibiting the taking of water from wells in the Hundreds of Roby, Sherlock and others as it considers there is a risk that the available water will not meet future demand. This area is not all that far form Cape Jaffa and it is inconceivable that one Dept should prohibit the taking of water while another allows the same water to flow out to sea.	Refer to response provided above.
Public Submission 27 Comment 15	After everything said about conserving our dwindling underground water, to knowingly break into a high quality aquifer and drain it to the sea is a delinquent act.	
Public		Once the waterways are established a portion of the existing flow of groundwater to the sea will occur via the waterways. Approximately 900 cubic metres per day will flow to the sea via the waterways yet overall there will be no increase in outflow of groundwater to the sea as the ground flow along the nearby coast to the sea will be correspondingly reduced. See Section 5.2.6 of the EIS for a detailed explanation.
Public Submission 27 Comment 6	The EIS contends that the development will result in no additional water being removed from the aquifer and flowing out to sea, and further assesses a figure of 900 cubic metres per day as the total daily outflow.	
5.2.4 Groundwater - Effects on Marina Water Quality and Seagrasses in the Bay		
Government		Sensitivity Analysis Sensitivity analysis of the groundwater and tidal flushing models and the interaction between the two models has been conducted to provide realistic ranges of concentrations of nutrients and other compounds entering the marine environment via the mouth of the breakwaters. These models were presented in the EIS in Sections 5.2.2, 5.2.3, 5.2.22 and Appendices 14 and 21. The results are summarised by the table presented below and details are contained in Appendix C. The three scenarios assessed define the expected minimum, maximum and typical concentrations of nutrients and inorganic compounds entering the marine environment. The expected typical case is based on the following scenario: • the concentrations of compounds in groundwater are equal to the average measured groundwater concentration during the recent investigations. This is conservative as it assumes no attenuation within the groundwater system; • the groundwater outflow is the expected seasonal average outflow; • 25 % of the nitrogen and phosphorous in garden fertiliser loading leaches to the waterways. The loading is based on 300 households each applying fertiliser to 150 square metres;
Gov Submission 13, EPA, Comment 7	Provide sensitivity of groundwater modelling and supporting information to assess realistic ranges of groundwater and associated compounds/potential pollutants that are discharged to the waterways, and changes to the fresh/saline groundwater interface. Provide sensitivity of tidal flushing modelling and supporting information to support the minimal impact interpretation, including integration of the sensitivity (variability) estimates for groundwater flows to the waterways (per above). Provide variability of concentrations of nutrients/pollutants within the waterways and supporting information to assess, within the waterways, the: • potential for generating nuisance algal blooms, and • other potential effects on aquatic fauna and flora. Provide further assessment, including supporting evidence, of the effects of potential pollutants, particularly nutrients, on the nearby seagrass beds. In low nutrient waters the EPP criteria may not be sufficiently protective of seagrass colonies when under stress from numerous sources, but nevertheless requires that pollutants do not impact the seagrasses.	

- It is further assumed that all of the nitrogen is oxidised nitrogen; and
- mixing and dispersion in the waterways is that which corresponds to the average tides of 0.7 metre tides.

Range of Concentrations of Nutrients and Inorganic Compounds Entering the Marine Environment Via the Mouth of the Waterways (mg/L)

Compound	Criteria		Best Case	Typical Case	Worst Case	EIS Case
Total Organic Carbon	EPP-Marine	10.00	0.00	0.01	0.28	0.23
Oxidised Nitrogen	EPP-Marine	0.200	0.000	0.002	0.047	0.036
Total Nitrogen	EPP-Marine	5.000	0.000	0.003	0.048	0.037
Phosphorous	EPP-Marine	0.100	0.000	0.000	0.007	0.003
Cyanide	EPP-Potable	0.0800	0.0000	0.0001	0.0010	0.0008
"	NEMP-Marine	0.0050	"	"	"	"
Arsenic	EPP-Marine	0.05000	0.0000	0.0000	0.0003	0.0003
Cadmium	EPP-Marine	0.002000	0.000000	0.000000	0.000010	0.000008

The results of the expected typical case indicate very low concentrations of all compounds. These concentrations are all undetectable by normal assessment methods as they are less than normal laboratory detection limits.

The worst case scenario is very conservative as it is based on all of the worst case conditions existing at the same time. It assumes the following occur simultaneously:

- All of the groundwater entering the waterways contains all of the compounds at the highest concentrations measured anywhere on or off the site during both rounds of groundwater sampling. Again, it is assumed that no attenuation occurs within the groundwater system;
- The maximum expected seasonal groundwater outflow to the waterways;

- all of the nitrogen and phosphorous in garden fertilisers leaches to the waterways, with the loading based on 450 households all applying fertiliser to 200 square metres and that all of the applied nitrogen is oxidised nitrogen; and
- a waterways mixing and dispersion that corresponds to continuous dodge (neap) tides.

Even in this combined worst case scenario very low concentrations are indicated, with the only compound that might be detectable by normal sampling methods being nitrogen.

It should also be noted that the majority of the nutrients that reach the marine environment via the mouth of the breakwaters are already discharging to the marine environment via the current groundwater outflow along the length of the coast. See Section 5.2.6 and Appendix 14 of the EIS for further information. The effect of the waterways is to divert the existing groundwater and associated compounds, which will then enter the marine environment via the mouth of the breakwaters rather than along the coast. Thus there will be a corresponding reduction in the concentration of nutrients and compounds near the coast adjacent to the breakwaters and, given the rapid mixing within the bay, there is no overall increase in concentrations of compounds associated with the groundwater within the marine environment.

Nevertheless, there is increased nutrient loading as a result of household use of garden fertilisers and the table below presents the additional concentrations of Nitrogen and Phosphorous at the mouth of the breakwater that result from garden fertiliser use under the defined scenarios.

Range of Increase in Concentrations at the Mouth of the Waterways Resulting from Garden Fertiliser Use (mg/L)

Compound	Criteria		Best Case	Typical Case	Worst Case	EIS Case
Oxidised Nitrogen	EPP-Marine	0.200	0.000	0.000	0.003	-
Total Nitrogen	EPP-Marine	5.000	0.000	0.000	0.003	-
Phosphorous	EPP-Marine	0.100	0.000	0.000	0.003	-

		Note that there is some offset against this increase as the land is currently fertilised as part of its agricultural use, however in order to be conservative the table ignores this offset. These concentrations are in addition to the background concentrations of nutrients in seawater, which for nitrogen is typically in the range of 0 to 0.020 mg/L (Appendix D). Also note that the previously presented table includes the effect of garden fertilisers and thus incorporates these loadings. This table shows that even in the worst case scenario, the increase in nutrient concentrations that result from garden fertiliser use is small in comparison to the background levels in seawater and is below the normal laboratory detection limits. This assessment is in no way intended to justify the irresponsible use of garden fertilisers and management of risks associated with pollution of the waterways from household chemical use is further discussed in Section 5.6.2 of this Response Document. <u>Risk of Effects on Fauna and Flora</u> The normal concern for seagrass health in relation to water quality is that increased nutrient levels, particularly dissolved inorganic nitrogen, can result in increased density of opportunistic macroalgae growing on the leaves of *Posidonia*, which shades the plant. The ability to capture light is critical to seagrass health and if light is reduced for lengthy periods plant productivity reduces, leaves die and the density of shoots is decreased. This is particularly relevant for seagrasses located in deeper water where incident light intensity is lower. The likely effects on the marine environment were discussed in the EIS in Section 5.2.6. Nevertheless, additional assessment of the risk of effects on aquatic fauna and flora, including seagrasses of the bay, has been conducted using the ranges of concentrations identified in the sensitivity analysis and is presented in Appendix D. The expected levels of nutrients are well within the typical ambient ranges found at other locations in Australia where healthy *Posidonia* seagrass meadows exist and the risk of adverse effects is considered to be low. All of the scenarios presented in the sensitivity analysis show nitrogen concentrations that are less than that found in Marmion Lagoon near Perth, which has ambient sea nitrate concentrations that vary from undetectable in summer months to about 0.060 mgN/L in winter. Marmion Lagoon contains dense beds of *Posidonia sinuosa* and *P. angustifolia*, as well as other seagrasses, and is about 6m deep at its deepest edge (Appendix D, Kirkman *et al.*, 1991).

Although adverse effects are not anticipated given the low nutrient levels, the proposed seagrass monitoring and management plan incorporates the monitoring of seagrass health by measuring *Posidonia* shoot density at control sites and in the receiving environment nearby to the breakwaters. Contingency plans will be included to remedy the situation in case reduced shoot density is found.

Pesticides and Herbicides

Groundwater was tested for major pesticides (OCPs and OPPs). For all pesticides assessed, the measured concentrations in groundwater, before mixing in the waterways, were well below EPP-Marine guidelines.

Glyphosate is a very widely used non-selective herbicide used domestically and agriculturally. Despite its extensive use, it is classified as relatively non-toxic to aquatic flora, with concentrations ranging from 1 to 100 mg/L having no effect on the photosynthetic capacity of the seagrasses investigated (Westphalen *et al.* 2004).

The herbicide Atrazine is known to have adverse effects on seagrasses if present at concentrations of 30 to 50 ppm. It is not normally used in the region but its typical use is as a selective broad leaf weed control in establishing pines and some crops. Its use is very unlikely Near Cape Jaffa, with the only potential use being in establishing pines. This is unlikely within about 10 km of the site although there are established pines near Mount Benson. Atrazine is not available for domestic garden use.

Potential for generating nuisance algal blooms

The sensitivity analysis has also been used to examine the concentrations of nutrients and other compounds within the waterways. Concentrations vary throughout the waterways and are generally higher at locations further from the mouth of the breakwaters. The table below presents the expected range of concentrations at the location of the maximum levels, which is at the end of the south-eastern arm of the waterways:

Range of Concentrations of Nutrients Within the Waterways (mg/L)

Compound	Best Case	Typical Case	Worst Case
Total Organic Carbon	0.00	0.03	0.63
Oxidised Nitrogen	0.000	0.004	0.106
Total Nitrogen	0.000	0.006	0.108
Phosphorous	0.000	0.001	0.016

		Using this information, the potential for algal blooms has been assessed and this is presented in Appendix D. Algal blooms occur when high nutrients in the water column occur at the same time that calm weather prevails. They are of concern as they may smell offensively, cause irritation to humans and reduce available photosynthetic radiation to seagrass. The levels of nitrate predicted in this project will not normally cause an algal bloom as even in periods of dodge (neap) tides, the layout of the waterways allows sufficient exchange to maintain water quality. Outside the breakwater, any nutrient and microalgal concentrations are quickly reduced to negligible levels. It is noted that the deeper seagrass plants are those that maybe affected first as they have the least available light, however these deeper seagrasses are further from the breakwaters and thus unlikely to be effected.
Public		Herbicides and other agricultural chemicals are being used in the area now. The potential effects of run-off from fertilisers used on the gardens of the development have been assessed. From worst-case scenario projections these amounts will have no effect on the marine environment. There is no scientific evidence of seagrasses being destroyed by run-off containing pesticides or herbicides, see the response presented above. There is no evidence that the existing drains and creeks nor the waterways of the marina will kill large areas of seagrasses. The nutrient loading from the surrounding agricultural land use that reaches the groundwater currently flows to the bay and this will continue to occur. Once the waterways are established, some of this loading will then occur via the waterways. As a result, the establishment of the waterways and the consequential groundwater flow into the waterways will not result in additional nutrient loading to the marine environment. The assessment presented above shows that the discharge at the mouth of the breakwater will contain nutrient levels that are significantly below the EPP Criteria for discharge of wastewater to the marine environment. Further, the concentrations of nutrients entering the marine environment at the mouth of the breakwaters will be similar to the natural nutrient levels found in the marine environment. The rotting seagrass along the beach at Kingston is a natural phenomenon that has been going on for probably hundreds of years. Evidence of this is the remains of seagrass leaves a few hundred metres inland from the present shoreline and this is discussed in Kirkman and Kendrick (1997). Refer to the response to Government Submission 13, EPA, Comment 7 presented above.
Public Submission 1 Comment 3	Decline in seagrass beds in the Kingston area has been observed in the last four years. The use of herbicides and other agricultural chemical has contaminated surface water that discharges to the sea and streams within the unconfined aquifer that discharge well out to sea, which may explain why seagrass is dying. Continued attrition of seagrass will have a serious impact on fish stocks and beaches.	
Public Submission 2 Comment 4	Waterways dredged into the watertable will act as a drain and will destroy seaweed.	
Public Submission 3a Comment 5	South East Atlantic Salmon has been monitoring seagrass in the Cape Jaffa/ Lacepede Bay area for nine years and because the bay is very sheltered, if disturbed, seagrass will have the capacity to regenerate and recolonise the disturbed area in a relatively short time. We cannot see that the marina will have any effect of the seagrass in the long term.	
Public Submission 7 Comment 7	The outflow of 900 cubic metres of freshwater per day from groundwater plus unknown quantities from the aquifer into the sea will destroy seagrass, creating heaps stinking rotting seagrass against the sea wall and a sand desert in bay. Check rotting seagrass in Kingston destroying the beach, due to fresh water outfall from drains.	
Public Submission 9 Comment 3	The flow of fresh water through the channel will kill hundreds of acres of seagrass, as is happening from drains and creeks carrying water to the sea.	

Public Submission 16 Comment 1	Concerned that the EIS significantly underestimates the outflow of groundwater to the sea via the waterways by as factor of 10 to 20 minimum. This flow of freshwater would kill large areas of sea grass and lower the surrounding groundwater level a lot more than stated in the EIS. The project will waste large quantities of groundwater and water will flow unrestricted out to sea forever.	Refer to the response presented above.
Public Submission 27 Comment 10	The concentration of the groundwater outflow to the sea, which is acknowledged in the EIS, will result in the destruction of vast areas of seagrass, as evidenced by the obvious seagrass decline at any of the southeast drains system outlets.	
5.2.5 Groundwater - Effects on Wetlands, Lakes and Periodically Inundated Land in the Region		
Government		Assessment has been made of the effects of the changes in groundwater levels on the nearby periodically inundated land in Section 5.2.6 and Appendices 11 and 14 of the EIS. Additional investigations have been conducted to clarify the effects and are attached as Appendix E. This are outlined below. <u>Wetlands, Lakes and Periodically Inundated Land in the Region</u> To the east of the site there are a wetland, a number of lakes and a number of areas of low lying, periodically inundated agricultural land. Butcher Gap Conservation Park contains Butcher lake and Salt Lake and is located approximately 10 km northeast of the site, at the southern extremity of the developed area of Kingston, Wyomi and Pinks Beach. These lakes are listed in the Directory of Important Australian Wetlands as the "Butchers & Salt Lakes Wetland" and defined as a wetland of national significance, covering approximately 40 hectares (Environment Australia 2001). The Australian Wetlands Database (www.deh.gov.au/water/wetlands) describes the wetland as: *"An aggregation of three shallow lakes on the inland side of coastal dunes. Butchers Lake is the largest at approximately 25 ha in size, Salt Lake is approximately 10 ha, and an unnamed Lake is around 5 ha. In extreme wet years the area of the lakes expand into the surrounding scrub creating tea-tree and sedge swamps".* Water for the Wetland is sourced from Butchers Gap Drain and a freshwater spring in Salt Lake. It is brackish, less than a metre deep and acts as a refuge for waterbirds
Gov Submission 12, Planning SA, Comment 30a	Clarification of the potential effects on the adjacent Paperbark swamp and the discontinuous wetlands that extend east to Butchers Gap Conservation Park.	
Gov Submission 8/13, DEH, Comment 18.2&18.3	The seasonal saline wetland is of limited biological value but does compliment less degraded habitat in the district. The footprint of the marina will cause destruction of a portion of the degraded seasonal saline wetland. Potential drawdown of the groundwater of approximately 0.4m due to the marina excavation will extend a significant distance from the site. Wetlands of the area need to be identified (Hog lake, Salt Lake and Butchers Gap) and assessment undertaken to determine whether draw-down will alter ecological character. Local community members have advised that they have observed wetland hydrology at these lakes and maintain that they are groundwater dependent and therefore threatened by any reduction in groundwater levels.	
Gov Submission 11, SENRCC, Comment 3d	There has been no assessment of the impact of lowered groundwater levels (and possible reduced surface water run-off) to some of the wetland habitats in the area, particularly Hog Lake, which is considered a groundwater dependant ecosystem.	

Public	
Public Submission 2 Comment 1	There is too much drainage of land in the south east.
Public Submission 5 Comment 3	Concerned that the water table depression on my land would result in potential devastation in terms of wildlife loss, including birds and reptiles.
Public Submission 7 Comment 5	Lowering of watertable will effect seasonal wetland, thus effecting bird and animal habitat and destroy frog breeding grounds.
Public Submission 11 Comment 20	I hope the swamp will not be affected by groundwater changes. Will there be public access? Will Musk Duck breed in the swamp?
Public Submission 15/22 Comment 2	We have recognised wetlands on our property that support various species of flora and fauna. Our water is therefore an invaluable asset and should not be disturbed. If the project proceeds we require monitoring of our stock and irrigation bores for water level and quality for not less than 10 years.
Public Submission 18 Comment 6	Our wetlands are a wildlife haven and should the water level be lowered, we will lose this sanctuary.
Public Submission 21 Comment 7	We are concerned about the potential impact on the chain of wetlands in the region. Grazing pressure has already degraded much of this area and further impact from seawater or effluent contamination or reduced groundwater levels would compromise the wetlands.
Public Submission 29 Comment 45	The inundation also provides wetlands for swans, duck and other wildfowl. If inundation is less often or for shorter periods, the birds will lose nesting sites.
Public Submission 30 Comment 2a	The development overlays and damages a wetland of national significance which lies within the development site. The "Directory of Important Wetlands" for the 1980's (2nd edition) described a significant corridor of vegetation (which still exists) between Hog and Butchers Lakes, of 270 ha, containing some of the last remaining significant stands of coastal scrub between Coorong and Robe. The "Wetland Resources of the South East" (1984) recommended that Hog Lake and surrounding vegetation be purchased and added to the Butchers Gap Conservation Park.

in summer or during drought. The area supports tea-tree scrub, samphire flat, sedgelands and coastal closed scrub and contains some of the last remaining significant stands of coastal vegetation in the area. The area is considered a potential habitat of the nationally endangered Orange-bellied Parrot (Environment Australia 2001).

The Butchers Gap Conservation Park Information Sheet (www.parks.sa.gov.au) depicts the Wetland and Park area and describes the Park as:

> *"This small park is one of the last remaining significant stands of coastal scrub between the Coorong and Robe. The foredune and low-lying areas (swales) contain dense coastal scrub which, if you look closely, you will notice have been shaped by persistent strong onshore winds."*
>
> *"A 40 ha wetland area, including Salt Lake and Butcher Lake, is divided by the Butcher Gap Drain. This drain brings large amounts of fresh water each winter from the farmlands, through the Park and out to sea."*
>
> *"Salt Lake usually holds water between June and January and during this time waterbirds such as Chestnut Teal, Black Duck and Mountain Duck will be seen. Japanese Snipe and other wading birds use the area in spring and summer and the sedge covered swales hold numbers of Brown Quail, a species far less common than the grassland loving Stubble Quail."*

Hog Lake is located approximately 5 km northeast of the eastern edge of the site and covers approximately 54 ha. Although not listed in the Directory of Important Australian Wetlands and not classified as a nationally important wetlands, Hog Lake does compliment the Butchers & Salt Lakes Wetland. It is fed by a freshwater spring, local catchment and in very wet years from Butcher Gap drain, via over-land flow along the coastal strip. It is described as being groundwater dependant.

Like many areas in the South East of South Australia, the low-lying coastal land nearby the Butcher & Salt Lakes Wetland and Hog Lake is periodically inundated with freshwater. The water flows overland from Butcher Gap drain and, in very wet periods, local catchment and the waters of the nearby lakes. The westernmost extremity of these areas is adjacent to the development site and an associated stand of paperbark is described as the "paperbark swamp" in the EIS (Section 4.6 and Appendix 11). These areas are visible in the DEH 2002 aerial photography of the coastal strip from Butcher Gap to Cape Jaffa.

Public Submission 30 Comment 2b	The channels are too close to the wetland, risking active and passive seawater intrusion and watertable lowering around the swamp. The entire eastern extent of the development needs to be total redesigned given the significance of the wetland, to removing the channels, associated roads, groundwater lowing or risk of seawater intrusion in the proximity of the wetland. The method of dealing with the wastewater is strongly supported but it is recommended to move the treatment plant and other infrastructure a suitable distance form the wetland. It is not a bad idea to put a facility that will rarely have people visiting near the wetland, but this is too close.	Groundwater Effects *Butcher and Salt Lake Wetland* The modelling of changes to groundwater levels that occur as a result of establishing the waterways is presented in the EIS in Sections 5.2.2, 5.2.3 and Appendix 14. It shows that the extent of groundwater level changes is limited to the Cape Jaffa area immediately surrounding the waterways, as shown in Figure 5.13 of the EIS. As the Wetland is located approximately 10 km from the site there is expected to be no noticeable effects on the Wetland. *Hog Lake* Hog Lake is also significantly further from the site than the expected extent of groundwater changes and again there is expected to be no noticeable effects at this location. *Periodically Inundated Land Adjacent to the Development* The seasonally inundated area adjacent to the site is the only such area within the expected extent of changes to the groundwater levels that occur as a result of establishing the waterways. Investigations into this area and its relationship with the groundwater system have been conducted. This area covers approximately 30 hectares east of the site and is within approximately 2 km of the waterways. It is generally flat ground with an elevation of between 1.3 mAHD near its centre, rising to about 1.7 mAHD near its edge. Information from the land owner and survey of the area indicates inundation occurs to a level of up to approximately 2.1 mAHD. Survey shows that in 2004 the water level in the area reached a high of approximately 1.95 mAHD in late August/ early September, creating a water depth of up to about 0.65 metres. Using an average water depth over the 30 hectares of 0.5 metres indicates a total water volume in 2004 of approximately 150,000 cubic metres. Groundwater levels in the vicinity of this periodically inundated land adjacent to the site have been monitored since July 2003 (monitoring bores CJ16 and CJ24). A total of eight groundwater levelling surveys have been conducted in that time, which show groundwater levels have ranged from about 0.55 to 1.73 mAHD. In 2004, the groundwater levels peaked in late September / early October and on the 10th October 2004 were recorded as 1.58 and 1.73 mAHD in CJ24 and CJ16. This supports the understanding that infiltration to the groundwater from this inundated area is occurring, as the water level in the inundated area was approximately 200mm higher (1.95 mAHD) than the highest recorded groundwater levels, as is expected whilst water is infiltrating into the aquifer.
Public Submission 30 Comment 2c	Establishment of the waterways will result in lowering of groundwater and risk of seawater intrusion. The groundwater around the wetland could be lowered by as much as 1 metre and the predicted extend of seawater intrusion as a result of establishment of the waterways remains unclear. This will degrade the wetland, potentially drain it and prevent recruitment of new trees. Water quality in the freshwater swamp nearby the channels would be compromised by any seawater intrusion, which could then travel the entire length of the wetland system. The EIS (Appendix 14), together with the precautionary principle, suggests that to protect the freshwater wetland it should be at least 50 m away from the waterways. However active seawater intrusion during construction poses an additional risk to the quality of the water supplying the wetland. The EIS states that the channels will lower the groundwater, thus the development will effectively reclaim land. The Wetland Strategy distinctly warns against this practice.	
Public Submission 30 Comment 2d	The south eastern channels should be shortened or removed because this is where the most toxic, saline and nutrient laden groundwater monitoring wells are. Testing in wells 15 and 15a is cause for concern. A major concern is that the road runoff will drain directly into the wetland and contaminate drinking water for wildlife. Figure 3.15 of the EIS shows that the water in the north eastern corner will run off to the nearby swamp. A strategy for wetland water management is required and water used to maintain wetland water levels must be of suitable quality.	

Late Submission 2 Comment 3	Any change to the present water levels will have a catastrophic effect on the adjoining protected, secluded and unspoilt areas of Hogs Hut and coastal swamp. The fragile environment, flora and fauna of these areas will be annihilated by the relatively sudden change in water levels and salinity.	In seasons when the area is inundated, it drains over the spring and is typically dry by about November, although in very wet years it may take until early January to dry. In 2004 it was essentially dry by the beginning of December. Water is lost mainly by evaporation and infiltration to the groundwater and although limited data is available to make an assessment of the rate of infiltration into the groundwater, estimates can be made using the initial investigations of the area discussed above and the groundwater modelling presented in Section 5.2.2, and Appendix 14 of the EIS. The assessment indicates that in 2004 approximately 150,000 cubic metres of water, corresponding to about 0.5 metres of water over the 30 hectare area, was lost to evaporation and groundwater infiltration over a period of approximately 9 weeks from October to the beginning of December. Average evaporation over that period (from Padthaway and Konetta pan evaporation data) was approximately 285 mm, which indicates that more than half of water loss is by evaporation. Over the 9 weeks about 215 mm was lost to the soil profile, some of which was recharge to the groundwater system. Although some of this water would be lost by evapo-transpiration and not reach the aquifer, conservative assessment can be made by assuming that all of the 215 mm became recharge to the aquifer. This equates to about 65,000 cubic metres over the 30 hectares and indicates an average infiltration rate of about 3.4 mm per day or about 1030 cubic metres per day. The groundwater modelling presented in Sections 5.2.3 of the EIS includes assessment of the effects of establishing the waterways on groundwater levels in the vicinity and Section 5.2.6 presents an assessment of the expected rate of groundwater inflow to the marina waterways. The modelling indicates an average lowering of the groundwater levels over the adjacent inundated area of 300 mm to 500 mm, with 300 mm furthest from the waterways and 500 mm nearest to the waterways. In addition, the modelling shows an inflow to the waterways from the groundwater beneath the inundated area east of the site of about 290 cubic metres per day. Although the groundwater inflow to the waterways from the east will clearly not all be from the inundated area, a conservative assessment of the effect of the waterways can be made by assuming that the inflow to the waterways results in increased groundwater infiltration from the inundated area by the same amount. This is equivalent to assuming that the surface water of the inundated area supplies all of the inflow to the waterways from the east via the groundwater system. If this assumption is made it indicates that in 2004 the establishment of the waterways would result in the infiltration rate in the inundated area being increased from
Late Submission 3 Comment 6	The EIS process did not identify the presence of a wetland of national importance. The assessment of the Development Plan in the EIS states “there are no wetlands on the site”.	

		approximately 1030 cubic metres per day to approximately 1320 cubic metres per day. This equates to an increase from 3.4 mm per day to 4.4 mm per day and, after allowing for adjusted evaporation, would result in drying occurring in about 8.1 weeks, ie about 0.9 weeks sooner. If seasonal variability in rainfall and groundwater levels is considered, as is presented in Appendix C, the groundwater outflow from the east might be more than that presented by the model. The sensitivity assessment indicates that the outflow might be as much as approximately 390 cubic metres per day and this would result in drying occurring approximately 1.3 weeks sooner, as compared to 0.9 weeks sooner as discussed above. Note that this increased groundwater flow would only occur in a very wet year, when the inundated area to the east contains more water and thus will be wet for longer. Nevertheless, the assessment provides a representative indication of the effects of establishing the waterways. This assessment indicates that the groundwater flow to the waterways is small in the context of the volume of water in the adjacent periodically inundated area and only minor change to the period of drying is expected. The potential effects of these changes on vegetation were discussed in the EIS (Section 5.2.5 and Appendix 11), which concluded that: *"The critical factor for the survival and regeneration of the M. halmaturorum is the period of seasonal inundation. Over recent years, depending on the amount of winter rainfall, the area east of the project site has standing water from about May to November. This is not expected to change significantly. It is possible that after completion of the final stage of the development (10 to 15 years), the draining of this area through the aquifer into the marina basin may bring drying on more quickly. This possible change may be offset through stormwater management involving a system of retention basins that will allow infiltration of stormwater into the groundwater and its redirection towards the swamp area.* *Taking all these factors into account, it is not expected that the survival of the M. halmaturorum will be threatened. The removal of stock will aid regeneration. If any changes in vegetation structure do occur, it will be over an extended period and if seasonal drying of the swamp happens slightly more quickly than currently, conditions may favour the Gahnia filum (chaffy saw sedge). This successional shift is expected to have minimal effect on the habitat value of the swamp area."*

		In summary, it is expected that the area will continue to be inundated in wet periods from both local catchment and inflow of water from further east. Increased infiltration to the groundwater as a result of establishing the waterways may result in marginally quicker drying and this is unlikely to have any adverse effects on the flora and fauna.
5.2.6 Groundwater - Effects on Land Use		
Government		The land referred to as having limited primary production capacity is the land within the development area. This land is low lying and differs from the higher land to the south. Soil texture is sand and organic carbon content is very low. Moisture holding capacity is correspondingly low. The structure and inherent fertility of the soil improves with distance and elevation from the coast and productivity likewise improves. The EIS sets out in Section 5.2.5 the expected effects of the groundwater levels changes on the nearby land and native vegetation. Marginally reduced drying times are anticipated for nearby areas that are periodically inundated. The EIS states *"The most significant effect of the reduced groundwater levels is expected to be the improved drainage in seasonally inundated low-lying areas. As a result of periodic inundation or very shallow groundwater levels, some areas currently exhibit low agricultural productivity, elevated groundwater salinity or elevated soil salinity.* *After construction of the waterways, land currently subject to seasonal inundation within the groundwater depression zone is likely to be inundated less often or for shorter periods, thus allowing improved agricultural productivity and reduced soil salinity over time. In addition, low-lying areas within the groundwater depression zone will become more suitable for residential or commercial use. In the more elevated areas where the depth to the groundwater is greater, no noticeable effects are anticipated."*
	There are no government submissions on this issue.	
Public		
Public Submission 5 Comment 1	Depression of water table will have an adverse effect as I rely on high watertable during summer and autumn to provide green feed for my stock, which would result in a major loss of productivity for my business.	
Public Submission 8 Comment 4	5.3.10 of the EIS states the land is limited in primary production capacity but our farm is good grazing country and many properties in the area grow good crops. Land may become limited in its capacity if the watertable is affected.	
Public Submission 15/22 Comment 1	Concerned that the proposal will lower the water in the unconfined aquifer and that the flow of fresh water to the sea will increase, particularly when Stage 2 is completed. On our low-lying flats the water is 1.2m below the surface, which keeps perennial grasses green all year.	
Public Submission 18 Comment 1	We have grave concerns that the digging will effect underground water and hence impact efficient running of our property.	
Public Submission 18 Comment 4	The EIS lacks understanding of agricultural use of our land. There would be no economic benefit to nearby primary producers, only a detrimental effect.	
Public Submission 18 Comment 5	We rely on the swamps flooding during winter and early spring to reduce any salinity build up, wet winters produce good fodder on the high ground, and reduced groundwater levels from the marina would be permanent.	

Public Submission 23 Comment 2	We have fresh green natural pastures 11 months of the year due to the root system being ion the unconfined aquifer, which is essential to our beef and lamb production and be financially devastated if the watertable was lowered by the development.	Refer to response above.
Public Submission 26 Comment 1, 2 & 3	My land is in close proximity to the development. It is still quite productive and not degraded, as suggested in the EIS, and still suitable for growing crops, fattening lambs and breeding cattle. It is my only income at the moment. The suggestion in the EIS that the later stages may result in increased risk of seawater intrusion is very alarming as this would make the land useless.	
Public Submission 29 Comment 44	The farmland within the groundwater depression zone is used for lamb, wool and cattle production, and for growing lucerne and other hay. The seasonal inundation provides moisture for green feed during dry months. Reducing inundation will significantly increase feed costs.	
5.2.7 Groundwater – Response Time to Reach Equilibrium		
Government		The groundwater model has been developed as a steady state model in order to determine the long term effect of establishing the waterways on the unconfined aquifer. The actual interim changes will be less than the long term changes and changes will occur progressively over time as the groundwater system will take some time to respond to changes and also as the waterways will be established in stages that span approximately 10 years. As the model is a steady state model, it does not determine the time for equilibrium of groundwater levels. Nevertheless, it is reasonable, and conservative, to assume that the ultimate effect on the groundwater system will occur soon after the completion of the waterways and based on the expected staging of the waterways, as presented in Section 3.7 of the EIS, will reach equilibrium in about 2016. The response time of the groundwater system to changes is indicated by it speed of responses to existing fluctuations. Information provided in Section 4.14 of the EIS indicates the rate at which the groundwater system responds to seasonal and tidal fluctuations is relatively rapid. The methodology of determining the expected location of the seawater interface is set out in Section 4.14.11 and 5.2.3 of the EIS. Its location is dependant on the elevation of the groundwater level and as the model does not determine the time for equilibrium of groundwater levels, the time for equilibrium of the location of the seawater interface is also not determined. Again, it is reasonable to expect that the
Gov Submission 12, Planning SA, Comment 56	Can the groundwater model be used to predict the time for equilibrium of groundwater levels after establishment (and thus the location of the seawater interface) in order to provide a better indication of potential effects on existing groundwater users?	
Public		
	No public submissions received on this issue.	

		location of the seawater interface will reach equilibrium soon after establishing the last stage of the waterways, which is about 2016, although it is commonly understood that changes to the location of the interface can take significant time to respond to changes in groundwater levels so it may take some time to stabilise after the waterways are established.
5.2.8 Groundwater – Water Allocation Plan		
Government		Various measures to mitigate the effects of the development on the unconfined aquifer are discussed in the EIS and further outlined elsewhere in this Response Document. In addition, a Groundwater Monitoring and Management Plan is being prepared and will detail these measures. The only activity to be licensed in accordance with the Lacepede-Kongorong Water Allocation Plan is the extraction of water from the confined aquifer for the purposes of establishing the town water supply. Additional investigations to better assess expected level changes in the confined aquifer will be conducted in the near future, as soon as the appropriate equipment is available. The investigations that have been carried out to date and the proposed additional investigation are detailed in Section 5.2.21 and Appendix 23 of the EIS.
Gov Submission 10, SECWMB, Comment 5	Is the anticipated mean groundwater (unconfined aquifer) level change acceptable per the Lacepede-Kongorong Water Allocation Plan? The EIS needs to present mitigation measures in case the trigger levels are exceeded.	
Public		
	No public submission received on this issue.	
5.2.9 Groundwater – Monitoring and Management		
Government		The Groundwater Monitoring and Management Plan (GWMMP) is being developed to define the monitoring and management requirements for groundwater matters associated with the development. Responsibility for the implementation of the GWMMP, including costs, lies with the proponent. A comprehensive bore survey is proposed as part of the GWMMP to identify the location and details of existing groundwater users and to undertake a baseline assessment of groundwater conditions at these locations. Invitations to participate in the monitoring program will be sent to property owners located within the Cape Jaffa settlement and approximately within the 0.2 m drawdown contour (as shown on Figure 5.9 of the EIS). The following information will be collected from the bores nominated by interested parties: • location (GPS); • details of well construction; • pump details;
Gov Submission 10, SECWMB, Comment 9	Groundwater Management Plan: The GMP appears to cover the requisite aspects for the monitoring of groundwater resources to ensure that the development does not have a deleterious effect. However, it is unclear in the document where the responsibility lies for the implementation of the plan, including the cost of supporting monitoring activities prior, during and after construction of the marina.	
Gov Submission 11, SENRCC, Comment 3a	As indicated in the EIS, there will be some permanent lowering of levels in the unconfined aquifer in the vicinity. This may adversely impact existing groundwater users and may result in reduced supply or loss in quality. A comprehensive bore survey within the likely zone of groundwater level impact is recommended.	

Gov Submission 11, SENRCC, Comment 3b	The assessment that nearby land is likely to experience less inundation and become more suitable for residential and commercial use, as a result of groundwater level changes, is considered somewhat subjective. This will need to be monitored and assessed following development of the marina.	• groundwater salinity; and • groundwater level. Existing groundwater wells close to the marina will form part of the monitoring program during development. Another key feature of the GWMMP is the monitoring of wells established by the proponent on nearby land (refer Figure 4.68 of the EIS). The purpose of this component of the monitoring program is to validate and update the conceptual and numerical models as required and to anticipate potential effects as the development progresses. The proponent has established groundwater monitoring wells within and adjacent to the areas of dune vegetation, Bernoulli Conservation Reserve and the paperbark swamp located east of the site. These wells will be monitored during development of the site as identified above, and water level and salinity data will be reviewed together with the Vegetation Management and Monitoring Plan to assess the potential affect on vegetation. The Vegetation Management Plan is discussed elsewhere in this document. As part of the GWMMP, a groundwater monitoring well will be installed at depth to identify the nature of the freshwater/seawater interface and to monitor changes of the interface during development. This monitoring program will assist in anticipating, where possible, future effects to existing groundwater users as a result of the changes to the interface. During Stage 1 of the development, wells in proximity to excavations will be monitored more frequently to test conclusions of the model. Monitoring of dewatering activities will be used to anticipate potential effects as the development progresses. If potentially unacceptable affects are identified the management plan will provide means to altering the dewatering in order to minimise effects.
Gov Submission 12, Planning SA, Comment 72	Groundwater levels should be monitored and this should be combined/linked with monitoring of the dune vegetation in case the level of any freshwater lens that sits on top of the groundwater under the dunes is lowered.	
Gov Submission 13, EPA, Comment 6	Changes to the fresh/saline groundwater interface need to be determined to assess potentially effected groundwater wells and develop management strategies in case impacts occur.	
Gov Submission 13, NVC, Comment 26.4	The NVC requests that the EIS document be amended to include provision for the establishment of groundwater monitoring sites in Bernouilli Conservation Reserve, the M. halmaturorum wetland area within the proposed development and adjacent areas of coastal dune. The EIS document should be expanded to include a Monitoring Plan needs to be submitted and approved, prior to development approval. That plan should include a review of current studies of drawdown effect on similar vegetation, described the experimental method to be used in the establishment of the proposed monitoring sites, and expands on the methods (mentioned in Appendix 11) to be used to manage water regimes should an effect on the vegetation be recorded.	
Gov Submission 14, DWLCB, Comment 3	The staging of the development to limit the zone of influence caused by dewatering activities during construction is a good approach, considering the limitations and the assumption made for the model. It is recognised that the TLA is a multi-layered aquifer consisting of limestone, marly limestone and marl, with different hydraulic properties.	
Gov Submission 14, DWLCB, Comment 4	Scenario 2 of the model simulation, the Stage 1 dewatering example, needs to be tested and checked during construction for the impact of change in saltwater/fresh water interface due to changes in groundwater heads by the dewatering. A predicted change of 0.2m to 0.6m by the model could cause a change of 8m to 24m in the saltwater/fresh water interface (using the Ghyben/Herzberg relationship). This is important to other users close to the coast, as Table 2.1 estimated the depth to be between 18 metres to 33 metres	

	below ground level at a distance of 100 – 200 metres from the coast, and about 30 – 38 metres at a distance of 500 metres from the coast.	
Public		Refer to the responses presented above.
Public Submission 11 Comment 2	CJDC bores should be monitored long term.	
Public Submission 20 Comment 3	Any effect on groundwater is traditionally difficult to resolve and careful monitoring should be instigated. We believe that groundwater should be monitored for a long period of time before any actions that might compromise it are commenced.	

Coastal		
5.2.10 Coastal Hazard Management		
Government		It is acknowledged that the minimum site and floor levels of 2.5 and 2.75 mAHD respectively, and the maximum level of the breakwater of 2.5 mAHD, can be specified in the authorisation.
Gov Submission 8/13, DEH, Comment 19.1	The minimum site and floor levels (2.5 and 2.75 mAHD) meet the Coastal Protection Branch of DEH (CPB) minimum recommendation and should be specified with any authorisation granted. The maximum level of breakwater (2.5 mAHD) should also be a condition of approval in order to minimise amenity effects.	
Gov Submission 8/13, DEH, Comment 19.2	The setback of residential allotments, proposed coastal reserve and further buffer are considered to assist long term coastal protection and satisfy DEH concerns regarding potential coastal erosion for the majority of allotments. A number of allotments are proposed closer to the high water mark however this area is expected to accumulate sand and the proposal incorporates measures that are expected to provide hard protection, which should be constructed to a minimum level of 2.5 mAHD. DEH advise that CPB policy does not support the provision of grants for repair or damage of the facility or adjacent coastline, as a result of the construction of the facility, including storm damage. Council's acceptance of responsibility for long-term maintenance and upgrading of the facility and adjacent coastline should be determined prior to approval.	It is acknowledged that the design satisfies the coastal protection requirements of Department for Environment and Heritage and that the long term maintenance and upgrade of the facility that may result from coastal processes is the responsibility of the proponent. This is in accordance with the responsibilities as set out in the EIS in Sections 5.4.5, 5.5.8 and 5.5.16.
Gov Submission 8/13, DEH, Comment 19.11	The EIS incorporates provision of a public reserve of at least 50 metres in width with an additional erosion buffer, which is considered to satisfy DEH potential coastal erosion concerns as well as maintaining adequate beach areas should long term coastal recession occur.	
Gov Submission 8/13, DEH, Comment 19.4	The EIS presents proposed sand bypassing, monitoring of sand accretion/erosion and modelling of the effect of the breakwaters on the shoreline. Appropriate ongoing monitoring is required to ensure the rate of bypass represents the littoral drift. DEH advise that bypass of sand in excess of 9 cubic metres is development and would need to be the subject of further development approval, whereby the	The EIS described the proposed adaptive coastal management program. This ongoing monitoring and maintenance regime forms part of the proposal and is represented in the Adaptive Coastal Sand By-Pass Monitoring and Management Plan (SBMMP) that is currently being developed. See Sections 4.13, 5.2.13, 5.2.16 and 5.2.17 of the EIS. This proposal incorporates the requirements for development in the nature of sand

	CPB has the power of direction. DEH further advise that the Coastal Protection Board policy does not support assistance in costs of management, operation or remediation of impacts resulting from the development.	by-pass of 9 cubic metres or more and accordingly no additional application for approval is required. This requirement is also incorporated in the SBMMP. Costs of management, operation and maintenance are the responsibility of the proponent.
Public		This bay is the result of many centuries of erosion and accretion with a net accretion or build-up of sand, as evidenced by the creation of sand dunes along this coast. It is not correct to assume that sand build-up results from seagrass loss. It is also incorrect to assume that seagrass beds are being lost in the bay. Sections 4.13 and 5.2.11 to 5.2.18 of the EIS contained detailed discussion on the coastal processes.
Public Submission 1 Comment 5	Sand build up is occurring on beaches, particularly Pink's area in the bottom of the bay, due to sea grass loss.	
Public Submission 29 Comment 48	Constant dredging of the entrance channel will most likely be required as sand and seaweed are transported past the end of the breakwater, as experienced at Robe. Dredged material then has to be disposed of. Interference with the marine environment will have undesirable consequences.	The movement of sand and seagrass wrack and the effects of dredging have been reviewed in various sections of the EIS, including Sections 4.7 to 4.13, 5.2.6, 5.2.7, 5.2.13, 5.2.28. 5.3.3, 5.5.1, 5.5.10, 5.6.9, 5.6.16 and Appendices 13, 16, 21 and 27. The relevant monitoring and management plans will further define requirements to manage and mitigate these potential effects.
Public Submission 30 Comment 20	There has been considerable investigation into the positioning of the breakwater and we are not suggesting an alternative location. It sits on the apparent point of division between accretion and erosion and it is well positioned with regard to the existing foredune vegetation. The breakwater itself may provide some extra habitat.	It is acknowledged that the breakwater has been located in a most opportune position and designed to minimise future management of sand and seagrass wrack movement. The costs associated with the maintenance of the channel have been considered and incorporated as part of the short and long term management arrangements. These works, and the associated costs, are the responsibility of the proponent and the EIS sets out details of how this has been provided for.
Late Submission 2 Comment 5	I acknowledge that the breakwater design will hopefully prevent seaweed build-up within the channel. However, debris will inevitably build-up and there will surely be ongoing cost in keeping the channels clear.	
5.2.11 Seagrass Wrack Management within the Waterways and on Adjacent Beaches		
Government		It is acknowledged that management of seagrass build-up, whether it occurs adjacent to the breakwaters, within the breakwaters or within the waterways, will be the responsibility of the proponent. This proposal incorporates the requirement for development in the nature of relocating seagrass wrack of 9 cubic metres or more and accordingly no additional application for approval is required. Modelling has been performed that describes the currents at and adjacent to the
Gov Submission 4, PIRSA, Comment 1	The potential need for removal of seagrass wrack is an activity that is managed by PIRSA Fisheries. The need for early discussions with PIRSA Fisheries about the management of seagrass removal is flagged as a priority.	
Gov Submission 8/13, DEH,	The breakwaters are expected to effect the natural accumulation and dispersion of seagrass wrack in the area.	

Comment 19.5	The EIS discusses management of seagrass wrack on the beach between the breakwaters, but does not detail any modelling that demonstrates that there will not be build-up within the breakwaters (channel and basin) nor mention to where such wrack is to be relocated. It is recommended that a note or condition of approval be applied making the proponents aware that relocating in excess of 9 cubic metres of seagrass wrack constitutes development and would be subject to direction from the Coast Protection Board.	breakwaters in flood and ebb tide conditions. The effects of various wind conditions have been incorporated in this modelling and some of the results are presented in Section 5.2.22 of the EIS (Figures 5.37 and 5.46). Further detail is provided in Appendix 21 of the EIS. As wind driven currents are a major contributing factor to the transportation of suspended seagrass, this modelling provides a reasonable understanding of the areas of likely deposition of seagrass wrack. Modelling of seagrass settlement is unlikely to provide a clearer picture of deposition given the random nature of the movement of individual seagrass wrack particles and variations in settlement velocities. Winds and wind driven currents move seagrass particles that are suspended in the water column and then breaking waves "filter out" and cast the wrack onto the beach. As a result, build-up is expected to occur when currents have an onshore component, particularly west of the breakwaters during periods of north to north-west winds. The design and orientation of the breakwaters has been performed to minimise the potential for it to accumulate long-term and to allow as much as possible to clear seasonally, as currently occurs during the summer when winds have a more southerly component. Anecdotal evidence and the lack of seagrass in the shallow sediments at Cape Jaffa indicates that long-term build-up of seagrass wrack does not occur at Cape Jaffa, although at Kingston, where the beach orientation is such that the winds have more of an onshore component all year round, the wrack that is cast on the beach does definitely accumulate long term. Nevertheless, management of accumulated seagrass wrack may be required and is further discussed later in this Response Document.
Gov Submission 8/13, DEH, Comment 19.6b	The flushing study does not discuss/model the possibility of seagrass wrack entering the waterways or determine where the seagrass would settle if the sea grass did enter the waterways. Seagrass wrack decomposing at the bottom of the waterways would pose a significant environmental risk and the assumption of a non-settling constituent would not apply to decomposing seagrass wrack. It is strongly recommended that some form of modelling be performed to demonstrate the likelihood of seagrass wrack movement and accumulation in the waterways. It is recommended that contingency management plans be implemented for the management and removal of seagrass wrack.	The arrangement and orientation of the mouth of the breakwaters minimises the likelihood of seagrass suspended in the water column entering the waterways. Nevertheless, during periods of on-shore (north to northwest) winds, when the near-shore waters have higher concentrations of suspended seagrass, some will enter on a flood tide. The only beach area within the breakwaters where waves are expected to deposit wrack is the area of beach between the breakwaters east of the channel entrance to the main basin. Any settling that occurs within the waterways will result in deposition of some seagrass wrack in the floor of the waterways. This may be sufficient to warrant management and the Waterways Monitoring and Management Plan, together with the Seagrass Wrack Monitoring and Management Plan, discussed later, are designed to monitoring and manage this potential outcome. If required, dredging of the seagrass wrack is expected to be the most practical management technique, as is performed periodically in similar facilities such as at North Haven on the Adelaide coast. Should this be required, it is
Gov Submission 11, SENRCC, Comment 11	There has been inadequate assessment of the possibility of seagrass wrack entering the marina. Such impacts need to be assessed and appropriate contingency management plans developed, if considered necessary.	

Public		acknowledged that this would be the responsibility of the proponent. The EIS contains various additional relevant discussions, particularly in Sections 4.10 to 4.12 and 5.6.16.
Public Submission 4 Comment 2	Concerned about seaweed build up between the jetty and the breakwater.	
Public Submission 9 Comment 4	The breakwater will stop the natural flow of seaweed along the beach, causing it to buildup and rot where it rest, covering the white sandy beaches, stinking the area out, filling underneath the jetty and restricting recreational fishing from the jetty.	
Public Submission 16 Comment 3	We agree with the EIS in regard to the current movement of seaweed along the beach. However, we disagree with the EIS that the breakwater would not collect seaweed by stopping its natural movement along the beach. The effects of the breakwaters will be changed water currents, water swirling around the breakwaters, massive beach erosion on the eastern side and blocked channel. The rotting seaweed will result in a putrid smell and no beach to walk on.	
Public Submission 24 Comment 4	Building the breakwater would cause a huge build of seaweed, blocking the channel and spoiling the beach.	
Public Submission 27 Comment 11	The EIS asserts that the annual seagrass wrack buildup on the beach during Autumn and winter is removed by a combination of offshore winds and high tides in spring. Observation over many years clearly shows that seagrass wrack is removed by the interaction of winds, swell and tide, resulting in a sea surge along the beach in an easterly direction. Contrary the EIS, the breakwater will result in a buildup on the western side of the breakwater, resulting in an offensive, smelly and maggot infested mass of rotting seagrass.	
Public Submission 29 Comment 47	Any solid construction into the sea causes alteration to the normal movement of the water, sand and seaweed. It will therefore probably cause a build-up of seaweed and sand on the western side of the breakwater, stretching to and covering part of the jetty, if left unchecked, as has occurred in Kingston.	
Late Submission 1 Comment 2	Seaweed buildup around the breakwater will cause a stink hole. Currently, natural storms clean the beach.	

Late Submission 2 Comment 4	The dredging on the entrance channel and breakwater construction will adversely effect the current flows along the beach and cause uncontrollable, monstrous accumulation of seagrasses. Seagrass deposits on the beach and is cleared naturally during summer. The breakwater will interrupt the natural cleansing of the beach and thousands of tonnes of seaweed will accumulate against the breakwater and damage the sensitive coastline.	Refer to response above.

Water		
5.2.12 Swimming in Designated Areas		
Government		It is acknowledged that the areas identified for direct contact will need to meet the Australian Guidelines for Recreational Use of Water (NH&MRC1990) and NWQMS (ANZECC 1992). The monitoring and management requirements for ensuring water quality is acceptable before allowing direct contact activities will form a part of the Waterways Water Quality Monitoring and Management Plan.
Gov Submission 2, Dept. of Health, Comment 10	The proponent will adopt measures to ensure public health and safety related to the use of water in the marina. These are generally supported with the exception of allowing swimming and wading in the waterways. All areas intended for primary contact (eg swimming, wading, bathing and direct contact water sports) and secondary contact (boating and fishing) should comply with the relevant guidelines: Australian Guidelines for Recreational Use of Water (NH&MRC1990) and NWQMS (ANZECC 1992). The Department of Health recommends that the water in the marina be regarded as unsuitable for primary contact until it is shown otherwise. Secondary contact may be suitable if the water complies with the guidelines.	
5.2.13 Marina Water Quality – Stormwater Management		
Government		The proposal is to direct stormwater away from the waterways, as set out in Sections 5.2.4, 5.4.11, 5.6.13, 5.7.2 and Appendix 19 of the EIS, and to utilise stormwater for localised infiltration into the soil profile.
Gov Submission 8/13, DEH, Comment 19.6a	The EIS incorporates numerous models that predict the level of flushing and indicates that the waterways are well flushed during normal tidal conditions. The south west arm has been identified as the critical area as it has less flushing than the rest of the waterways. As proposed in the EIS, stormwater must be redirected to a stormwater treatment facility and not directly into the waterways, to ensure that contaminated stormwater or other wastes are not discharged into the waterways, especially the south west arm during unfavourable weather conditions.	
Public		
	No public submission received on this issue.	

5.2.14 Use of Confined Aquifer for Town Water Supply		
Government		The health and well being of the community will be enhanced by the provision of a reticulated water supply to which existing residents will be able to connect. The benefits of the communal wastewater system are discussed in Section 5.2.15 of this response document.
Gov Submission 2, Dept. of Health, Comment 4a	The opportunity for the existing residents at Cape Jaffa to be connected to the water reticulation and communal wastewater systems is welcomed as it should result in better control of risks to health and contribute to the South Australia Strategic Plan Objective 2, Improving Well-being.	
Gov Submission 7/13, DWLBC, Comment 22.3b	The EIS does not outline details of the impact on existing residents of the new water supply/sewerage treatment system. Has research been undertaken to determine if existing users are willing to transfer onto the new infrastructure? Who is responsible for the costs of transfer? What, if any, are the consequences of existing residents choosing not to transfer? DWLCB requests a survey be conducted on the costs involved for existing residents to use the new infrastructure and the options available to residents.	No existing residence can be forced to connect to these services by the proponent. There are a number of residents wishing to connect when the services become available. There are costs and risks associated with operating an individual private water supply. The costs include the capital for the infrastructure ie. bore, pump and storage and the ongoing power costs to supply flow and maintenance. Additional infrastructure for rainwater catchment and storage is required for drinking water although some have suggested the groundwater from the unconfined aquifer is used for drinking. For those connecting at the time the main is installed, a connection and metre will be supplied to the boundary at no cost to the individual. For those not choosing to connect, and while the main is in private ownership, there will be no charge for the main passing the property. Should the main revert to Council or SA Water, charges may apply in the normal manner. For those wishing to connect at a later time, costs of the works and materials to create the connection will be charged whilst the infrastructure remains the property of the proponent.
Gov Submission 7/13, DWLBC, Comment 22.3a	Based on limited existing information, a maximum of 43 megalitres per annum can be withdrawn from a single confined aquifer well, which is apparently sufficient to meet the needs for Stages 1 to 3 of the development. An investigation well has been drilled into the confined aquifer but pump and other tests required to allow for a more detailed assessment of the likely impacts of the proposed extraction are yet to be carried out. Once this information is available, further assessment can be made of the effects of extracting the full amount required. Further to previous correspondence, DWLBC requests that pump tests be carried out on the investigation well drilled into the confined aquifer.	Further investigations have been undertaken to identify options for the provision of an appropriate town water supply at Cape Jaffa. One of these options is the use of water from an existing bore located approximately 17 km east of the site. Initial flow testing indicates favourable results and the flow capacity is likely to be in excess of the 43 mega litres required for the initial 3 stages of the development. Detailed investigations of the aquifer, including pump testing of this bore are being conducted to confirm the sustainability of extraction of the full amount of the water required for the development and the existing township. This includes investigations regarding the sustainability of supply, potential effects on the aquifer and other users of the aquifer and the potential salinity effects of the increased groundwater use.

Gov Submission 7/13, DWLBC, Comment 22.3c	Investigations need to be undertaken to further evaluate the potential salinity impacts of increased use of groundwater? DWLBC requests a groundwater management plan be prepared, including investigations to determine the direct salinity impacts of increased groundwater use.	As a result of the Ministerial approval and the changes that are to be incorporated in the Water Allocation Plan, it is understood that water allocation to utilise confined aquifer for a town water supply is available, subject to provision of the additional information required.
Gov Submission 10, SECWMB, Comment 3	SECWMB supports the comments made by DWLBC (Gov Submission 13 Comment 22.3a) regarding the need for pump testing of the confined aquifer.	
Gov Submission 11, SENRCC, Comment 12	The EIS indicates that reticulated water is to be established from the confined aquifer and extended to the existing development. The reference to the water supply being sourced from the unconfined aquifer (first paragraph of Section 5.2.21) is assumed to be incorrect. It is considered that the stated thickness of the confined aquifer of about 22 metres is optimistic and is more likely to be about 9 metres. It is possible that the exploration bore intersected the Mepunga Formation and not the Dilwyn Formation. It is considered that, whilst one bore may be sufficient, the construction of an additional bore as a standby would be prudent. It is not clear whether any water quality testing was undertaken in the exploration bore.	Reference in the first paragraph of Section 5.2.21 of the EIS to the unconfined aquifer is incorrect. The Ministerial advice, incorporated in Appendix 7 of the EIS, refers only to the confined aquifer. The comments regarding the thickness of aquifer and likely formation intersected are acknowledged and generally agreed. Further, it is agreed that whilst one bore may be sufficient, the installation of an additional bore would be prudent. The ongoing investigations will include assessment of the confined aquifer for the appropriate development of a bore field to satisfy the long term water requirement in a sustainable manner. It is anticipated that the bore field will be developed in a staged manner to meet the progressive increase in water required as the development proceeds. The anticipated need of the initial three stages is expected to be satisfied by the existing bore and pumping testing is being conducted to confirm this and assess the potential effects on the aquifer. It should also be noted that sustainable water practices will be encouraged in line with water sensitive urban design principles employed to reduce water demand. These factors will promote efficient use of the available water resources and allow the further development of the Cape Jaffa area without being impeded by water supply availability. Water quality testing is incorporated in these ongoing investigations.
Gov Submission 12, Planning SA, Comment 58	Given DWLBC indication of availability of water, what are the alternative sustainable water supply options and economic impacts for the later stages of the development. Additional information is required on pump tests of the confined aquifer.	
Gov Submission 14, DWLCB, Comment 5	A sustainable water supply is an important issue for this project and it hasn't been addressed fully in this report. A well was drilled to investigate the source for a water supply, mainly within the confined aquifer. It is not clear if any test were carried out to assess the production capacity of the aquifer and the quality of the water within the zones penetrated by the drilling.	
Public		Permission has been granted to extract 43 mega litres per annum as an interim measure, leading to the revision of the current water allocation plan. This will
Public Submission	Inadequate information on the quantity and quality of the town water supply.	

18 Comment 8		provide adequate water for the water requirements of the project prior to the next revision of the water allocation plan.
Public Submission 30 Comment 26	Permission to use the confined aquifer for water supply is not guaranteed.	
Late Submission 2 Comment 2	Supply of quality water from elsewhere would be costly and not practical as it would put demand of the unconfined and confined aquifers.	
5.2.15 Wastewater Treatment - Benefits to Existing Community		
Government		SENRCC acknowledges that there is likely to be adverse impacts from individual septics on the unconfined aquifer water quality. The provision of a community waste water system for future development with the opportunity to encourage others to connect is a favourable environmental outcome and reduces the associated public health risks. Normally where areas have on-site disposal via septic tank and trench and council develops a STEDS or CED scheme, it does so at a standard cost per allotment to cover the costs of the infrastructure. Similarly if a SA Water service is provided, even though an allotment may not be connected to a service, a service charge is applied to all owners who's property the service passes. In this instance, the only costs to be borne by the existing residents will be the connection from the house to the main service. In doing so this will reduce the risk of detrimental effects on the groundwater and human health. There are therefore economic public health and environmental incentives in the proposal. The current Development Plan incorporates significant areas for residential and industrial development at Cape Jaffa without incorporation of a communal waste water treatment facility. The potential effects and risks from this greater development will also be removed.
Gov Submission 2, Dept. of Health, Comment 4b	The opportunity for the existing residents at Cape Jaffa to be connected to the water reticulation and communal wastewater systems is welcomed as it should result in better control of risks to health and contribute to the South Australia Strategic Plan Objective 2, Improving Well-being.	
Gov Submission 11, SENRCC, Comment 5a	It is agreed that the existing use of individual septic disposal trenches at Cape Jaffa is likely to be causing adverse impacts on the unconfined aquifer quality. The establishment of a full sewer system extended to the existing settlement is supported. Provision of incentives for existing dwellings to connect to the sewer system should be considered.	
Public		Various government agencies regard the groundwater of the unconfined aquifer in areas where effluent disposal occurs as a risk to health. Many of the bores are in close proximity to the sea and do not exhibit salinisation. The creation of the waterways does not result in a breach between fresh and salt water. Rather the interface remains, albeit varied in location. Monitoring of the bores is proposed as part of the ongoing monitoring and management of the groundwater and early detection of changes are able to be determined.
Public Submission 7 Comment 2	EIS suggests septic water is contaminating the groundwater but we can and do drink it, wash in it, use it in the household and gardens. The development will flood it with saltwater, making it useless.	

Public Submission 29 Comment 41	There are currently no health issues associated with the groundwater usage. If the population is maintained at its current level it should not be a concern.	It is readily acknowledged by relevant authorities that there are health risks in the use of the unconfined aquifer water where effluent is disposed. The population will not remain at its current level as the existing Development Plan incorporates significant areas for residential and industrial development at Cape Jaffa.
Wastewater – Treatment and Irrigation Management Plans		
Government		It is acknowledged that a separate approval is required in relation to the detailed design of the wastewater treatment plant from Department of Health. It is also understood that the concept, layout and location of these facilities is adequately covered as part of the current overall assessment of the development. Draft Monitoring and Management Plans for wastewater treatment and irrigation using reclaimed water are being prepared. It is recognised that these plans are critical to ensure the appropriate management of these activities and, despite the fact that detailed design of these facilities has not yet been finalised, work has begun on documenting the monitoring and management requirements. It is also noteworthy that the form and nature of these facilities do not differ from those that would be established for the expanded Cape Jaffa township in accordance with the existing zone provisions and that these types of facilities are common practice. A modular treatment system is proposed that allows progressive upgrades as and when required. The initial stage of wastewater treatment and irrigation management system will be designed to cater for Stages 1 to 3 of the development and will be based on conservative assumptions, including a value of 3.5 people per allotment all year round, in accordance with Department of Human Services "Aerobic wastewater treatment system design criteria for towns and other large developments". In later stages, as the system is upgraded for increased loads, historical records of actual loadings on the system and population/census data will be used to refine actual loadings and allow more accurate definition of capacity requirements for the future upgrades. Flows from all sources, including apartment, motel and cabin accommodation, the existing township, vessels and trade wastes will be incorporated in the design requirements for the WWTP. The proposed siting of the waste water treatment plant is the south eastern corner of the site as depicted on Figure R2. Various options exist for the use of biosolids from a wastewater treatment plant. They include liquid injection into the soil on agricultural land and in this instance it is prudent to keep the application area separate from the wastewater irrigation area.
Gov Submission 2, Dept. of Health, Comment 7	The winter value of 2 people per allotment to calculate the wastewater flows is considered too low. A value of 3.5 people per allotment should be used all year round. It is unclear whether the wastewater volume used includes flows from apartments, motel and cabin accommodation, boats, commercial and industrial areas. Wastewater flows from all sources must be included. Little reference has been made to future increases in the population and the effect this will have on the wastewater management system. The collection system, treatment system and irrigation area should accommodate future increased flows, i.e. a modular treatment plant, space requirements and ease of upgrade issues. The location of the wastewater treatment plant should be clarified. Management of biosolids should be addressed in more detail. A reference to composting of biosolids was found in Section 5.2.20, however other options exist and should be assessed. The issues raised above should be addressed and the concept plan for wastewater management reviewed as at present there is insufficient information for the Environmental Health Service to support it. It should be noted that a separate approval from the Environmental Health Service is necessary under the *Public and Environmental Health (Waste Control) Regulations*.	

		Permanent pasture and olive plantations are generally suitable for liquid injection, pending the stabilisation of the product. Dewatering either by drying beds or in geo-tubes and then application to agricultural land or incorporation into composts is another option. Agricultural industries include viticulture and olive plantations where dewatered biosolids may be incorporated at establishment. Biosolids may be used in municipal gardens provided sufficient safe guards for public health are included. More detailed information will be provided as part of the monitoring and management plan as outlined below and will form part of the documentation for the application to the Environmental Health Service under the *Public and Environmental Health (Waste Control) Regulations*.
Gov Submission 7/13, DWLBC, Comment 23	There appears to be no contingency plan in the EIS outlining the option of industry choosing to not take up use of the wastewater. DWLCB requests the preparation of a contingency plan outlining the different options for use of the wastewater should industry decide not to use it.	The EIS in Sections 3.5.22 and 5.2.20 sets out an irrigation scheme that provides for the disposal of the total compliment of treated water. This is a guaranteed use of the water and is not subject to negotiation. Since preparation of the EIS, negotiations regarding the use of the reclaimed water have continued. The primary reuse scheme proposed in the EIS, that is the irrigation of an agricultural crop or woodland on the land immediately east of the site has be confirmed as the preferred option and access to the land has been finalised to that end (refer to EIS Sections 5.2.4 and 5.2.20). The various other options for reuse will continue to be investigated but at present are concepts/possibilities for the potential higher value use of the water in the future. As a result, suitable management of the reclaimed water is not contingent upon industry choosing to take the water. As stated previously, a Draft Irrigation Monitoring and Management Plan outline is presented later in Section 5.5.4 Construction and Operational Effects. The IMMP initially covers the primary reuse option only. If other options are confirmed in the future then further documentation will be provided at that time as part of approval of appropriate revisions of the applicable licence conditions and management plans.
Gov Submission 11, SENRCC, Comment 5b	The reuse of reclaimed water through a developed Irrigation Management Plan is fully supported and additional assessment is required to: • determine the most appropriate crop, with emphasis on a crop such as lucerne hay that can be harvested to remove nutrients and which has a relatively high water use. Snail infestations may cause difficulty in establishing lucerne; and • determine the likely high volume of reclaimed water generated seasonally from the peak increases in population through the spring	The primary objective of the IMMP is to manage the application rate of water and nutrients to the land/crop to prevent or minimise escape to the aquifer. The water balance and nutrient balance assess the plant uptake of water and nutrients in comparison with the water/nutrient supply from the treatment plant/storage dam to define the maximum allowable application rate of water/nutrient. Further, the winter storage dam provides a buffer of balancing storage so that periods when supply is temporarily greater than crop demand can be managed. The activity will be managed via records of application and monitoring of the groundwater and soil conditions, and will be set out in the IMMP.

	and summer.	It is also acknowledged that lucerne hay should be considered the most appropriate reuse option, nevertheless, investigations into the relative merits of crop/woodlot options is ongoing. Although the establishment of lucerne can be hampered by various factors, including snail infestations, this is considered to be manageable, as evidence by the recent establishment of lucerne crops in the area, including just a few kilometres east of the proposed irrigation site. It should also be noted that the soil conditions are favourable for lucerne growth and that a number of new varieties of lucerne have been recently developed that aid it its management and establishment.
Gov Submission 12, Planning SA, Comment 32	What are the effects of reclaimed water irrigation on adjacent wetland and dune communities given the close proximity. The potential creation of a groundwater mound, implications for surrounding vegetation that may access the local water table and the need for a suitable buffer need to be addressed.	The irrigation will be undertaken using water balance analysis and management to ensure the quantity of irrigation matches the takeup rate of the crop. This is standard practice and will ensure there is no build-up of water and a consequential load on surrounding vegetation. As a result, the formation of a groundwater mound and potential effects on nearby vegetation can be prevented. As stated previously, a significant area is available for expansion of the irrigation activity if it is required for future upgrade or in case it is determined that application rates should be lowered.
Gov Submission 12, Planning SA, Comment 57	Clarify potential use of the nearby Council quarry area for reclaimed water reuse to ensure impacts on groundwater do not occur.	The use of the disused portion of the Council's quarry for reclamation, rehabilitation and subsequent irrigation is one of the potential options for the management of reclaimed water for the future. If the option is pursued, it is envisaged that spoil from the site could be used to rehabilitate the land to it's original landform. Subsoil and topsoil could than be replaced to return the land to agricultural use, and then the site would be appropriate for irrigation of an agricultural crop or woodlot. Once again, if this option is to be pursued in the future then further documentation will be provided at that time.
Gov Submission 12, Planning SA, Comment 66	The Irrigation Management Plan (IMP) is critical and will be a condition of approval, if it has not been finalised. Although underlying groundwater is saline and of limited agricultural use, surplus irrigation water could form a fresh water lens/groundwater mound above the existing unconfined aquifer and percolate to the sea unless the IMP maintains a satisfactory balance between evapotranspiration, surface storage and wastewater production. What is the alternate plan if the existing irrigation area is inadequate? Is there an option to expand the areas or change management?	It is acknowledged that the Irrigation Monitoring and Management Plan is an integral part of the licensing. Provision for future capacity upgrades, that is the expansion of the modular treatment plant, winter storage dam and irrigation area has been made. The area of land suitable and available for irrigation of a fodder crop or woodland and for construction of storage dam is significantly greater than just the area shown in Figure 5.12 of the EIS, therefore the contingency is to expand the area of irrigated crop as required.

Gov Submission 12, Planning SA, Comment 68	In relation to reclaimed water irrigation, it would be more appropriate to say the groundwater under the eastern side of the development is "approx 1,000 to 15,900 mg/L" than to say "as high as 14,900 mg/L" when referring to the groundwater quality under the eastern side of the development.	Acknowledged.
Gov Submission 12, Planning SA, Comment 69	What is the anticipated salinity of the irrigation water?	The anticipated salinity of the irrigation water is approximately 1200 mg/L. The groundwater under the irrigation area is somewhat saline and it has been measured as being in the range of approximately 1,000 to 15,900 mg/L.
Gov Submission 13, EPA, Comment 4	Winter storage dams for treated wastewater, and wastewater treatment lagoons need to meet EPA requirements in terms of siting and proximity to seasonal water table, as defined by the Water Quality EPP (2003) and the Draft Separation Distance Guidelines (2000).	The EPA requirements for the winter storage dam location and proximity to the watertable have been considered and the proposed location shown in Figure 5.12 of the EIS is considered the most appropriate location for this infrastructure. The requirements for lining and general construction of the storage dam are also discussed in the IMMP. Figure 5.12 of the EIS also shows the location of the reclaimed irrigation areas. Note that the figure shown in Appendix 20 of the EIS was produced as part of the initial concept design and is superseded by Figure 5.12. Groundwater testing in wells CJ15 and CJ15a and the results of the additional soil testing that has recently been conducted is discussed above in Section 5.2.2. This assessment shows that there is no surface soil contamination and that the elevated concentrations of some compounds in the groundwater are expected to be a result of the effects of evapo-concentration of naturally occurring compounds.
Public		
Public Submission 30 Comment 16	The irrigation storage area must be lined to prevent contamination of the groundwater.	
Public Submission 30 Comment 2e	There is concern over where the material excavated from the basin and waterways will go. The diagram in Appendix 20 showing the irrigation location and the SCMP states that the excavation spoil will be used in part to fill the area to be used for irrigation using reclaimed water. Testing in wells 15 and 15a is cause for concern. The spoil generated in this area might better be left where it is and not dug up and spread around the area.	

Management		
5.2.17 Management Responsibilities		
Government		The ongoing management responsibility, including liabilities for issues related to the development, is set out in Section 5.5.8 of the EIS and this section provides more information in regard to those requirements. The family of monitoring and management plans to be provided will set out the detailed MMP requirements and also the responsibilities in relation to those requirements, whereas this section discusses responsibilities for management of the development, and responsibility for implementing the MMPs.
Gov Submission 7/13, DWLBC, Comment 21	The EIS does not state who has liability for the development. There needs to be a statement included outlining that the State Government does not have liability for the infrastructure during or after completion of the development. It should also outline who does have liability for the infrastructure during and after completion of the development.	
Gov Submission 10, SECWMB, Comment 8	It is unclear what mitigation strategies exist in case of potential deleterious impacts on the groundwater resource. A statement regarding the responsibility for mitigation and/or remedial works would be of benefit.	The agreement between Council and CJDC sets out the responsibilities of each in relation to the management of the project during and after construction. CJDC are responsible for the management and maintenance of the facilities during, and for an extended period after construction. Maintenance responsibility then passes to Council for the long term. These responsibilities include monitoring and management of the effects of the development.
Gov Submission 11, SENRCC, Comment 8	It is not clear in the EIS who has responsibility for on-going monitoring and evaluation of impacts (particularly longer term) and responsibility for implementation of any mitigation measures, should these be required.	In order to avoid the general community being expected to bear any additional costs of management and maintenance, a marina maintenance fund will be established. Contribution is made to the fund by CJDC in the form of a lump sum upon the sale of each allotment, and by Council via a portion of rate revenue collected over the first 5 years from each allotment within the development. Ongoing rate revenue will also be allocated in part to the management and maintenance of this area as part of Councils normal responsibilities. Further details of management agreements between Council and CJDC can be found in Section 5.5.8 of the EIS.
Gov Submission 12, Planning SA, Comment 31	Who is responsible for management and maintenance of the dune and wetland reserves?	In the long term, management and maintenance of the reserves within the development area, including the dune and paperback swamp areas, becomes the responsibility of Council in accordance with the normal land division process unless it is determined that DEH and or DWLBC and their various branches should play a role in the care of these areas. In normal circumstances, Council receives rates and taxes to undertake a range of activities including roadside maintenance. Note that CJDC has an extended maintenance and management responsibility compared to that which would normally apply to land division.

Public		The Section 48 Report included in the EIS shows clearly that Council is well funded to manage this development and also provide better services and facilities to the wider community. Groundwater, sea cast wrack, sand bypassing and keeping the marina waters clean and navigable are all parts of the management responsibilities of CJDC. These responsibilities then pass to Council for the long term, as is normal in these circumstances. The family of Environmental Monitoring and Management Plans outlined in the EIS and further discussed elsewhere in this response document provide further detail of the specific measures to be adopted to manage the construction and long term operational effects of the development. The maintenance fund will be sufficient to provide for the maintenance and management requirements of the development. Various other environmental management works in the locality are the responsibility of the applicable landowner or government agency, for example the management of Bernouilli Conservation Reserve is the responsibility of DEH. The proponent intends to work with these agencies and this is further discussed elsewhere in this Response Document and will be documented in the relevant monitoring and management plans. Standard construction practice requires that contractors are responsible for monitoring, management and reporting in relation to their own activities. This requirement is reflected in the Site Construction Management Plan. In addition, certification is required from various authorities during construction and the proponent has overall responsibility for ensuring that these requirements are met. To this end, as part of the normal contract management, the proponent will conduct additional monitoring and auditing of the activities being undertaken by contractors.
Public Submission 8 Comment 5	A marina at Cape Jaffa would be nice to have but there are too many risks to the watertable and natural environment. I see seaweed as a major problem at the entrance to the breakwaters. Who will pay to keep it open and deep enough for all boats.	
Public Submission 11 Comment 17	The native/roadside vegetation in the region will require ongoing management. Will Council be able to afford additional staff to perform this role?	
Public Submission 14 Comment 3	I do not want to be left with destroyed livelihood and increased rates because the development has destroyed our environment and lifestyle and we are left to rectify the problems.	
Public Submission 21 Comment 5	Given past management of the coastal zone at Kingston, we do not have confidence that it will be appropriately maintained or cared for.	
Public Submission 27 Comment 12	The resulting swirl around the end of the breakwater will result in sand erosion on the eastern side of the breakwater, which the EIS acknowledges. We find it hard to contemplate that the Council will cart sand from the western side to the eastern side to replenish the eroded sand forever.	
Public Submission 30 Comment 5	There does not appear to be any financial provision for long term revegetation maintenance. Assessment of the Council's income and costs related to the development is unclear and does not make adequate provision for care of the reserves, roadside vegetation and wetlands. Council has underestimated the maintenance requirements, for example weed management officers, dog and cat control, monitoring the dunes and dune vegetation for changes, especially considering orange bellied parrot, hooded plover, bentwing bat, glossy grass skink and other vulnerable birds or lizards inhabiting the reserves. The marina management fund should be increased to provide more money for environmental management.	
Public Submission 30 Comment 17	The Site Construction Management Plan needs to be altered so that contractors are not responsible for monitoring their own activities and compliance because there is no incentive for them to rectify problems. Suggestions for changes are provided.	

Late Submission 1 Comment 4	If there are major problems, who is responsible for the costs.	Refer to the response provided above.

General		
5.2.18 Effects of Increased Boating Activity on Lacepede Bay		
Government		The effects of boating traffic and people pressure on the environment and specifically on the waters of Lacepede Bay is detailed in Section 5.2.27 of the EIS. Additional boating traffic is minor for this environment given the scale of Lacepede Bay and the extensive fishing and boating grounds. The total recreational boats, once the development is completed, has been estimated at approximately 1 boat per 50 hectares of the bay. Given that much of the subject land is zoned for development and Council has previously proposed the development of a protected boat ramp, increased boating traffic will occur regardless of this proposal. The effects of increased aquaculture activity will occur mainly in the area of the Bay where the aquaculture pens are located some distance off-shore and well away from the development. The pens are located inside the main reef system. The recent review of the expected effects of aquaculture on the marine environment made by PIRSA/EPA/Planning SA has resulted in revision of the Aquaculture Management Plan for Lacepede Bay and has made provision for expansion of the aquaculture activities at Cape Jaffa and within the Bay. The management of fish stocks is the responsibility of the State Government which sets catch and size limits for the protection of targeted species. Compared to many of the States waters this area has relatively low pressure from recreational fishers, nevertheless ongoing monitoring of the fishery is required to ensure its sustainability. The marina is about many facets of the community's growth and development, not just the provision of facilities associated with fishing. The need for and the benefits of the proposal are documented in Section 2.0 of the EIS.
Gov Submission 12, Planning SA, Comment 42	What are the potential impacts of increased boating activity on the relatively 'quiet' marina environment, especially marine mammals such as whales, particularly given that the possible expansion of the aquaculture industry could result in increased regular boating traffic. Significantly greater 'people pressure' would have a greater impact on the marine environment than the terrestrial environment due to the relatively pristine nature of the bay.	
Public		
Public Submission 1 Comment 2	Fish stocks have dramatically reduced compared to 3 years ago. An additional 50 recreational boats competing for available diminishing fish stocks will impact on the existing recreational and commercial fishers.	
Public Submission 24 Comment 5	Isn't the marina about fishing? There seems to be fewer and fewer fish caught each year. What will happen when the area is completely fished out?	
5.2.19 Direct Effects on Seagrass Beds		
Government		It is acknowledged that there will be a loss of seagrass as a direct consequence of the construction of the breakwaters and channel, however it is considered that this loss is offset by the regeneration of seagrass following the relocation of boats from the swing moorings in the nearby Rock Lobster Sanctuary, particularly as the ecological value of the seagrass beds within the sanctuary is high.
Gov Submission 8/13, DEH, Comment 19.7	The EIS assumes that the loss of seagrass from the construction of the breakwaters will be outweighed by the regeneration of seagrass following removal or relocation of boats from the swing moorings to within the marina, thus advances that the development will have negligible impacts on the existing	

	seagrass colonies. Whilst relocating boats may result in seagrass regeneration, there are no mechanisms proposed to force boats to relocate, nor controls on further boats utilising swing moorings. Thus there is no guarantee that recolonisation of seagrass will occur. The marine studies mention that Posidonia spp. may take up to 50 years to recolonise and notes some settlement of seedlings of A. antartica where moorings/cages have left scours. There appears to be no follow up studies to determine whether seedlings survived winter storms and other coastal processes and DEH is aware that whilst many seedlings settle, few actually colonise. Other factors may lead to seagrass loss such as potential for erosion scarps to form and not recolonise. The overall impact of the breakwaters on coastal processes and seagrass needs to be assessed as altering the flow of sand and seagrass wrack along the coast may effect the manner in which seagrass adapts or otherwise to an altered environment. The net result in seagrass loss would therefore be not less than the 3.0 hectares consequential to the construction on the marina.	The breakwater and channel have been design to minimise potential effects on the seagrass beds, whilst providing safe navigable passage for vessels. The direct effects on seagrass beds were outlined in Section 5.2.15 and Appendix 13 of the EIS, which indicated that approximately 3 hectares of seagrass beds will be affected. That assessment was conservatively high and a more accurate calculation of the area affected seaward of the seagrass line is presented below. Some of the areas contain bare sand so the actual area of seagrass beds affected is less than these figures: Channel 16525 m^2 Western Breakwater 5270 m^2 Eastern Breakwater 770 m^2 Total 22565 m^2 ie approximately 2.25 ha. As outlined in the EIS, the proponent has no jurisdiction over moorings outside of the marina and the breakwaters. The area of the current moorings is within State Waters and is therefore the responsibility of TSA. Further it is within the Rock Lobster Sanctuary, the management of which is the responsibility of PIRSA. The provision of moorings within a safe haven will inevitably result in the relocation of vessels and hence provide a significant environmental benefit to the seagrass meadows within the Rock Lobster Sanctuary. The relocation of vessels allows the seagrasses to recolonise and removes the risks associated with boats breaking their moorings whist at anchor in the open sea. During extensive discussions with fishers who use the moorings there is clearly strong support for the provision of safe moorings and 21 of the fishers have registered their interest to relocate to a berth within the anchorage. It is reasonable to assume that all of the vessels will eventually relocate into the anchorage, consistent with the relocation of the fishing fleet at Port Lincoln and other locations where improved facilities have been provided. If the authorities responsible for the moorings area wish to accelerate the environmental benefit associated with the relocation, the provision of alternate mooring facilities creates the opportunity for government to enforce the removal of vessels from the Rock Lobster Sanctuary. It is therefore considered inappropriate to dismiss this significant environmental benefit in the assessment of the proposal.
Gov Submission 13, NVC, Comment 25.2	The Native Vegetation Act 1991 pertains to both terrestrial and marine native plants. "Clearance" in relation to native vegetation means the killing, destruction, removal, severing, burning or any other substantive damage to native vegetation, and includes the draining or flooding of land, or any other act or activity that causes the killing or destruction of native vegetation, the severing of branches, limbs, stems, or trunks of native vegetation or other substantive damage to native vegetation. The development will thus necessitate clearance under the Native Vegetation Act 1991 in the form of damage to seagrass. DEH summarises that "the net result in seagrass loss would therefore be not less than the 3.0 hectares consequential to the construction on the marina" (see Gov Submission 8/13 Comment 19.7 above). The NVC and DEH both have concerns regarding direct and indirect damage to seagrass beds. The NVC requests that the concerns identified by DEH be addressed in the EIS documentation.	

		Review of ortho-registered aerial photographs from 1997 and 2002 has identified 42 discrete swing mooring scars, with the total area effected being about 2.3 hectares. The photography indicates that in the period 1997 to 2002, seven of the disused swing moorings experienced significant seagrass recolonisation, with bare sand being visible in these areas in 1997, but not visible or barely visible in 2002. See Section 5.2.14 of the EIS for further information. Underwater investigations conducted by PIRSA also show that regeneration of seagrasses has occurred at Cape Jaffa after boat and fish cage moorings have become disused (Bryars 2003). This report is attached as Appendix F. This, together with the aerial photography, provides clear indications that regeneration has occurred and seedlings have survived winter storms and coastal processes. It is considered that the reefs and extensive areas of shallow water in the bay contribute to wave attenuation and create a relatively calm environment in which seagrass regeneration is encouraged. It is likely that *Amphibolis Antarctica* will recolonise in the short and medium term, and that the more prevalent *Posidonia* will recolonise thereafter. Studies indicate that although *Posidonia* shoots recover quickly if the root mat is intact, recovery of the root mat can take several decades. For further information refer to EIS Section 5.2.14, EIS Appendix 13 and Appendices D and F of this Response Document. The potential for other factors such as water quality or erosion scarps to have adverse effects on seagrasses has been assessed and further information is presented in Sections 5.2.4, 5.2.20 and Appendix D of this Response Document. Although these factors are considered to present minimal risk to the seagrasses of the bay, monitoring and management plans are being developed to mitigate these risks. The potential effects of the establishment of the breakwaters and entrance channel on costal process is presented in Section 5.2.13 and Appendix 16 of the EIS. The EIS also presents the proposed adaptive coastal management regime. The sand bypass modelling shows that the management regime will limit sand build-up to the area close to the breakwaters and that the coastal processes will have minimal impact on the nearby seagrasses (Appendix D). Seagrass wrack on the beach is a natural phenomenon and is mostly old leaves that have sloughed off *Posidonia* plants and washed up on the beach after storms. The early winter storms bring the most wrack as leaves lay where they fall until sufficient disturbance brings them ashore. It is fairly obvious that the distribution of rotted and dissolved material from wrack is dispersed along the beach by tides and wind, so that an interruption of the long-shore drift will probably make little difference to the

		distribution of nutrients through natural nutrient recycling (Appendix D). It should also be noted that once the entrance channel has been excavated the area is available for recolonisation by seagrasses and the likelihood and species preference for this recolonisation as discussed later in Section 5.2.20. Should this occur there will be a net increase in the area of seagrasses in the bay of about 1.6 hectares. In summary: • it is inevitable that the existing swings moorings in the rock lobster sanctuary will become disused as improved facilities become available over time; • there are clear indications that seagrass recolonisation will occur in the short to medium term; • the recolonisation of seagrass in the scarred mooring areas is considered to be of high biodiversity conservation value as these areas are within the Rock Lobster Sanctuary ; • the relocation of boats provides the additional environmental benefit of removing the risks associated with boats breaking their moorings; • the risk of other factors resulting in seagrass loss is low, nevertheless monitoring and management plans are being developed to mitigate these risks; and • once the channel is established the area is available for recolonisation by seagrasses. If this occurs there would be an overall net gain in the area of seagrass beds as a result of the development of about 1.6 hectares.
Public		The management of the Rock Lobster Sanctuary will be more readily achievable if the moorings and other related fishing and aquaculture activities are relocated to a safe and secure area. There is evidence of seagrass recolonisation of the existing swing mooring areas once they are no longer used.
Public Submission 30 Comment 3	If future management is insufficient there are concerns for the future health of the rock lobster sanctuary. Despite considerable survey effort in the seagrass beds, very few marine organisms were observed. The EIS states that 2.2 ha of seagrass beds will be disturbed in dredging the channel. Appendix 13 stated approx 3 ha. This is a significant area and the risk of blowouts is present.	

Public Submission 11 Comment 8	Who will remove the swing moorings?	Removal of the swing moorings is detailed in Section 5.2.14 of the EIS. It should also be noted that the resulting significant environmental benefits, that is the recovery of the seagrass beds and the elimination of the risk of boats breaking their moorings, are dependant upon the moorings becoming disused and not necessarily on the removal of the mooring equipment.
Public Submission 18 Comment 13	The existing moorings do not appear to have resulted in any significant damage to the sea grass or bed. The proposed channel will cause more damage than the moorings. The marine environment will also be effected by flow of concentrated fresh water. There are numerous white holes throughout the area, not just at the moorings.	The loss of seagrass as a result of the existing moorings is clearly evident in aerial photographs provided in Section 4.13.3 of the EIS and other aerial photography taken as part of the investigations. Details of damage as a result of the swing moorings is outlined in Section 5.2.14 of the EIS and further detailed in the response provided above. These effects are well documented and acknowledged. The effects of groundwater outflow to the sea via the waterways and the breakwater are detailed in Section 5.2.6 of the EIS. The investigations conclude that the reduction in salinity at the mouth of the breakwaters is negligible and will have no detectable effect on the marine environment. The existing seagrass in the Cape Jaffa area have been assessed and this information is presented in Section 4.7 and Appendix 13 of the EIS. The existence of white holes in the seagrass beds was identified and bare sand makes up a small proportion (9%). Examination of the aerial photography provided in Sections 4.13.3 and 5.2.14 of the EIS shows the characteristic shape of swing mooring scars and they are clearly discernable from the natural white holes in the seagrass beds.
5.2.20 Potential Scarping and Erosion Adjacent to Dredged Entrance Channel		
Government		The apparent inconsistencies are not actually inconsistencies as the mechanisms that result in potential erosion and scarping of the seabed are quite different from those that result in transportation, deposition and accumulation of seagrass wrack on the beach. Thus, the presence or otherwise of seagrass wrack on the beach bares little relevance to the risk of erosion or scarping of the seagrass beds in the vicinity of the channel and breakwaters. The formation of an erosion scarp adjacent to the entrance channel or breakwaters is unlikely, although this risk cannot be ruled out. The risk of seagrass loss as a result of either scouring around the breakwater or an erosion scarp adjacent to the channel is discussed in detail in Appendix 13 of the EIS. Erosion scarps form when high wave energy erodes the sediment in a patch devoid of seagrass, which then continue eroding and increase in size. EIS Appendix 13 concludes that these indirect effects on seagrass beds are unlikely because:
Gov Submission 10, SECWMB, Comment 6	There are inconsistencies in comparisons made between the conditions at Kingston and Cape Jaffa in regard to erosion of seagrass beds and seagrass wrack accumulation on the beach. The report concludes that there will be little erosion of seagrass, based on the similar conditions at Kingston but also states that the deposition of seagrass wrack onto the beaches is different between Cape Jaffa and Kingston. Appendix 13 also states that 'understanding of when and where channels dredged through seagrass will erode rather than remain stable is insufficient to confidently state that erosion will not be a problem.	

Gov Submission 8/13, DEH, Comment 19.8	There is no evidence to suggest that the area to be dredged will be the only area affected. The dredging of the channel external to the marina through existing seagrass colonies may undermine the stability of the seabed leading to increased scarping and erosion of seagrass along either side of the dredged channel. It is recommended that a monitoring and contingency management plan be implemented to counteract any adverse outcomes, including changes external to the channel to ensure any scarping or erosion either side of the channel is identified and managed. The format should be adopted in consultation with DEH (Coastal Protection Board) and should include monitoring, setting of thresholds for management action and defining management actions. The management actions should address what actions are to occur, how they are to be funded and who is responsible for implementing those actions.	• increase in sediment concentrations will be short lived; • natural sand movement predominantly occurs inshore of the seagrass; • the sand bypass system will maintain the natural long shore sand drift and manage the potential build-up and erosion of sand adjacent to the breakwaters; • very little erosion is evidenced around the breakwater at Maria Creek which has a similar setup to the breakwater arrangement at Cape Jaffa but experiences higher water movement; • this coastline is accretional and has a much lower wave energy than either Adelaide or Beachport (where seagrass loss has occurred), which substantially reduces the risk of an erosion scarp forming; • the best analogy is probably the Maria Creek area where there has been very little erosion. Although there are no data available in the literature on the surge, current or wave action that might damage the *Posidonia* rhizomes, comparison of time lapse aerial photography provided in Section 4.13.3 of the EIS does not indicate ongoing erosion of the existing bare patches near Cape Jaffa and scouring was not observed around the Marina Creek breakwater from aerial photography in 1997 and 2000. The edges of the channel will be monitored and if they should erode, a contingency plan will be in place to stabilise them. This is discussed in Appendix D which contains further information regarding the risk and management of potential erosion scarps. The proposed monitoring and management plans will incorporate the monitoring and management of indirect effects on seagrass beds. This plan addresses monitoring, action definition and thresholds, how these are to be implemented and funded and the relevant responsibilities. In addition, water quality and general seagrass health monitoring will be implemented in order to identify any indications of broader potential effects. This is discussed in more detail in Section 5.2.4 and Appendix D of this Response Document.
Gov Submission 13, NVC, Comment 26.5	NCV comments that DEH is concerned that indirect damage to seagrass beds may occur as a result of dredging of the proposed channel and possible resulting instability of the sea bed floor. DEH has requested that a monitoring program be set up to address this (see Gov Submission 13 Comment 19.8). Note that a further erosion/damage to seagrass beds will constitute additional clearance under the Native Vegetation Act 1991 (refer also to Gov Submission 13 Comment 25.2). The NVC supports the concerns raised by DEH and requests that these issues be addressed in the EIS documentation.	

Gov Submission 12, Planning SA, Comment 43	How will the excavated depth of the entrance channel effect seagrass recolonisation with regard to species water depth preferences?	The base of the channel seaward of the breakwaters is to be excavated to a depth of -3.0 mAHD. The existing seabed levels range from about -2 to -3 mAHD (refer to Figure 3.4 of the EIS) and three metres is well within the light requirements of the seagrasses. This small change in water depth is not expected to have any noticeable effect on species water depth preferences in regard to recolonisation of the base or side slopes of the channel. This is evidenced by the seabed video surveys, which extended significantly further seaward than the channel into deeper water about 2.5 kilometres from the beach to about -5 mAHD. The location of the channel approximately corresponds with the first few hundred metres of the inshore seabed video transects In3 and In4 presented in Figure 2 of Appendix 13. These transects indicate that *Posidonia* is the dominant species for the entire length of the channel and beyond into deeper water. Refer to Appendix 13 and Section 4.7.1 of the EIS for further information. As a result, any recolonisation is expected to occur with the same species, initially with *Amphibolis Antarctica* and thereafter with the more prevalent *Posidonia*, although *Posidonia* can take a long time to recover. Should recolonisation occur to the full area of the channel then there will be a net increase in the area of seagrasses in the bay of about 1.6 hectares.
Public		
	No public submission received on this issue.	

5.3 Effects on Communities

5.3.1 Social Characteristics and Demographics

Government		The immediate/direct social effects of the proposal, relate primarily to Cape Jaffa as it will alter the demographics of the settlement significantly albeit in a controlled and progressive manner. The limited services in the settlement will be expanded although any expansion is expected to be limited, and to a large extent focussed on the fishing, aquaculture and tourist industries. Kingston town and to a lesser extent Robe, provide the main social infrastructure support for the wider district and will be effected. As the hinterland is sparsely populated and in essence comprises large land holdings, the effect on the social fabric for this sector will be evident in the relationships, activities and engagement of the farming community in the towns. The broader/indirect effects will be represented by the flow-on activities also primarily focussed in Kingston town as well as Robe. There are lesser effects that extend beyond the immediate effects that relate to the flow on or spin-off effects of increased tourism and expenditure, more jobs and greater variety of opportunity. The growth and future population although important, will occur over a period of about 10 years and therefore the limited incremental or slow growth and change will not have significant effects for which dramatic or significant change will be necessary to infrastructure and support services. The small changes over time will be readily managed. The projections for the future population are primarily driven by the current age structure and therefore whether the population congregate at Cape Jaffa or elsewhere, the service and infrastructure needs will not ultimately change. The demographic information for Cape Jaffa was derived from the only available formal data base, C-Data being the official Bureau of Census and Statics population data. Further information has been provided by the Kingston District Council as follows: Permanent Residents 27 adults 11 children 38 total Dwelling Tenancy 14 permanent 15 holiday 29 total
Gov Submission 12, Planning SA, Comment 1	Could there be a clear definition on which areas are affected by both the immediate/direct effects and the broader, indirect effects (both positive and negative) of the development.	
Gov Submission 12, Planning SA, Comment 2	Further comparative information on future demographic trends would be useful to assess the implications of the demographic changes.	
Gov Submission 12, Planning SA, Comment 3	Further demographic details will allow more detailed assessment of social issues including aging, industry and labour force status, aboriginal populations (if relevant) and income trends.	
Public		
Public Submission 28 Comment 8	The demographic study should be redone as to include the additional area “Environ” of Cape Jaffa misrepresents the facts of Cape Jaffa. Kingston is the focal point for health, education and employment and the “Environs” should be linked to Kingston. The residents and property owners in Cape Jaffa are the target group as it is their lives that will be effected most by the change.	

		The benefit of this settlement growth lies in its proximity to the existing valued infrastructure of recreation, medical, educational, retail and other service infrastructure at Kingston and to a lesser extent Robe and also its ability to satisfy latent demand for seaside living in an orderly planned development. The alternative is to locate these people in locations where the same lifestyle or housing choice options do not exist. As Cape Jaffa has, for many reasons, been selected as an appropriate strategic location for development at the federal, state and local government levels, it is inevitable that it will grow and that is best undertaken in a planned development scheme.
5.3.2 Workforce Requirements		
Government		At start up, the majority of the workforce will be contractor staff from Adelaide. As the project progresses and training occurs, the use of local labour will progressively increase. Where available, local contractors and service providers will be utilised to supplement labour, plant and equipment requirements of the project, thereby minimising the potential for perceived social stressors. It should be noted that generally, locally supplied labour and plant and equipment will be more cost effective (cost of accommodation and transport for non-local labour) and thus market forces will promote a natural tendency toward the use of local labour and services. Where possible, construction will be undertaken during off-peak periods thus making more efficient utilisation of these services. An on-site construction base is proposed at the south eastern most corner of the land in the infrastructure services area. The arrangements are generally depicted on Figure R2. The only period expected to have a non local workforce demand that might require the use of an on-site camp is the construction of the major infrastructure that is the breakwater, channel and main basin. As a result, the use of a construction camp is expected to be limited to stage 1. Further information in relation to accommodation options are contained in Section 5.3.1of the EIS. The majority of the construction workforce is on-site. A small number of the construction workforce outlined in the EIS will be engaged off-site producing and transporting raw materials to the site. Naturally, there will be administrative and support services associated with these activities some of which will occur off-site. Much of the staged construction is, by its staged nature, short term. Therefore there will be a component of short term employment (estimated to be about 15%)
Gov Submission 12, Planning SA, Comments 4, 5, 6, 7, 8, 9, & 10	Assessment of potential social issues would benefit from clarification of the construction workforce requirements and provision of further information in relation to: • link to demographic data, • potential social stressors for existing similar industries, • source of construction workforce, • proportion of short and long term employment, • proportion of off-site to on-site workforce and thus accommodation, • conceptual information for the possible on-site camp, and • consideration of seasonal effects on environmental and social impacts. .	
Public		
	There are no public submissions on this issue.	

		according to market demand and period between stages of construction. It is relevant that many of the employees will be long-term employees of contractors who are working on the site and move from project to project. Housing construction will have a more uniform work flow than the civil construction components and present a higher proportion of long-term employment. There are existing seasonal fluctuations in population in the district and where possible the major construction activities will be undertaken in off-peak periods. This will allow a greater and more efficient utilisation of locally sourced labour and services. The other factors that influence construction timing include seasonal environmental effects and housing demand as discussed in the EIS.
5.3.3 Implications for Public Service Providers		
Government		Kingston Soldiers Memorial Hospital currently operates with 10 acute beds and 17 high care nursing home beds available which is currently sufficient for the community's needs and is suggested by hospital management to be sufficient for the foreseeable future. The Lighthouse Lodge is situated in a separate facility on Hospital grounds. It provides 15 low level care beds. Vacant land adjoining these facilities owned by the Kingston Soldiers Memorial Hospital has been earmarked for extensions to the Hostel and will be considered if demand continues into the future. Limestone Coast Health Pty Ltd currently leases a building from Council, which operates as a medical centre. The development at Cape Jaffa will reinforce and support these services which can readily respond to the gradual growth in the district. After several years of discussion and planning it has recently been agreed between Council, Limestone Coast Health and the Kingston Soldiers Memorial Hospital, to build a purpose built medical centre on the hospital grounds which will provide the community with a facility that meets accreditation standards and will serve the Kingston Community well into the future. Funding is currently being sought from the State and Federal Governments for this project. Existing recreation and tourism at Cape Jaffa is focussed on the beach, jetty and waters of Lacepede Bay. There are nearby wineries and the other recreational facilities at Kingston and Robe. Expansion of tourist accommodation is reliant on service infrastructure availability and the growth in use of the tourist park. The development of the fishing and aquaculture industries will also provide interest to travellers and build on the base that exists at Cape Jaffa.
Gov Submission 2, Dept. of Health, Comment 8	The proposal is likely to place significant pressure on the current health facilities at Kingston. An increase in population, particularly aging, would increase the service need and would require additional funding to respond. Funding is limited and there may be a significant difference between the expectations of new residents and the level of health services provided.	
Gov Submission 2, Dept. of Health, Comment 9	Access to services is a key determinant of health, particularly for the aged. Given the distance to Kingston and Robe, the provision of adequate and affordable transport systems should be addressed.	
Gov Submission 6, DFC, Comment 1	A key issue is access to key services such as community and health services, particularly as the majority of new households will be retirees with increased need for particular support services. The proposal contains relatively little about community and health services and it is recommended that the EIS be expanded to include more analysis of this issue.	
Gov Submission 6, DFC, Comment 2	Access to transport is frequently raised by communities and it is anticipated that this will be a significant issues. Affordable and appropriate transport systems will need to be made available. It is recommended that the EIS be expanded to include some more analysis of this issue.	

Gov Submission 12, Planning SA, Comments 17, 18, 19, 20, 21, 22 & 23	The EIS addresses the guidelines in relation to Health and Aged Care providers, it is generally considered sufficient but quite general. The assessment would benefit from further information on: • the effects on social service providers, • the current availability and need for public transport facilities • acknowledgment of indirect effects on health and aged care services • information on preliminary discussions with service providers, • would be useful potential off-peak and on-peak demand for health services providers. Clarification of the significance of existing recreational/tourism opportunities is required. What degree of 'under-capacity' of schools is there? Any supporting data?	Kingston Kindergarten currently operates 2.5 days (5 sessions) per week with a permitted capacity of 35 students. As enrolment numbers continue to increase, the Kindergarten will apply to the Education Department to make available more session times. The maximum sessions per week could potentially increase to 10 sessions and become a full time Kindergarten operation. There is therefore capacity for double the current service. 'Occasional Care' is currently offered at the kindergarten for children aged between 2 and 4 years. There are 4 sessions of Occasional Care offered per week with each session providing placement for up to 8 children. Each session is for 2.75 hours duration. Occasional Care operates 40 weeks per year in line with the Kindergarten/School terms. "Rural Care" is expected to commence at the Kingston Kindergarten site in late 2005. Rural Care will supersede 'Occasional Care'. Rural Care will provide 4 placements per day, 5 days per week, 48 weeks of the year and will operate between the hours of 8am and 6pm. It will accommodate children from birth, offer care after school and during school holidays. Rural Care is a significant step forward for the Kingston Community as far as child care is concerned. The Kingston Retirement Village currently has 28 units with plans for 7 additional units to be built in the near future to meet immediate demand. The Retirement Village Board is currently investigating the purchase of additional land for the future expansion of the Retirement Village. Kingston Community School is a Reception to Year 12 school and currently has 430 students enrolled. In the past the school has had up to 530 students enrolled and can comfortably accommodate well in excess of this number. There are already children from Cape Jaffa attending the Kingston Community School who are collected and returned by school bus. There will inevitably be additional students from Cape Jaffa. Preliminary discussions with TAFE have been held to determine the level of interest in promoting the aquaculture and fishing interests. These discussions will be progressed once approval has been issued to define the potential for this specialist education focus. There is no claim that this development will justify a hospital at Cape Jaffa. The development will reinforce the Kingston hospital need and the medical centre facility
Public		
Public Submission 24 Comment 6	Facilities such as medical, shopping, banking and schooling are barely adequate now.	
Public Submission 29 Comment 51	The claim that the development will support a hospital and medical services is not correct. Kingston and Robe have found it very difficult to attract health professionals to service the needs of both communities. Robe does not have a hospital and considering the proximity to Kingston Hospital this development would not have such a facility.	
Public Submission 29 Comment 53	Has any consideration been given to the fact that the school bus route is on Cape Jaffa Road?	
Public Submission 29 Comment 56	Once people become infirm, they tend to move to a centre with sophisticated medical facilities, according to the Mayor of Robe. There is an aged care facility in Kingston, it will not have the capacity to deal with increased demand.	
Public Submission 29 Comment 57	It is unlikely that this development will increase the school population or that people purchasing property will be interested in pursuing a TAFE course as they will not be permanent dwellers.	

		and provide critical mass to assist in the viability of a broader range of services to the benefit of the wider community. The operation of the school bus facilities to Cape Jaffa will become more efficient with a growing user base. The rerouting of the bus in the manner required by this proposal is inconsequential and does not impact on any user. Preliminary discussions have already been held with retirement village owners with a view to provide facilities as and when the need arises. In terms of shopping, banking and related commercial services, the existing infrastructure in Kingston provides the necessary services and as it has in the past it will grow and change according to demand.
5.3.4 Visual Amenity		
Government		The breakwater has been designed to be kept as low as practical to minimise visual effects, yet still provide adequate protection from the larger wave profile from the north west in storm conditions. This is a low breakwater compared with many due to the degree of protection afforded by the Cape, the fringing reefs and the relatively shallow Lacepede Bay. For these reasons the Cape Jaffa breakwater will not be as prominent as breakwaters along the metropolitan Adelaide coast. Figure 3.22 of the EIS also shows that as a consequence of the fore dunes, there is little opportunity for direct views of the beach and the breakwaters. The breakwaters will be visible from the beach and points of public access to the beach. However, it is not the only view of the beach that an observer is able to enjoy as views to the east along the beach and Bay towards Kingston are readily available as are the views west to the jetty, the fish processing area and the Cape beyond. The jetty is a similar height at its outer end at platform level and there are balustrades and other structure above. Views from the beach in the vicinity of the proposed breakwaters of the jetty in the distance, reveal that a structure of this height is not visually prominent nor does it detract from the attractiveness of the beach and bay. Therefore, the magnitude of visual effect anticipated from the breakwaters is similar to the visual effect of the jetty as viewed from the distance. It is also noteworthy that given the deep curve of the bay in this locality, the breakwaters as viewed from the jetty and nearby areas have land as a backdrop and as such there is no continuous sea view. The breakwaters create the focal point for boating activity. This will create visual and activity interest in the same manner as the jetty has in the past.
Gov Submission 8/13, DEH, Comment 19.12	The EIS advances that the breakwaters be developed to a height of 2.5 mAHD, which is relatively low in comparison to other similar developments, nevertheless the breakwaters will result in a significant change to the visual appearance of the coast and will affect the amenity of the area as experienced by both beach users and people on the sea.	

		Boat users will also be able to view the breakwaters and will see them as a valuable element in the landscape as they afford protection and safety. The breakwaters do not obliterate the view of the extended beach of Lacepede Bay only interrupt a small portion of the view. Extended views are available both east and west along the beach for long uninterrupted distances, some for many kilometres.
Gov Submission 12, Planning SA, Comments 11, 12, 13, 14, 15 & 16	EIS section on visual amenity and landscape quality is well written and structured and this topic is also addressed throughout the EIS (Sections 3.6, 4.2.1 and 5.3.15). It makes broad statements or generalisations but with little reference to magnitude and significance of effects. The assessment would benefit from further information including: • clarification of definitions and methodology for visual assessment, • acknowledgement of the subjectivity of assessment. • assessment of visual effects of offsite overhead powerlines (although later section 5.3.14 provides better assessment), • assessment of visual effects of earthworks. • is further information available on detailed landscape plans?, and • the use, ownership, rehabilitation and management of foredune buffers and rehabilitated dunes and plantings.	These types of assessments are inevitably subjective. The methodology incorporated visual inspection of various comparable areas and facilities combined with extensive experience in the planning assessment of urban and rural areas. For example, the breakwater was compared with similar structures at Kingston, Copper Cove, Port Vincent, Wirrinna, Glenelg, North Haven as well as interstate breakwaters in Western Australia, Victoria, New South Wales and Queensland. All of these breakwaters are in locations where there is greater exposure to the sea and greater wave heights are more common. The Cape Jaffa breakwaters do not need to be as bulky or as high as many of those inspected, as the Bay affords a significant degree of protection and wave attenuation. Their visual effect will therefore be less than other like structures viewed. Refer to Sections 5.2.11, 5.3.2 and Figure 5.19 of the EIS which discuss and show an image of the breakwaters in Lacepede Bay. Kingston and Robe both have breakwaters that are visible from the beach and the sea and neither of these are a blight nor are they obtrusive such that they diminish the attractiveness of the area. These localities are considered both attractive and desirable and are considered as highly attractive seaside tourist and recreation destinations. If the breakwaters were offensive in visual terms this would have been recorded as a detrimental feature in those localities. A visual assessment of the overhead power lines was also undertaken to determine the apparent prominence or otherwise in the landscape as viewed by the traveller along Cape Jaffa Road. This assessment took the form of interrogating users of the Cape Jaffa Road between The Southern Ports Highway and Cape Jaffa. The overwhelming response was that the power supply infrastructure was not readily apparent to many of those questioned and others, although aware of its existence noted that a single run or supply was something that they anticipate in this type of environment. Further, the scope of the view was so large that the overhead power lines were insignificant. It was also stated however that if there were a multiplicity of lines then that would become unattractive and intrusive in the environment. In terms of the earthworks, these will generally be undertaken over shorter time

		frames and much of the earthworks apart from the areas created for allotments and the waterways will be in locations which are not readily visible due to vegetation corridors, topography and distance. Landscape schemes will be the subject of detailed design development for each of the development stages and will be undertaken in accordance with an overall Vegetation Monitoring and Management Plan. The foredune to the east of the eastern breakwater will be in the ownership of the Kingston District Council. The area to the west is in the name of the Crown and there are no plans known to the proponent to alter these arrangements. The Vegetation Monitoring and Management Plan will incorporate the necessary actions and responsibilities for the rehabilitation and future use of these areas including discussions with relevant authorities.
Public		The need for a breakwater in the bay is acknowledged.
Public Submission 14 Comment 2	Happy to have a breakwater built in the bay.	
Public Submission 28 Comment 7	The EIS states that the breakwater will be only 2.5 mAHD. Cape Jaffa locals have told me that there have been severe storms that have had waves crashing over the jetty for extended periods. Maybe 2.5 mAHD is not high enough – has this been considered?	The breakwaters have been designed following extensive investigations taking into account known tide and wave data. Refer EIS Sections 4.10, 4.11, 4.12, 5.6.16 and Appendix 27.
Public Submission 30 Comment 18	The infrastructure area will obscure the scenic view of the wetland.	Views of the land are limited by the roadside vegetation along Cape Jaffa Road. A new road will be created running from Cape Jaffa Road northward to the coast which will be closer and create an opportunity to view the Tea Tree area.
5.3.5 Public Amenity		
Government		To accommodate the broader interests and economic base of the community special facilities are required to realise recognised strategic aims and objectives. These include a safe working harbour for the Rock Lobster and aquaculture industries and the provision of highly desirable recreational fisher's facilities. This requires change to the visual and physical character of the locality including breakwaters and harbour. In doing so there are significant flow-on benefits for business investment, in the service sector and the creation of an attractor of some note to the tourist industry. It is also noteworthy that the physical setting of the settlement would alter significantly in any case as a large part of the land is zoned for further residential and industrial development.
	There are no government submissions on this issue.	
Public		
Public Submission 18 Comment 12	Cape Jaffa is one of the safest, protected open sea anchorages. It provides a safe swimming beach and delightful beach for walking. The marina would cut the township off from the family beach and visitors who enjoy the beach would not return.	

		There remains an extensive beach between the jetty and the breakwater of about 750 metres which provides safe swimming waters. There is also over 1 kilometre to the west of the jetty to the point of the Cape and around the point, kilometres of attractive beach. In all there are many kilometres of delightful beaches to walk. It is noteworthy that the area to the west of the settlement has regenerated in recent years, is closer to the Bernouilli Conservation Reserve, is quite extensively vegetated and is rising land which is more exposed to the weather across the Cape. The marina does not cut off the beach to the east as new roads create better public access than currently exists. Parking areas and walkways will be developed to provide significantly improved access to the beach. These features will improve public amenity.
Public Submission 24 Comment 7	We have no objection to a few more housing blocks being opened up in the approved areas, perhaps west of the settlement, but certainly not upsetting the major layout of the town as it stands.	It is acknowledged that there is acceptance of the development of Cape Jaffa. The area west of the settlement is closer to the point of Cape Jaffa and is more exposed to the weather and is vegetated. The character of Cape Jaffa will change regardless of this proposal given the current zoning. For the numerous strategic reasons as previously expressed and as incorporated in Sections 2.0, 5.1 and 5.9.1 of the EIS, Cape Jaffa is the most appropriate location for accommodating housing, industry and tourist needs along this coastline.
Public Submission 29 Comment 18	The character of Cape Jaffa needs to be preserved and need more Cape Jaffas not less.	
Late Submission 2 Comment 6	Wrights bay to beyond the Murray mouth is the longest stretch of unbroken and accessible sandy beach in Australia. This asset should be protected.	The sandy beach is extensive however it should be noted that there are interruptions at Cape Jaffa at the jetty, Butchers Gap Drain, Kingston jetty and the Maria Creek drain outlet. Further, the sea grass on the beach at Kingston also interrupts this “accessible sandy beach”. Nevertheless there are extensive stretches of beach readily available and visible to the public that are not affected by this proposal.
Late Submission 2 Comment 7	We are opposed to closing of a portion of King Drive and the present entry to the settlement should not be changed.	Accessibility to Cape Jaffa does not alter materially as a consequence of the relocation of the main access road to the settlement. This rearrangement will ultimately result in a significant reduction in industrial traffic travelling into and past residences in the existing town.
5.3.6 Adequacy of Car Parking and Coastal Access		
Government		The current demand for spaces on the beach has been for 80 car and trailers. It is anticipated however that with the provision of marina facilities that this number may be reduced. There remains a significant area of land for parking and Council has made application to SABFAC expressly for the purpose of establishing a new boat ramp and associated car and trailer parking area. The extent of these facilities is
Gov Submission 1, DTED, Comment 2b	The adequacy of the parking facilities for both cars (72) and cars and trailers (69) is questioned.	

Gov Submission 8/13, DEH, Comment 19.10	DEH recommends ensuring appropriate and unrestricted public access to the coast is maintained to car parks, breakwaters and boat ramp facilities and queries the adequacy the number of parking spaces given that up to 80 car and trailers access this strip of coast for launching of vessels and general recreation activities.	reliant on the allocation of funds from SABFAC. Further, there are car parking facilities proposed on the southern side of the dunes at the eastern most end at the start of the access track to the beach, another in the area adjacent to the entry to the footway closest to the eastern breakwater, an area near the southern end of the western breakwater and kerbside parking along a number of the defined reserve areas. The off street car parking adjacent the beach provides spaces for about 36 vehicles where there are none provided at present. In addition there are beachside reserve areas where kerbside parking allows for a further 25 spaces on the eastern side of the development. This is well above current demands which peak at about 20 vehicles often associated with camping on or near the beach when the caravan park is at capacity. The provision of alternate boat launch and retrieval facilities will also reduce the potential for effects on coastal habitat for Hooded Plover. Refer Government Submission 13, NVC, Comment 25.3. In the existing town, the only formalised parking area is an existing paved area at the southern end of the jetty which accommodates both industrial and public parking needs. This area accommodates all current need with considerable space available for additional vehicles.
Gov Submission 12, Planning SA, Comment 44	Provide more information on public car park locations, demand, and number of spaces, particularly at the eastern end of the beach, areas adjacent to public walkways and adjacent to the jetty.	
Public		The proposal only deals with that section of the beach within the Major Development Area. There is no proposal to restrict or prohibit public access east of the Major Development Area. From this eastern most location to the breakwaters, vehicular access will be restricted to emergency and service vehicles in order to create a safe pedestrian beach environment. Continued access to the beach is enabled whilst an area for public boat launching and retrieval has been provided for within the development and is proposed to be a public facility sponsored by SABFAC and Council. The continued use of the beach remains the responsibility of Council. It is proposed to create an alternate access to ensure that there is no interruption to the beach access.
Public Submission 28 Comment 4	I have no problem if the EIS refers to precluding vehicle access west of the breakwaters, however, I am concerned if the EIS proposes to restrict traffic east of the breakwater from Kingston to exit near the existing boat ramp. Vehicle and boat trailer access to the eastern side of the channels is important because: • even at present the road that gives access to the beach is private land and once the development starts there are no other exiting points; • When there are large fishing events eg Easter weekend, the additional launching places would be beneficial; • The ability to drive onto the beach and experience the panoramic views is amazing and fantastic and should not be given away. Access must be maintained to the beach before stage 1 starts for continued boat launching at Cape Jaffa.	

5.4 Economic Issues

5.4.1 General Employment and Economic Benefits

Government		The support of DTED is acknowledged. These facilities will create the best opportunity for the existing operators and will be more attractive to new enterprises.
Gov Submission 1, DTED, Comment 1	The Department of Trade and Economic Development (DTED) sees obvious economic benefits for the region including increased employment during and after construction, tourism industry, growth in the fishing and aquaculture industries and possible value adding opportunities. The development provides the fishing/aquaculture industry with appropriate wharf infrastructure to facilitate servicing and refuelling of vessels while improving efficiencies and providing possibilities for expansion and diversification of the industry.	
Gov Submission 2, Dept. of Health, Comment 3	Employment is one of the key determinants of health: 215 new ongoing jobs, up to 222 jobs per annum during construction and 311 "once off" jobs has the potential to significantly improve health of the regional population. This would contribute to the South Australia Strategic Plan Objective 2 Improving Well-being, Objective 5 Building Communities, Target 5.8 Regional Population Levels and Target 5.9 Regional Unemployment.	Department of Health states that employment has "the potential to significantly improve health of the regional population" and improve well-being consistent with the South Australian Strategic Plan. This is entirely consistent with the conclusions of the investigations made for the EIS in Sections 5.4.2 and the support of DH is acknowledged.
Gov Submission 3, PIRSA, Comment 3	The Cape Jaffa Anchorage project is consistent with the objectives of South Australia's Strategic Plan and we would hope to see this project proceed as it has the potential to significantly contribute to the economic growth, employment opportunities and further development of a number of industries within the region.	PIRSA hopes "to see this project proceed" and acknowledges the consistency the project has with the South Australian Strategic Plan and the consequential economic benefits and opportunities.
Public		These submissions support the project for several reasons. The opportunities arising from this comprehensive development will extend over a number of years and will broaden the economic base of the locality and the region. There will also be benefits to skill levels and the range of skills developed in the region. Many of these skills and jobs will be sustainable in the long term as greater interest and awareness in the area is achieved. Many of the current activities at Cape Jaffa but also at Kingston have been limited by the lack of infrastructure. This project can provide the catalyst to existing business expansion and new business ventures.
Public Submission 2 Comment 2	Cape Jaffa has the potential of producing more produce for the State.	
Public Submission 6 Comment 1	This project has the potential to create large employment during the construction phase.	
Public Submission 6 Comment 2	Importantly, this project also has the potential to create long term employment through tourism, the building industry and improved facilities for professional fishermen.	

Public Submission 11 Comment 4	Who will be marketing the blocks of land? Will the local real estate people be involved?	Opportunities for many local services will result from the development. Decisions have not been made in relation to marketing as the proposal has not yet been approved. Flow-on benefits from tourism for existing businesses in the area are significant and create opportunities for expansion and new tourist development as well as a catalyst for the development of essential services and infrastructure.
Public Submission 19 Comment 1	We fully support the proposed development as it will provide the cohesive support structure necessary to compliment the increasing demand for tourism in the area, which revolves around the caravan park, the wineries and the fishing and diving activities. These businesses are currently restricted by poor or non-existent services.	
Public Submission 19 Comment 4	Public and retail facilities will support Mt Benson and Cape Jaffa tourism.	
Public Submission 19 Comment 5	The anchorage provides opportunities for local businesses that compliment tourism to expand.	
Public Submission 25 Comment 1 Public Submission 25 Comment 2 Public Submission 25 Comment 3	I would like to express my support for the development, as it would: • provide economic growth; • bring many more people to live in our district, thus bringing more money to be spent in our shops and businesses; • provide employment for our local young people; and • provide tourism development. This development will be a major focal point and reaffirm economic growth and employment.	
Public Submission 29 Comment 11	Unemployment in the Kingston/Cape Jaffa area is reasonably low, with employment in building, retail, tourism and viticulture. As developers usually bring their own workforce, there will probably not be significant employment opportunities for local workers.	Over time it is highly desirable to develop local skills as these are more economical than the cost of support outside labour. The workforce requirement of this development is significant and will create numerous job opportunities in direct and indirect employment as detailed in Appendix 24 to the EIS and Sections 5.4.1, 5.4.2, 5.4.3, 5.4.6, 5.4.13 and 5.4.14.
Public Submission 29 Comment 13	The development will not enhance the sustainability, growth or export of the fishing industry as it cannot export more than it catches and the catch is limited to a quota. The industry that has existed for many years does not need a marina or huge residential development to continue.	Opportunities for value adding enterprises in the fishing and aquaculture industries are not limited to catch quantity and may include preparation and packaging of lobster tail, steaks/medallions, smoking or otherwise processing, treating and packaging salmon. International and national markets have not been tapped as the cost of operation, due to the lack of infrastructure, has constrained these industries.

Public Submission 29 Comment 20	It is doubtful that any real economic benefits or employment will derive from the project.	Refer Sections 5.4.1, 5.4.2, 5.4.3, 5.4.6, 5.4.13 and 5.4.14.and Appendix 24 of the EIS. Reference should also be made to Government Submissions numbered 2 and 3 under the heading Fishing and Aquaculture Industry Benefits. These set out the likely benefits in terms of economy and employment for Cape Jaffa and the area. In summary, every $1 million injection from an imported workforce could boost the regional economy by an additional $1,209,800 in value added benefits (salaries, wages and profits) and an additional 22.7 FTE jobs per annum. If the 222 workforce estimated for the first full project year each spend $200 per week locally, then the regional economy could be boosted by an initial $2.3 million resulting in $2.8 million in value added benefits and 52 FTE jobs. The investigations provided in the EIS are extensive and are based on well proven criteria and economic rationale for the assessment of economic effects.
Late Submission 2 Comment 9	We do not agree that the development will create a great deal of ongoing employment, revenue of millions of dollars or allow value adding to the fish catch.	
Public Submission 29 Comment 58	The charter fleet consists of 1 vessel with charters mainly in January and sporadic work up till Easter. There are no charters in bad weather and patrons apparently enjoy the current process to board and leave the vessel. It is doubtful that there would be enough work for more than one vessel, as has been experienced in Robe.	There are a number of existing charter operators in the area including Kingston Cape Jaffa and Robe. These operators will benefit from an increased demand for their services out of Cape Jaffa due to increased exposure and tourism generally. The ease and safety with which an operator can launch, retrieve and collect and receive charterers enhances the positive experience for all.
5.4.2 Fishing and Aquaculture Industry Benefits		
Government		Department of Health confirm the flow-on benefits to industry and employment and the contribution this proposal is likely to make to Improving Well-being.
Gov Submission 2, Dept. of Health, Comment 2	The availability of a safe, all weather harbour and greatly improved facilities for loading and unloading vessels is likely to result in expansion of the existing fishing and aquaculture industries, which would contribute to increased employment opportunities in the region and contribute to the South Australian Strategic Plan Objective 2, Improving Well-being.	
Gov Submission 3, PIRSA, Comment 1	PIRSA supports the Cape Jaffa Anchorage as: • In 2000/2001, aquaculture in the South East contributed approximately $3 million directly and $3.7 million in flow-on business to the State's economy (49 and 27 jobs respectively). • The Lacepede Bay Aquaculture Management Policy establishes zones that allow growth and expansion of the aquaculture industry at Cape Jaffa, however the present infrastructure is inadequate to cope with any real expansion.	PIRSA confirms its support for the proposal, the value of the economic benefits and the potential to generate new enterprise and expand the aquaculture interests. These benefits are also identified in Sections 5.4.6 and 5.4.1 of the EIS. PIRSA also acknowledges the inadequacy of the current infrastructure and the constraint this places on industry development.

	• Cape Jaffa Anchorage represents a major regional project, contributing to the future diversification of a regional economy that has been predominantly reliant upon traditional primary industries. It has the potential to generate a new range of business and employment opportunities for the region and to significantly contribute to the States economy.	Refer to the response provided above.
Gov Submission 3, PIRSA, Comment 2	The economic impacts that the Cape Jaffa Marina could have to the aquaculture industry include: • Increased aquaculture production to 500 tonne per annum with an estimated value of $3 million per annum • Increased employment of another 31 full-time positions • Potential related aquaculture plant and equipment investment of $1 million • Additional once only employment impacts from construction and investment activity of 18 full time jobs • Plus associated processing and flow-on benefits, which could generate up to 30 additional jobs Such a development would not only provide for the expansion of the industry in the South East region and significantly contribute to the overall growth of the industry within South Australia, but also enable existing operators to more efficiently farm the present leases at Cape Jaffa through improved wharf/jetty facilities for harvesting, sites for equipment storage and repairs and infrastructure upgrades (eg power).	
Public		The development of this industry is limited unless appropriate infrastructure is available.
Public Submission 3a Comment 2	PIRSA introduced an extensive Management Plan late last year that has implemented legislation to develop a 3,000 tonne per annum aquaculture industry in the bay at Cape Jaffa. This will only happen if the marina is built.	
Public Submission 3a Comment 4	If the aquaculture industry is developed fully to 3,000 tonnes per annum, it will employ approximately 80 to 100 people in the Cape Jaffa area. The product, when on sold, will also create further employment.	The economic and employment benefits of aquaculture are potentially very significant to the region.
Public Submission 11 Comment 21	The EIS says that better facilities will increase the value of the crayfish catch. This is not logical as there is a quota and no extra can be caught.	Opportunities for value adding enterprises in the fishing and aquaculture industries

Public Submission 29 Comment 13	The development will not enhance the sustainability, growth or export of the fishing industry as it cannot export more than it catches and the catch is limited to a quota. The industry that has existed for many years does not need a marina or huge residential development to continue.	are not limited to catch quantity and may include preparation and packaging of lobster tail, steaks/medallions, smoking or otherwise processing, treating and packaging salmon. International and national markets have not been tapped as the cost of operation, due to the lack of infrastructure, has constrained these industries.
Public Submission 18 Comment 14	Aquaculture can be addressed by upgrading the jetty. A safe haven to load fish feed will have no effect on sea conditions, where the cages are located.	Discussions with the aquaculture operators revealed that the high cost of labour and the limitations of operating from the jetty are a major constraint to their activities and that their winterising during the 2005 year provides them with " a break before the lead-up to establishing in the marina." (pers comm. Doug Peel). Refer Public Submission 3A.
Public Submission 27 Comment 2	The growing aquaculture industry referred to in the EIS has ceased operations after unsuccessfully trying to sell. The pens have been removed form the sea and cut up. The current lease is close to shore and future leases will be located further out to sea, rendering it inaccessible during much of the year due to rough seas, and is therefore not viable.	The aquaculture activities have not been ceased. Rather the pens or rings have been demounted and put in storage for the short term whilst this proposal is assessed. There is no doubt that the aquaculture activities are stressed due to the lack of infrastructure. Accordingly, the states strategy for this industry at this location supports the provision of safe and convenient facilities to significantly improve the efficiency of this industry. The lease areas vary in their location however, the inner grounds are accessible with the current equipment. Refer also to Government Submission 3 PIRSA.
Public Submission 29 Comment 5	Currently there are no aquaculture operators at Cape Jaffa or elsewhere along the coast so there are definitely no jobs or export opportunities.	
Public Submission 28 Comment 9	The EIS misinforms readers by suggesting that lobster fishers would be able to go out in bad weather to benefit from higher prices. The ocean sea conditions are the reason they don't fish in bad weather. I hope the EIS did not calculate additional net worth of the project, as this would be false.	A limiting factor during poor weather conditions is the ability to safely and efficiently load and unload materials and product from the vessels via the jetty. The provision of a wharf area in a protected harbour will enable these activities to occur in all weather conditions. Fishing in bad weather is a universal industry constraint and can arise whilst out at sea. Therefore a safe haven to finish the days work by unloading the catch is easier and safer. This is how many other fishers operate such as at Robe.. In this respect, the Cape Jaffa fishers are disadvantaged and this is the basis of the discussion in the EIS.
Public Submission 29 Comment 4	Increased exports of rock lobster in the Southern Zone are impossible due to quota restraints and the fact that only a small proportion of the catch is exported live. At Cape Jaffa, there are three buyers operating out of premises located adjacent to the jetty. Live product exporters based in Adelaide and Mt Gambier employ two people, one of which is an independent buyer who sells live product to an exporter in Melbourne.	The current arrangements are based on live export only. There is potential to increase this market as well as process fish to export value added product. An example of this is the Rock Lobster tail medallions. It is also noteworthy that the southern zone fishers have, through their own efforts and responsible fishery management, created a sustainable fishery. With improvements in the fishery these quotas may be reviewed and increased in time.

	Therefore, this industry would at best provide three jobs for the season, depending on whether they buy at another port. It is unlikely that establishing a marina at Cape Jaffa would provide any incentive to establish further processing facilities for the domestic rock lobster market.	
Public Submission 29 Comment 22 Public Submission 29 Comment 59 Public Submission 29 Comment 26 Public Submission 29 Comment 62	The relocation of the current industrial and commercial services should not be taken for granted bearing in mind the costs, which would be far in excess of $50,0000 for processors as claimed. Existing rock lobster processing facilities are more than adequate, are in good condition, well kept and replacement or relocation is a long way off. Commercial vessels are likely to migrate away from Cape Jaffa so the number of buyers will shrink. The cost of relocation would be closer to $100,000, which would not be an incentive in a shrinking market. Relocating the fuel service from the jetty would probably cost $100,000 and the company might not be willing to bare this cost considering the diminishing fishing fleet and fishing days per season. It is unlikely there will be any migration of commercial fishing activities on King Drive into the marina because of costs. The fuel provider has recently upgraded the existing facilities and unlikely to relocate as the estimated cost of $50,000 plus the purchase of an allotment for the fuel tank would be prohibitive in light of the diminishing returns.	The proponent has no control over the continued use of the existing fish processing operations in their current location. The quality of these facilities has not been challenged in the EIS however it is noteworthy that they do not have waste water disposal arrangements to current standards. The proposition that commercial vessels are likely to migrate away from Cape Jaffa and that the number of buyers diminishes is unsubstantiated. Robe has a proposal to redevelop Lake Butler and related commercial infrastructure however, the facilities are limited and the hard stand commercial area is proposed to be reduced. Similarly, the relocation of the fuel facility would result in a considerably reduced risk to the environment and provide a safer means of fuelling than the current arrangements. Arguments about the relocation of facilities relying on a diminished fleet and fewer fishing days by the commercial fleet ignores the reality of the growing recreational demand for services.
Public Submission 29 Comment 30	The air strip at Kingston is a valuable and well developed facility. It is ridiculous to suggest it should be upgraded to accommodate direct exporters because: • it would need to accommodate planes capable of several tonnes and international flight; • none of the existing processors has DPI certification; • none of the buyers are exporters and all of the lobster is currently shipped to export via Adelaide or interstate.	The Kingston air strip is a well developed facility for the district and provides the opportunity for connecting intra and inter-state transport of product. Existing status or accreditation of existing processors is not relevant to the future or potential status of innovative business enterprises. Further, the fact that none of the current buyers, according to the author of this submission are exporting product, does not preclude them or others entering the market.
Public Submission 29 Comment 49	The EIS states that the value of lobster is weather dependant. This is not always the case. Price can be more affected by border closings, health scares etc and the marina will have no effect on these factors. It will also have no effect on the weather and fishing will continue to not be undertaken in poor weather.	Poor weather is a more significant determinant when managing a vessel along side a jetty in bad weather in the open whether for refuelling, loading bait, crew or unloading catch. The marina provides a sheltered area to tie up along side and accordingly creates a safer and more comfortable site for performing loading, unloading, fuelling and related activities. These arrangements better reflect current Occupational Health and Safety Standards.

Public Submission 29 Comment 60	Without a buyer/processor at Cape Jaffa, shark fishers will not land catch. The current fishers are based at Robe and are well serviced with buyers/processors.	With significantly improved facilities, and the protection of a harbour like Robe, those that do catch shark and wish to operate from Cape Jaffa or those Rock Lobster fishers wishing to better utilise their vessels during the off-season are likely to encourage additional services including a buyer.
Public Submission 29 Comment 61	There is a chandler operating at Beachport who services the entire fishery. There is insufficient work for 2 chandlers. It is doubtful that he will relocate. The cost of establishing or relocating a mechanic or shipwright business would far outweigh any potential returns for a shrinking, seasonal business.	There is the long term potential with the development of the recreational and commercial fleets to create a demand for marine related retail and service activities. The provision of some basic services and the sale of materials and equipment for the boating sector would provide convenience to the fishing, aquaculture and recreational boating fraternities. This could also create a base upon which to build the enterprise to serve others in the locality in addition to the marine activities.
Public Submission 29 Comment 63	There are only 19 commercial fishers and 6 have indicated to me that they have no intention of relocating to the marina, mainly due to the costs, it would seem that this development is counter productive.	The costs associated with the berthing of commercial vessels have been discussed with the fishers in very general terms however no detailed arrangements or price determined. There are 21 fishers who have registered their interest and at various discussions including the individual fishers and industry representatives the concept. was viewed most favourably and not counter productive to their interests.

5.5 Construction and Operational Effects		
5.5.1 General Comments		
Government		The materials excavated during construction will be classified in terms of purpose and utilised accordingly. There will be additional topsoil available to provide a greater depth of this material. The additional topsoil is derived from the areas of the waterways to be excavated.
Gov Submission 11, SENRCC, Comment 7	There is some doubt regarding the suitability of materials excavated for the proposed use of improving topsoil quality.	
Public		The potential presence of endangered species is acknowledged and was assessed in detail as part of the EIS and the prior EPBC Referral. In the EPBC Act Referral documentation are assessments of the possibility of occurrence, and quality of habitat available for one amphibian, two plants, one terrestrial mammal, three marine mammals, one shark, 19 birds and eight migratory species, none of which are likely to be significantly affected by the proposed development. The outcome of the referral was a determination that the action is not a controlled action. Refer Appendix 1 of the EIS.
Public Submission 30 Comment 6	Critically endangered species may be present. The survey in the EIS appears inadequate, not well described, and it is difficult to assess. Consequentially the species list must not be regarded as comprehensive.	
Late Submission 3 Comment 1	The proponents have made some good decisions to work at a win-win situation for the environment and locality of Cape Jaffa. Protecting the marine environment is crucial and the irrigation management plan is a progressive idea.	The submission acknowledges there are advantages for all resulting from the proposal and that the irrigation management proposed is progressive.
5.5.2 Materials Used for Breakwater Construction		
Government		The materials are to be encapsulated in a fabric material to contain the sands and limestone proposed to be used in the core of the breakwater. In this way the core of the breakwaters will be impermeable.
Gov Submission 12, Planning SA, Comment 61	Clarification of terminology used in describing breakwater core material. It is described as impermeable and yet constructed of sands and rubble.	
5.5.3 Licensing Requirements		
Government		For the purpose of licensing, separate management plans will be provided for each of the activities that require separate authorisation from relevant agencies. The provision of concise, specific plans on each activity will assist the relevant agency in its role in relation to that activity. The activities that require separate authorisation or licensing are:
Gov Submission 13, EPA, Comment 14.1	Activities requiring licensing are: Dredging, Activities Producing Listed Wastes, Marinas and Boating Facilities, Sewage Treatment Works, Waste or Recycling Depots, Concrete Batching Works, Maritime Construction Works, and Discharges to Marine or Inland Waters.	

Public		• Construction Dredging (EPA); • Marine Construction (EPA); • Discharge to marine waters (Dewatering) (EPA); • Wastewater Treatment (DH and EPA); • Reclaimed Water Irrigation (EPA); • Marina and Boating Facilities (EPA); and • Adaptive Coastal Sand Bypass (EPA). Various other approvals or authorisations have been sought and obtained, or are sought as part of the Major Development process, including: • EPBC Referral - determined to be not a Controlled Action (EA); • Aboriginal Heritage (DAARE) – Section 12 and 23 authorisations; • Marine Construction (TSA); • Seagrass Wrack (PIRSA/CPB); • Coastal Sand Bypass (CPB); • Vegetation (Native Vegetation Council); and • Confined Aquifer Water (taking) Licence (DWLBC). Section 5.9.5 of the EIS also identified licensing and approvals requirements.
	There are no public submissions on this issue.	
5.5.4 Environmental Monitoring & Management Plans		
Government		All necessary analysis will be incorporated into the monitoring and management regimes to ensure water quality is maintained. The Monitoring and Management Plans under development form, a family of Environmental Monitoring and Management Plans that apply to the construction and ongoing operation of the facilities. In addition to the responses provided herein, the EIS provided a significant depth of investigation to assist authorities in their assessment. The monitoring and management plans are therefore focussed on the activities and operation of the development and will include water quality and seagrass monitoring, amongst other environmental management programmes, as identified above in 5.5.3.
Gov Submission 13, EPA, Comments 5	A full chemical analysis is likely to be required prior to opening of each channel(s) and connecting to the marine environment in order to confirm that the channel water quality meets the marine water quality.	
Gov Submission 13, EPA, Comment 13.3	Monitoring of water quality and seagrass coverage and health (by markers or photo points), together with marina and coastal water quality is likely to be required during construction and following commissioning. The monitoring could then be reduced/ceased should monitoring results confirm that the marina and associated water quality aspects are not impacting on seagrasses.	

Gov Submission 13, EPA, Comment 10	EPA recommend that neighbouring sensitive receptors be notified prior to operations of noisy and heavy machinery during the hours of 2200 to 0700 hrs.	In terms of sensitive receptors, the plans will incorporate the requirement that: *"neighbouring sensitive receptors be notified prior to operations of noisy and heavy machinery during the hours of 2200 to 0700 hrs"* Draft Monitoring and Management Plans will be provided to the authorities to assist in the assessment.
Gov Submission 13, EPA, Comment 14.2	EPA recommends finalising, as part of the response document, all management plans associated with activities requiring licensing, including: Dredging Environmental Management Plan, Soil Erosion and Drainage Management Plan, Waste Water Treatment Plan, Irrigation Management Plan, Site Construction Management Plan and Environmental Management Plan. This will alleviate difficulty that EPA has experienced in assessing the environmental aspects of the proposal.	
Public		Dust from construction activities will be specifically identified in the monitoring and management plan to ensure there are no effects from wind blown dust. The EIS in Section 5.2.30 sets out details in relation to the expected occurrence of dust. It is also noteworthy that the soil types found on-site are sand and limestone, with minimal clay content and medium particle size, therefore are not readily prone to being wind blown.
Public Submission 28 Comment 11	Dust will be a problem when the wind blows from the northeast, for at least 10 years as 2 million cubic metres of soil will be excavated, transported and redeposited, plus building dust. A protocol for wetting of the soil to prevent dust spreading over the township is required.	
Public Submission 29 Comment 54	50 Truck movements per day during summer, with dust and noise, will kill the tourist trade.	50 truck movements per day equates to only 5 per hour on average, which is an insignificant traffic flow. The construction activities will occur mostly some distance from the existing developed area and will attract the interest of tourists and visitors.
5.5.5 Dredging & Earthworks Drainage Management		
Government		The method of excavation of the main harbour basin is outlined in Section 3 of the EIS and discussed further in Section 5. Information in relation to dewatering of the excavations is provided in various sections of the EIS including Sections 5.2.3, 5.2.6, 5.2.10, 5.5.1, 5.5.10 and Appendices 13 and 14. The proposed excavation methodology is a partially wet excavation. It is intended to dewater to about the top of the limestone formation and to complete the excavation to the full depth of the waterways as a wet excavation, using excavators working on the limestone cap backwards away from the excavation face. This method therefore minimises dewatering during construction. Appendix 8 has been provided subsequent to the first issue of the documents to enable the assessment. It is considered most appropriate to discharge fresh water from dewatering onto nearby low lying land within the site. The highly permeable soils will allow the water to percolate through the soil profile and return to the watertable. If water with
Gov Submission 10, SECWMB, Comment 4	The method of excavation of the main harbour basin remains unclear. The Groundwater Management Plan (Appendix) describes the use of pumping wells for the purpose of excavation. Has a wet excavation of the main harbour basin been considered?	
Gov Submission 11, SENRCC, Comment 10	There is no detail provided regarding the dewatering during construction. Experience is that larger than expected volumes may result. With the missing information in Appendix 8, it cannot be determined whether there has been adequate consideration given to these aspects.	
Gov Submission 12, Planning SA, Comment 55	Clarify management of water generated by dewatering activities.	

		elevated salinity, which could potentially effect nearby vegetation, is encountered during dewatering, that water will be managed in a similar manner to the dredging water, as outlined in the EIS. This involves discharge to the sea via settlement ponds as required in order to manage turbidity. Appendix 13 of the EIS includes assessment of the likely effects of direct discharge of dewatering water to the sea, and concludes that *"it is unlikely to have any detectable impact".*
Gov Submission 13, EPA, Comment 1	The EIS refers to the construction of a coffer dam to contain and 'treat' dredged material prior to discharge of overflow back to the marine environment. Further detail should be provided of the estimated size of the dam, volume and rate of dredged material entering and leaving the dam, and the expected quantity of water to be released.	The EIS refers to the use of settlement ponds as the primary turbidity management methodology and, if required, a coffer dam for additional turbidity management. See Section 5.5.10 of the EIS. The estimated size of each settling pond is approx 2000 cubic metres, 1.5 metres deep and 35 metres by 35 metres. Each pond provides for approximately 1.7 days storage of dredged material, based on an input of 50 cubic metres per hour of solids. A retention time of 1 day is considered adequate, although given that the materials have low clay content, this is a conservatively long period. Multiple settling ponds will be used to allow a settling period and removal of the solids periodically. The expected volume of dredging water is approximately 20,000 cubic metres, although a significant portion of this will infiltrate through the soil profile or evaporate, so the volume of water returned to the sea will be reduced. The rate at which the water is discharged back into the marine environment will be determined by the pump capacity employed at the time however it is anticipated that a rate of 2500 m3/day is appropriate. The proposed Dredging Environmental Monitoring and Management Plan will incorporate further details of the management of dredging water and solids.
Gov Submission 13, EPA, Comment 13.1	The EIS (Appendix 13) details that disposal of dredging effluent will have different discharge criteria depending on where it discharges, possibly referring to application of a mixing zone under the EPP. As stated elsewhere, the region 200 m offshore is in dense seagrass, so it is unlikely that a mixing zone would be supported by the EPA at these locations.	It is acknowledged that the management of dredging activities must be conducted to protect the nearby seagrass beds from the potential effects of dredging, including the effects of reduced availability of light associated with turbidity. To this end, the EIS discussed several options for the appropriate location of dredging water return and monitoring of turbidity. The proposed Dredging Environmental Monitoring and Management Plan will incorporate the return of dredging water at an inshore location that is not over seagrass beds and monitoring of turbidity at prescribed locations, including at the nearest seagrass beds.
Gov Submission 12, Planning SA, Comment 59,	Further details required re the management of saline soil from dredging to prevent impact on vegetation, adjacent agricultural land or structures/foundations.	The dredged materials will be drained and relocated to be placed as fill on the site, together with materials excavated from land based construction. There is ample

Gov Submission 13, EPA, Comment 9	Further information is required to confirm at what depth below final land surface potentially highly saline material from dredging will be placed, with reference to final land use.	opportunity to place any saline soils at depth below other non-saline soils in order to minimise any potential effect on vegetation. Saline soils will not be used as fill in developed areas unless it is placed at sufficient depth to avoid any adverse effects on the future use of the land. The depth of fill required to achieve the final landform varies up to approximately 7 metres and given the small volume of materials to be dredged in comparison to the volumes of land based excavations and fill, there is ample opportunity to place any saline soils at sufficient depth to avoid future soil salinity issues.
Public		The periods of disturbance will be limited and monitoring will occur for the duration of the dredging activities. The extensive seabed video undertaken did not reveal significant fauna through the area nevertheless careful and timely adaptive management to minimise effects will be undertaken. Baseline seawater quality data has been collected as part of the ongoing assessment of the effects of drain discharges into the bay. The proposed Seagrass Monitoring and Management Plan, together with the Dredging and Marine Construction Monitoring and Management Plans, incorporates water quality and seagrass health monitoring and management regimes in order to minimise any potential effects.
Public Submission 30 Comment 11	Water turbidity is a concern to seagrass health and sea life and will need to be monitored during construction, as outlined in the EIS. The report comments on turbidity being expected to be tolerable for seagrass beds, but does not comment on effects on fauna. Turbidity monitoring during construction must be rigorous and adaptive management applied. Baseline sea water quality data needs to be collected. The sea should be tested for existing nutrient and toxin levels.	
5.5.6 Stormwater Management		
Government		Investigations indicate that for every 10 ha of developed area, an area of approximately 1000 m^2 is required to accommodate the 1 year ARI, 4 hour event. In the vicinity of Rothalls Road there is a requirement for about 5000 m^2. Along Rothalls Road there is an un-vegetated open area which is many times the size of the required stormwater detention without effecting the vegetation. There are therefore extensive areas in which stormwater can be accommodated and dissipated such as not to create waterlogged areas. These open shallow swale areas can be readily managed to eliminate weeds. This locality is presently heavily infested with weeds and the proposal will result in this area being rehabilitated. On the allotments along the waterways there is proposed a 4 metre easement in which stormwater will infiltrate where grass and gardens are provided. Where infiltration is not provided in this part of the allotment, landowners will be required under development encumbrance to direct water to on site systems incorporating infiltration to ensure that, except in extreme events, no stormwater is discharged directly to the waterways.
Gov Submission 12, Planning SA, Comment 34	Clarify location of stormwater basins along Rothalls Rd and implications for roadside vegetation from their construction.	
Gov Submission 12, Planning SA, Comment 67	For the stormwater detention basins shown inland of Cape Jaffa and Rothalls Rd, clarify basin size and the effects on surrounding land use, i.e. weed and local waterlogging,.	
Gov Submission 12, Planning SA, Comment 35	Clarification of stormwater management on the waterways side of allotments. It is suggested that a grassed swale or infiltration trench be considered to intercept runoff.	

Gov Submission 12, Planning SA, Comment 70	Is some form of vegetated or mulched infiltration trench and/or gutter/drain connection to the road system proposed?	Potential exists to use various on-site detention facilities including pebble paths, infiltration trenches and soak wells. The techniques are in accordance with the principles of Water Sensitive Urban Design (WSUD) as described in the Good Residential Design Guide (Planning SA 1999).
Public		
	There are no public submissions on this issue.	
5.5.7 Boat Washdown Facilities		
Government		The period for maintenance and lifting of commercial vessels occurs at the end of the season for the limited number of vessels working from Cape Jaffa and not when the facility is being heavily utilised by the recreation boat fraternity. If for example hull cleaning and wet rubbing were relocated this will occur in the commercial area to the east of the area identified for car parking. It is not anticipated that the volume and timing of activity will cause a conflict between and commercial and recreational users. Relevant facilities including cut off drains and collection systems will be established according to the draft Code of Practice for Vessel and Facility Management: Marine and Inland Waters (EPA Feb 05). No stormwater or wastewater from these washdown areas will be directed to the waterways, nor will wastewaters be directed to stormwater. The facilities will be established according to all relevant codes of practice, guidelines and legislative requirements. Given that the area will not be roofed as this will limit the size of vessel and also the operation of the proposed travel lift, the stormwater will be collected, treated and discharged to sewer rather than disposed into the stormwater system. The amount of stormwater that is collected and disposed to sewer is minimal given the size of the facility. Further as it is unroofed it is considered impractical and inefficient to install a first flush and treatment system as the remaining stormwater could still be contaminated depending on how clean the floor of the facility has been left. The boat washdown facility will be designed in accordance with the draft Code for Vessel and Facility Management. These features will be incorporated in a Stormwater Monitoring and Management Plan.
Gov Submission 12, Planning SA, Comment 37	Appropriateness of shared use of boat washdown facility is questioned. Congestion and conflict may become a problem. If hull cleaning and wet rubbing is precluded from this area, where would this occur?	
Gov Submission 13, EPA, Comment 3	The commercial & recreation washdown area should comply with EPA requirements and reflect in intent the draft Code of Practice for Vessel and Facility Management: Marine and Inland Waters (EPA Feb 05) and the draft Code of Practice for Materials Handling on Wharves (EPA Feb 05). The key aspect in the CoP is that there are interception drains in all work areas so that water undergoes treatment rather than just settlement and reuse through irrigation. The EIS is vague on this. The work areas should also have a first flush system.	

Gov Submission 13, EPA, Comment 11	The EIS states that wastewater derived from hull washing etc will be located within a bunded area and that treated wastewater will be directed to trade waste. It is recommended that the proponent clarify, where such areas are not roofed, will uncontaminated stormwater be directed to trade waste or (when not in use) be forwarded to the stormwater system. If so, what mechanisms will be used to prevent failure of such systems? The bunded areas must conform to the appropriate EPA Guideline (EPA 080/04).	Engine repairs, fibreglass repairs, painting, hull coating etc are also excluded as these will occur within workshop areas or other specially dedicated areas with the necessary infrastructure to contain, treat and dispose of wastes. All wastewater will be contained, whether bunded or otherwise, collected, treated and disposed in the same manner. The treatment of the water will include screening or filtering to remove larger sediments and particles, the remaining water will pass through an oil separator. This sludge will be removed and disposed at a licensed facility. A buffer storage volume will be provided to ensure that the wastewater can be discharged at a rate and concentration suitable for the WWTP.
Public		Refer commentary above and note that the facility will accord with the relevant Codes of Practice.
Public Submission 30 Comment 12	The boat washdown area, while good in theory, needs to be a tried and tested design that protects the environment. Clarification regarding the management of runoff from these high risk areas and definition of high risk is required. The objectives stated in the EIS are appropriate but the plans suggest that the boat washdown area that is used for abrasive and high pressure cleaning drains toward the waterways. The plan has not been detailed and there is no indication of the runoff collection point. Further detail of the trade waste collection system is provided in Section 5.6.11 but it does not detail what will happen to the liquids. The logical conclusion is that the liquids will be returned to the stormwater system and that contaminated liquids may return to the marina or sea.	
Public Submission 30 Comment 22	In water hull cleaning will be allowed with EPA approval if the Code of Practice is followed. This will go directly to the marina and out to sea.	The EIS states in Section 5.6.11 that: *"In-water hull cleaning within the marina will not be allowed without approval from the EPA."* It is acknowledged that this is not a practice that should be encouraged nor allowed without the appropriate approvals and management. It will not be encouraged and the Marina Rules will state specifically that, in addition to the appropriate approvals, it will not be allowed without the knowledge and consent of the Marina Manager. Only extenuating circumstances should warrant in-water hull cleaning.

5.5.8 Protection of Shipwrecks		
Government		It is noted that reference to the Act was omitted from Section 5.3.9 of the EIS. This Act will be incorporated and referenced in the relevant documents. Further discussions have been held with DEH and a review of the reports provided by DEH surrounding the loss of the Victoria confirms that the vessel was some distance from Cape Jaffa when it went down. Given all of the circumstances, DEH has advised that the Victoria is very unlikely to be in the area of the project. There have also been extensive seabed video survey undertaken extending several kilometres out to sea and there is no evidence of any wreck in those surveys. Nevertheless, appropriate awareness training will be undertaken to ensure that during construction items can be identified and action taken, should operators/contractors find evidence of foreign material.
Gov Submission 8/13, DEH, Comment 15.2	Reference to *Commonwealth Historic* Shipwrecks *Act 1996* should be included in Section 5.9.3, although it is referenced in Section 5.5.17.	
Gov Submission 8/13, DEH, Comment 15.3	DEH advise that the wreck of the *Victoria* has not been located, therefore its exact position is not known. Its last reported position in 1846 was 7km North of Cape Jaffa in around 12 metres of water. There is a possibility the remains are situated in the coastal waters off Cape Jaffa within the development area. DEH also advise: that the wreck of the Victoria is protected under the *Histroic Shipwrecks Act 1976* and it is an offence to interfere with a wreck or relic. • A seabed/shoreline survey should be carried out to identify any remains and avoid inadvertant damage. • If a wreck or relic is located it should be reported to DEH. • If a declared wreck exists, a 500 metre buffer zone applies and no development should take place within this area.	
Public		
	There are no public submissions on this issue.	
5.5.9 Community and Neighbourhood Noise		
Government		Section 5.5.18 of the EIS sets out the general conditions under which the commercial fishers operate to minimise as far as practicable the noise emissions from their operations including hours of operation for certain activities. Section 5.2.31 of the EIS sets out the likely sources of noise. Residential and tourist development is located away from the commercial area. residences facing the water in proximity to the commercial area will be required through the development encumbrance to acknowledge the existence of these activities and guidelines will set out techniques to incorporate design and building features as one measure to achieve appropriate standards.
Gov Submission 2, Dept. of Health, Comment 11	Noise from operations: To avoid conflict between residents and marina operations it is recommended that residences and tourist accommodation should be sited, designed and constructed to attain World Health Organisation's Guidelines Values for Community Noise. "Neighbourhood" noise generated by neighbours, is a source of potential conflict and may be from fixed sources, eg, air conditioning and pool pumps, as well as other sources. Noise generated from fixed sources should not exceed 40 dB(A) measured at the residential property boundary per the EPA's requirements.	

		Section 5.3.16 of the EIS includes: • incorporation of information about the activities of a working fishing port in the marketing information for the purchase of all land; • the application of minimum specifications for sound attenuation in the design and construction of dwellings in areas immediately abutting the main basin; • formal acknowledgment that some operational noise from the fleet may result from time to time; and • the control of activities and the times of those activities on the commercial wharf. In terms of "Neighbourhood" noise, the development encumbrances will require that all fixed sources of noise such as air conditioners and pool pumps not exceed 40 dB(A) at the residential boundary in accordance with EPA requirements.
Public		During construction, noise will be managed in accordance with the EPA Guideline on Construction Noise (July 2002) and AS 2436 (Guide to Noise Control on Construction, Maintenance and Demolition Sites). Construction noise is discussed further in Section 5.5.4 and in the Site Construction Monitoring and Management Plan. Construction activities will be limited in these later periods to the hours of 7.00am and 10.00pm. Council has established a committee expressly to manage the project. There will be, as part of the Construction Monitoring and Management Plan, a requirement to provide a means to receive comments from the public, to report those comments and take appropriate and timely action where necessary.
Public Submission 28 Comment 12	Construction noise, as the project gets closer to the township, will be a problem. A curfew period is required. A committee should be in place before stage 1 starts between CJDC, KDC and Cape Jaffa residents to monthly discuss concerns and resolve issues such as noise/dust as they arise.	
Public Submission 29 Comment 50	Commercial vessels typically leave between 4.00 am and 6.00 am. Although they have planing hulls, diesel engines and wet exhausts, they still make a great deal of noise and can be heard from several km away on calm mornings.	These vessels already operate in this locality. The greatest noise levels result from these vessels when they open their throttles out to sea. This will not change as a result of the proposal. Idling vessels, as will be the case within the marina are readily controlled. The movement of vessels already occurs close to the township and is part of the acknowledged function of Cape Jaffa as they are at Robe and other coastal locations where fishing fleets operate. Those vessels that choose to use the harbour will be further removed from the existing settled area of Cape Jaffa although vessels steaming in the open sea will not change. The dwellings facing the main basin will be required to incorporate building materials and design features that ensure an appropriate internal environment.

		It is also noteworthy that the more modern vessels incorporate quieter engines and wet exhausts, which reduces noise from the vessels.
Public Submission 29 Comment 52	Construction traffic noise will be intrusive and unacceptable. It will be going on for 12 hours per day, nine months of the year for up to 10 years.	Construction traffic will in the main be well separated from the existing township and therefore any noise associated with the construction of the development will be unlikely to cause noise impacts. The normal requirements for construction management including noise management will be set out in the Construction Monitoring and Management Plan. The heavy equipment required for major excavation works will not be present for extended periods as these works will be undertaken over short periods of about 3 to 4 months duration and not on a continuous basis 12 hours per day for 10 years.
5.5.10 Waste Management		
Government		Council is currently developing its waste strategy, have made application for the establishment of a waste transfer station at Kingston and has proposals for the receipt of garden refuse and green organics. The introduction of more development and activity in this locality will result in greater attention to inappropriate disposal of wastes.
	There are no government submissions on this issue.	
Public		
Public Submission 11 Comment 18	People are currently dumping rubbish in Bernoulli Conservation Reserve, will there be garden refuse collection?	
5.5.11 Vegetation Monitoring and Management		
Coastal Heath and Beach Access		
Government		Support for the revegetation of degraded areas is acknowledged. The access track to the beach at the eastern end of the development area will require the clearance of approximately 0.3 ha of coastal dune vegetation in moderately good condition although sections are infested with Bridal Creeper. This will replace two existing beach access points for motor vehicles.
Gov Submission 8/13, DEH, Comment 18.1	It is recognised that some coastal foredune would need to be destroyed to accommodate the proposed channel. DEH therefore supports the revegetation of degraded areas proposed in the EIS.	

Gov Submission 12, Planning SA, Comment 29	What are the implications of allowing beach access for the launching of boats at the eastern end of the development, which could lead to beach/foredune erosion, disturbance to dune vegetation/fauna and pollutants from cars/boats. The EIS states that up to 80 vehicles currently use the beach to launch boats and most of these boats would use the boat ramp within the development. It does not consider a scenario of continued beach launching at current or increased levels if boat ramp fees encourage it. Continued beach access would encourage vehicles to drive along the beach to Kingston which could detrimentally affect Hooded Plover populations and fauna (especially avifauna) associated with the coast, Butchers Gap Conservation Park and local wetlands? The proposed car park appears to have insufficient capacity to deal with the potential number of vehicles/trailers and tourists/visitors. It is unlikely that boat launchers would use the car park and walk to the beach unless parking on the beach was prohibited and enforced.	Given the proposed development of a boat ramp and associated facilities within the marina, there is likely to be considerably fewer boats that will be launched from the beach. The conditions in this eastern area and to the east of the major development area is generally less suited to boat launching and therefore notwithstanding the fees charged for the use of the ramp, boat users tend to use a safer reliable area for the launching and retrieval of their boats. Walking access tracks across the foredune vegetation will be constructed either as compacted rubble tracks or suspended timber "boardwalks" which can be built with only minor disturbance. Details of removals and remediation will be included in the Vegetation Monitoring and Management Plan. Remediation will include regeneration and enhancement of the foredune vegetation, infill plantings along roadsides, management assistance to NPWS in Bernouilli, Conservation Park, and assistance to an integrated weed management program in the area. Extensive landscaping in and around the residential allotments with local native species will further enhance the local environment. Active management of weeds and human traffic along the edges of the coastal dune vegetation area will help minimise the potential edge effects from adjoining land use. This vegetation type in good condition forms an almost impenetrable mass that makes foot traffic extremely difficult. Coastal wattle grows and spreads sideways very quickly and regeneration should be quite rapid once disturbance factors are removed. Control of domestic pets, particularly cats, is difficult as there are no by-laws or legislation available to help enforce responsible ownership. Nevertheless, encumbrances will be placed on all properties within the development advising of the impacts of domestic pets and the requirement for them to be contained on site and when on public land on lead. Fencing around the sensitive areas of potential native fauna habitat will be adequate to keep most dogs out and responsible ownership of all domestic pets will be encouraged through resident information and signage. The proliferation of marram grass along the Cape Jaffa foreshore has made much of the soft sand at the top of the beach less suitable for Hooded Plovers to breed. Although the Hooded Plover (eastern form) has recently been removed from the Commonwealth Environment Biodiversity and Protection Act listing, the species is probably still under threat in South Australia and is still listed as Vulnerable under State Legislation.
Gov Submission 13, NVC, Comment 25.3	NVC anticipates the large increase in human population will increase vehicular/pedestrian beach traffic and dogs/cats, resulting in potential threats to the Hooded Plover (Vulnerable in SA). Whilst various measures have been proposed, impacts on flora and fauna are still likely to be significant. The NVC requests that the EIS be expanded by providing further advice for the ongoing protection of this species, including either enforcing a closed season on the beach during the main part of the breeding season (September to late November) or prohibiting access to certain sections of the beach all year round. If this is not achievable the NVC requests documentation of how the vehicle and human beach traffic will not impact on Hooded Plover populations.	
Public		
Public Submission 21 Comment 3 & 4	We believe that the development will increase the number of vehicles travelling on the beach between Kingston and Cape Jaffa further degrading the foredune and increasing the likelihood of sand drift. This will further endanger waders and shorebirds and disturb the habitat of vulnerable species that frequent the area, including Bernoulli Conservation Reserve.	

Public Submission 30 Comment 7b and 7e	The EIS states the development proposes to protect native vegetation area whilst formalising public access to the coast in a sensitive manner. There is no clearly stated plan to provide suitable buffer zones and raised walkaways to protect the dunes. The footpath buffer between allotments and the foredune vegetation is inadequate and needs to be much wider than 6 metres. Housing will be built right up to existing foredune reserves outside the development area. Housing blocks will sit 20 m into and on the dunes, which is why yards will only be allowed to grow natives and building will have a 20 m setback. The dunes are already covered in tracks and degraded and it will be difficult to be kept people and trail bike riders out and they ought to be given another place to ride. A 20 m buffer is required between housing blocks in the development and the wetland. They also need to be fenced, reseeded and rehabilitated. Vegetated buffer zones of at least 25 metres around the dunes and 100 metres around the wetlands, per the SE Biodiversity Plan, need to be established and maintained. Better provision for the exclusion of cars from parts of the beach would be beneficial for some species such as the Hooded Plover and possibly the orange bellied parrot.	Many of the threats faced by Hooded Plovers involve humans, who accidentally crush nests and chicks, disturb the birds when breeding, and allow their dogs to chase and sometimes kill Hooded Plover chicks and eggs. Predation from foxes and cats is also a threat. Information will be provided to residents regarding protective measures that they can take to minimise further risks to these birds. It is also noteworthy that a significant increase in human population will occur as a consequence of the existing zoning for the land. As a consequence of this proposal, boats, trailers, cars and camping on the beach will be relocated away from the toe of the dunes thus reducing the threats to flora and fauna. A large area of partly vegetated fore dune on land used for grazing purposes, is proposed to be fenced and rehabilitated. This also significantly reduces threats to flora and fauna in this locality. Balancing this is the community expectation to have ready access to the beach in various forms. The use of the beach for access between Cape Jaffa and Kingston is considered to be outside the scope of the EIS as there are many other existing long-standing expectations of the community and this activity is controlled by Council under current by-laws. It is proposed however to create a vehicle free area within the major projects area portion of the beach. The trafficable area of the beach is well separated from the toe of the dune which is soft and does not afford a driveable surface. At high tides and during winter when sea cast wrack lines the beach it is not practical to use the beach as an access way. The proposed Vegetation Monitoring Management Plan will include a number of provisions to protect the coastal dunes from potential effects of the development. The 6 metre buffer, a portion of which is a hard surface, the vertical separation over the buffer, spot spraying within the buffer and adjacent native vegetation, fencing, controlled access points, dog and cat control, Bridal creeper control and the preclusion of cars and trailers from the area of the beach within the development site are all included. Further, commitments will be made to assist in the management of areas nearby the site which have conservation value and are in need of rehabilitation. The dunes have previously been damaged and developed. The Crown land was formerly an area accommodating a row of shacks. This area has not been well managed in the past however this proposal incorporates rehabilitation activities.

		Public access along beaches on the southeast of South Australia is a contentious issue that has been the subject of some debate. The environmental benefits of precluding vehicles from the beach are clear, as there are significant potential effects on vulnerable species such as the Hooded plover and orange bellied parrot. Equally, the community's desire to have ready access to the coast, including vehicular access has been clearly expressed. This issue exists for the entire coast from the Murray Mouth to well south of Cape Jaffa and this is clearly an issue for the management of the coast beyond this development area. It is also clear that changes to the management of the coast in the southeast outside of the area of this development are beyond the scope of this proposal. The proposal incorporates the exclusion of cars and trailers from the beach within the major development area, which is consistent with common practice in built-up areas and has been the case along the Kingston beach for quite some time. It is proposed to enforce this by Council by-law, as is done at Kingston, and that this would be subject to the normal Council process for the change of by-laws. Clearly, vehicular access to the beach in order to allow launching of boats from the existing boat launching area will be maintained until the improved facilities within the main basin are available. The proposal also maintains a vehicular access point to the beach so that cars (or cars and trailers), which can currently legitimately travelled along the beach to the east/north of the site, have continued access to/from that portion of the beach. Access points to the beach has been available for many years at Cape Jaffa and at a number for sites between Cape Jaffa and the portion of beach at Kingston that is closed to vehicular traffic. Vehicular access to the beach south/west of the existing settlement/jetty is not effected by this development and hence the potential effects of beach access adjacent to Bernouilli Conservation Reserve is considered to be outside the scope of this response document. In contradiction to these submissions, a number of submissions were made relation to the preservation of vehicular access to the beach. These submissions and the proponents response are provided previously in Section 5.3.6. Appropriate buffer zones adjacent degraded dunes have been provided and there is considerable work proposed in these areas to promote their rehabilitation utilising appropriate indigenous species. The Tea Tree area will be buffered and fenced and the waste materials removed as part of its rehabilitation. The area to the west of the access way to the beach will also be excluded from public access.

Community Ownership of Native Vegetation Areas		
Government		The community ownership of this area of vegetated land provides for its long term security in terms of land use and negates the existing rights for its agricultural use, including for example, its use for grazing of cattle, which would have significant consequences for the existing vegetation. The current situation of uncontrolled access and no management input in terms of weed, rabbit, cat or fox control provides an ongoing disturbance to some parts of the foredune vegetation. It is acknowledged that any increase in population could exacerbate these issues and therefore the incorporation of controlled access points, infill plantings, an integrated weed control program and a vermin control program will relieve these degrading pressures. It is acknowledged and understood that appropriate management of the area is also required to improve its protection. This is currently not the case for the lands held in the government's ownership. The area is degraded in a number of ways, including significant Bridal creeper infestation and the presence of some Cypress pines. The Vegetation Monitoring and Management Plan (VMMP) includes specific provisions for its protection. There are conflicting submissions on the benefits of community ownership of the vegetated foredunes. The foredune coastal heath vegetation in good condition is very difficult to walk through and easy access on controlled and maintained routes will allow people to get to the beach easily from the residential area whilst minimising disturbance to the vegetation, destruction of habitat and risk of snakebite or injury. The vegetated dune areas are deteriorating due to the intrusion of Bridal creeper and other pest plants. The managed movement of people through these areas will provide a greater degree of protection than currently exists. Evidence of encroachment is readily apparent in the privately owned land as well as the area owned by the Crown. The areas referred to east of the site and their associated corridors are outside the scope of this proposal and this assessment. The irrigation area is proposed to be located between the dunes and the Tea Tree
Gov Submission 11, SENRCC, Comment 6	Community ownership of the coastal vegetated dune would not necessarily result in its better management. This would require a dedicated commitment from the community owner (assumed to be Local Government). Increased population in the area will have some long lasting negative impact on the vegetated dune, despite the supported measures of its partial fencing and creation of buffer zones. There is some concern regarding the increased fragmentation of the vegetated dune as a result of constructing access paths to the beach. Elevated walkways are recommended. The statements "better quality habitat for native fauna in the foredune area" and "increased protection of foredune vegetation from foot and vehicular traffic" are questioned.	
Public		
Public Submission 11 Comment 7	It is good to transfer land to public ownership and to rehabilitate and protect it.	
Public Submission 21 Comment 2	We do not believe that transferring the vegetated foredune to public ownership will afford it any more protection and that the increased population will result in increased damage to dune and coastal vegetation.	
Public Submission 30 Comment 2f	The developer, state and local governments need to cooperate to negotiate with the landholders to the east of the site to secure future protection of the western end of the wetland system. The development could be an opportunity to organise land tenure discussions with the landholders. The vegetation corridor between Hog and Butchers Lake should be fenced from stock, rehabilitated, extended and re-established down to the development area so that they run along the entire length of the wetlands.	

Late Submission 3 Comment 2	The land owner to the east is open to new ideas for this land and the Government must seize the opportunity to secure protection of the wetlands now to redress the mistakes of the past and avoid more mistakes. The Commonwealth and State Governments need to cooperate to purchase, revegetate and fence off the wetlands up to Hog Lake. The irrigation area could run between the dunes and the wetland so that no stock goes north of the wetland and also the gap to the road could be revegetated. This would become a focus for tourism and sightseeing and improve the profile of the area.	area.
Paperback Swamp		
Government		Cattle fencing does not impede the movement of kangaroos or echidnas. The development area only covers the tip of this seasonally inundated area (approximately 2 hectares). The area of shallow water available to wading birds in the development area is very small, even in late winter and spring when water levels are at their highest. Pugging by cattle hooves and significant grazing impact is currently evident in this area. The rest of this seasonally inundated area to the east is privately owned land that is currently used for pastoral purposes. This adjacent land use is unlikely to change as a result of the development.
Gov Submission 12, Planning SA, Comment 30b	Fencing part of the adjacent Paperbark swamp from grazing would produce environmental improvements such as vegetation regeneration, however the benefits may be negligible as fencing will prevent access by more mobile fauna, such as kangaroos and echidnas. The close proximity of the land division and associated human disturbance may significantly reduce any habitat value, particularly for migratory waders and water birds. Greater benefits would arise from fencing a wider area. The proposed reserve could be extended to the north and the east to offset disturbance from the development.	
Public		The proponent would welcome commitments from relevant agencies and departments to have an input into the rehabilitation of key areas within the locality to ensure a win-win situation.
Public Submission 30 Comment 7h	Funding Sources for Rehabilitation There are several funding sources available that could pay for rehabilitation/revegetation of the wetlands. The development may provide a ready source of potential volunteers and 'friends' of the wetland to help. With care, there could be a win-win.	

Open Pasture Areas		
Government		The EIS in Section 4.6.1 includes a photograph of scattered trees in the open pasture area. The EIS also states that *"most of the original vegetation has been cleared"* All cleared vegetation will be chipped on site and spread as mulch for landscaped and unstable sandy areas. This will provide a seed source for natural regeneration, organic material to enhance soil structure and stabilisation of disturbed areas. Follow up weed control will be necessary to maximise the value of this mulching material and minimise competition for the regenerating vegetation and new plantings. There are remnants of senescent and mature coastal wattle and occasional drooping sheoaks scattered in this area. Understorey is dominated by exotic species including problem weeds such as boxthorn, false caper and horehound. The extent of boxthorn has increased significantly in recent years. Since the last access to the land by stock in 2003, there is evidence of coastal wattle regeneration. The removal of these remnants would be necessary in the construction of the waterways and the residential development within the existing zoned areas. Further, the requirements for coastal hazard risk also mean that extensive areas of the land need to be elevated. There have been no areas of native grasses or samphires identified.
Gov Submission 12, Planning SA, Comment 36	The EIS does not recognise that the Open Pasture areas contain scattered stands and/or individual native species. In particular, the land to the NE of the town entrance road supports a badly degraded dune community that was cleared after 1975 and has some residual plants and regenerants. Species of coastal sedge, shrubs and trees occur in areas.	
Gov Submission 12, Planning SA, Comment 40	How would vegetation be cleared and what would happen to the cleared material.	
Gov Submission 13, NVC, Comment 25.1	The NVC requests that the EIS document be amended to include further information on the vegetation within the "Open Pasture" area. In the event that it is considered to be native vegetation the Council requests additional information identifying the: • species, numbers and condition of the scattered trees in this area, and • number of trees that will require clearance. In addition, the NVC requires that any associated native understorey, such as native grasses or samphires, be identified and described.	
Public		
	There are no public submissions on this issue.	
Garden Escapes		
Government		It is proposed to elevate the land containing allotments to the south of King Drive, as detailed in Section 3 of the EIS. This allows a view of the bay over the existing vegetated fore dune, which continues to provide separation and a visual barrier between the allotments and the beach (see Figure 3.22 of t he EIS). This alleviates the risk of landowners illegally removing vegetation to obtain a view. The buffer between the fenced dune of 6 metres will be incorporated as part of the area to be monitored and managed to remove exotic plants should they attempt to establish in
Gov Submission 12, Planning SA, Comment 71	Protection of the dunes from exotic escapes from adjacent gardens will require more than a 6 metre buffer/walkway. Periodic spot spraying and inspections will be required to avoid exotic plants establishing.	
Public		

Public Submission 16 Comment 4	If King Drive is realigned and new houses are constructed, native vegetation will certainly be removed to avoid sea views being obstructed, thereby threatening the coastal dune. A local resident has planted trees along the road and these would have to be removed.	this buffer area. This buffer provides a valuable separation and a means of monitoring activities and the edges of the dunes for any weed intrusion. As such the buffer is a meaningful component of the plan for vegetation management. The proposed encumbrances and development guidelines will include specific provisions to ensure residents understand their obligations under the *Native Vegetation Act*. The VMMP details monitoring requirements and actions to be taken if illegal clearing of vegetation occurs. The areas of vegetation on the dunes will, in consultation and cooperation with the relevant authorities, be fenced, protected and rehabilitated. Development of the land also requires elevating the land to provide protection from sea level rise and hazards. As a consequence, upper levels of dwellings will gain distant views of the sea. The realignment of King Drive and the establishment of allotments will further remove vehicle activity from the rear sections of the dune and therefore there will be less threat to the dunes from erosion by severe winds and consequential loss of habitat.
Public Submission 24 Comment 2	If King Drive is realigned, the native vegetation along the sand dunes and roadside will be lost due to sand erosion from severe winds. The locals have nurtured this vegetation for many years.	
Public Submission 27 Comment 13	We are concerned that King Drive is to be closed to allow residential land to have 'absolute beachfront'. There is no meaningful buffer between these lots and the dune vegetation, which will be immediately between the lots and the beach. It can be anticipated that owners of these blocks will ensure that vegetation will be removed to increase their amenity, resulting in wind erosion of the dunes and loss of habitat for the native fauna.	
Late Submission 2 Comment 8	Houses adjacent to Section 306 risks the survival of its fragile flora and fauna.	
Pest Plant and Animal Control		
Government		This area is currently affected by feral cats and foxes. The population of cats is not expected to be significant due to the nature of the settlement. It is proposed to require owners of cats to contain them in enclosures outside or otherwise contained inside the dwelling. Similarly, dogs will not be permitted to freely roam outside of the owner's property within the Major Development Area. The reserves will be signposted similarly to the Bernouilli Conservation Reserve requiring dogs to be on leads. Council also has powers under the Local Government Act to manage dogs and cats. As part of the Vegetation Monitoring and Management Plan it is proposed to establish rules in relation to the restrictions/confinement of dogs and cats. Fencing that discourages the ready access of dogs will be erected around the dune and paperbark areas. In addition fencing along rear boundaries of allotments will be required to be constructed in a manner that does not permit the free movement of dogs into abutting reserves or walkways. Cats which are allowed to freely roam are more difficult to control as they are more agile and fencing required to contain cats is not practical or visually desirable. A Vegetation Monitoring and Management Plan will be prepared and will include a
Gov Submission 13, NVC, Comment 26.1 Gov Submission 13, NVC, Comment 26.2	The NVC requests that the proponent be asked to include within the EIS specific information describing the method or methods by which control of domestic dogs and cats is to occur, including details pertaining to proposed restrictions placed upon pet ownership, measurement of compliance and enforcement of controls. The NVC requests clarification within the EIS regarding the commitment to weed control, particularly in the dune vegetation, by the proponent. The NVC is of the opinion that this is best addressed through the development and implementation of a Weed Action Plan, including details of the controls placed on residents, the weed species to be targeted, their current levels of infestation, time of works, provision of funds and details of who will undertake the work.	

		Weed Action Plan and commitments in relation to the works to be undertaken, monitoring, timing and responsibilities.
Public		As part of the VMMP each land owner will be provided a list of the locally identified weed species together with lists of species appropriate and inappropriate for the area. Further, those properties with frontage to the vegetated dunes will be subject to more stringent controls on the type of vegetation that can be planted in the area 6 metres from the northern boundary.
Public Submission 11 Comment 13	I suggest that a list of problem plants be identified in consultation with Council weed officers and provided to all applicants.	
Public Submission 30 Comment 4	Protecting the marine environment from nutrient enrichment from wastewater has been addressed, but the marina will nevertheless will present an opportunity for introduced marine pests and boats will encourage their spread. Marine pest strategies need to be described and education resources provided for the boating community	Marine pests occur normally as a consequence of large vessels arriving from distant international waters. As this port is unlikely to receive cargo and other international waters passage making vessels, the propensity for marine pests is limited. Vessels entering the waters of the Port Adelaide River may also be exposed to higher risks. The provision of facilities for vessel maintenance reduces the need to steam to Adelaide and therefore reduces the risk of pest plant introduction. A Marine Pests MMP is being prepared.
Public Submission 30 Comment 7c	Cat invasion of the adjoining habitat is a significant threat to wildlife. Introduction of so many new allotments will result in a sudden impact on the wildlife from domestic dogs and cats. At least 170 new pet cats will roam the neighbourhood (based on average SA cat ownership). Other data indicates 290 new cats (based on 1,000 new residents). There will be at least as many dogs and people will walk their dogs and allow them to run off their lead in Bernoulli conservation reserve. Many birds will be slaughtered and many extra road kill will occur. This could significantly affect the viability of the orange bellied parrot. The assessment that the potential impact on this species is nil seems optimistic. Cat and dog control has not been addressed, which does not show environmental leadership. Controls must be strictly defined and enforced, and include: cat free zones (near the wetland, dunes and Bernoulli Conservation reserve), cat proof fencing and raised walkways through the foredune. The wetland will be afforded some protection by the fencing, however this is not sufficient to protect it.	There are likely to be fewer cats and dogs, given this is to be in part a holiday destination. Council has the authority to place controls and police the activities of dags and cats. Numbers and types of domestic pets is dependant on the demographic characteristics of the residents and users of this development. The presence of foxes is also of concern and vermin control programs in cooperation with Animal and Plant Control Boards or Natural Resource Management authorities will be implemented. Residents will be fully informed of their rights and responsibilities as pet owners. The Management Plan for the Bernouilli Conservation Reserve stipulates that animals be on leads. The policing of this and any other undesirable or detrimental activity is the responsibility of the ranger or parks manager. The vegetated dunes should also be dog and cat free zones and that animals are kept on leads when they pass through this area. The State Government manage the Bernouilli Conservation Reserve and together with the existing restrictions and additional requirements specific to the Cape Jaffa development these requirements will assist in protecting the local habitat. Fencing and walkways will be incorporated consistent with standard Coast Protection Board requirements.

Public Submission 30 Comment 7d	Cat and human deterrent fencing and raised walkways must be a part of the foredune and coastal access design. Fencing to the coastal foredune vegetation should be higher and more difficult to get through than a simple wire fence. The boardwalk through the coastal dunes should be high enough to allow native animals to pass underneath and protect people from snake bite. Cat proof fencing must be installed around the Bernouilli Conservation reserve, foredunes and wetlands. No-harm trap and return needs to be performed to check there are no large mammals that need to be spared from fences. Smaller mammals, snakes and lizards need to be able to get through the fences.	The proposal incorporates additional mechanisms to deter free ranging pets and information to owners of the impacts of pets on the natural environment. The Bernouilli Conservation Reserve is managed by the State Government and the responsibility for fencing rests with the government.
Late Submission 3 Comment 5	Cat control is a serious issue for the region because of endangered species. Cats kill hundreds of animals a year and can be perfectly happy if kept indoors. Council could easily control roaming cats as they do roaming dogs and fencing must be designed to control cats.	
Public Submission 30 Comment 7a	The development cannot proceed in its current design without conflicting with the Biodiversity Plan for the South East and SA Wetland Strategy for SA, which need to be respected. Concerned about habitat protection, fox/cat control, restoration/rehabilitation of linked habitat and the effects on the beautiful firetail, hooded plover and orange bellied parrot. The EIS discusses reseeding along the coastal dunes in consultation with Parks and Wildlife using local seed, re-establishing searocket and weed control in conjunction with the local weed control officer. This should be done in conjunction with dog and cat control otherwise it may do more harm than good. Restricting vehicles on the beach will help. More specific plans and assurances should be provided for vegetation management and rehabilitation that respect the state and regional strategies for protecting local species, habitats and areas of conservation significance.	The relevant Monitoring and Management Plans as an integrated set of management documents will recognise the biodiversity and conservation benefits of pest animal control together with the rehabilitation programmes to be implemented.

Amenity Plantings		
Government		Amenity plantings will generally be local native species, but selected exotics will be used to achieve a balance between the communities desire to protect and promote biodiversity conservation and communities desire to improve general and visual amenity. CPB has produced an information sheet which outlines garden plants that are known to become serious coastal weeds (CPB, 2003, Coastline No 34 - Garden Plants that are Known to Become Serious Coastal Weeds).
Gov Submission 12, Planning SA, Comment 33	Clarify species to be used for amenity plantings: are all amenity plantings natives or are species such as Norfolk Island Pines included.	
Gov Submission 13, NVC, Comment 26.3	The NVC commends the proposed inclusion of local native plant species in amenity/landscape plantings. The NVC emphasises that seed for these plantings should be sourced from as near as possible to the proposed development, preferably on the property. The NVC requests that consideration is given to seeking an amendment to the current EIS to ensure all species planted as part of the development are local native species. If this is not possible, then the NVC requests that plantings using alien species be minimised and controlled. In the even that non local native plant species are to be permitted the NVC requests that a list of alien species be included in the EIS and that the species on this list have a low potential for spread/establishment in native vegetation areas. The NVC further requests that the proponent identify mechanisms within the EIS to ensure the provision of advice to potential purchasers. It is understood that the reserve areas within the main development will comprise a combination of native and introduced species. The NVC requests that the scattered trees currently existing in areas designated as “reserve” be left standing, the area protected and supplemented by native understorey species.	Locally sourced seed will be used wherever possible, including from within the property and Bernouilli Conservation Reserve and Butcher Gap Conservation Park. To that end, discussions have been held with the Council officer, a local native vegetation nursery and Parks Ranger. The Vegetation Monitoring and Management Plan provides further information in relation to species used for amenity plantings, weeds and alien species planting. It includes planting guidelines in the form of a list of approved species, which is to be issued to all property purchasers. This will be further reinforced by requirements, within encumbrances, that preclude alien species which have a high potential for adverse effect on the nearby native vegetation areas. The existing vegetation in reserve areas will be preserved wherever practical. It should be noted that it will be necessary to change ground levels in some of these reserve areas as part of the development, as outlined in the EIS. The proponent in its design has attempted to establish an appropriate balance between the use of native species and exotics. Planting lists will be provided with the Design Guidelines to each purchaser of native and exotic species and the preferred areas for planting. There are some isolated outcrops of regenerated acacia in the existing zoned area used for cropping and pasture. These areas are interspersed with boxthorn and there is no native understorey. They are in part havens for rabbits and do not represent significant areas of vegetation value. There are better opportunities to provide linkages and significant rehabilitation along the road corridors and proposed new reserve areas.

		Where valuable vegetation exists within proposed reserves and the area does not require filling as part of the site works to meet Coast Protection objectives the vegetation can be incorporated in the overall reserve landscape plan.
Public		The proponent acknowledges the inclusion of Busaria spinosa (Danielle revolta). The proponent is willing to work with a 'friends' group should they wish to undertake labelling of species for education purposes. It is noteworthy that the proponents have had discussions with local residents about future planting and rehabilitation plans with a view to involve interested community members.
Public Submission 11 Comment 10	Agree that some unsuitable species have been planted along King Drive	
Public Submission 11 Comment 14	The list of recommended species should include *Busaria spinosa* (*Dianelle revolta*).	
Public Submission 11 Comment 15	Could the plants in one of the reserves be labelled for education?	
Public Submission 11 Comment 16	There are lots of good things mentioned re restoration/rehabilitation and vegetation of the dunes and road corridors. Why cant all reserves be planted with local vegetation to help link the coastal dune? Norfolk Island pines will dominate the skyline and change the visual landscape.	Acknowledged. Refer to response above.
Public Submission 21 Comment 6	We are concerned that unchecked planting of inappropriate species may impact on the coastal vegetation. Any replanting on the coastal zone should be carried out with local provenance. We already have a problem within Bernouilli Conservation Reserve from residents dumping prunings and cuttings within the park and in native scrub nearby, and are concerned that this will increase to an unmanageable level with increased population, especially if new residents are temporary or holiday residents or visitors.	With the increased activity in the area there is greater opportunity for surveillance and hence less likelihood of indiscriminate dumping of waste in the reserve.
Public Submission 30 Comment 7f	Use of Local Native Species Locally sourced native seed/species should be used where available, especially around the swamp area.	Locally sourced species will be used in the revegetation and landscaping schemes where available.
General		
Public		It is proposed to undertake rehabilitation, fencing and the construction of walkways through the vegetated dune areas adjacent to the development which will assist in the control of activities, dogs and cats in these areas. The proponent cannot speak for the government in relation to works to be undertaken in the Bernouilli Conservation Reserve.
Public Submission 11 Comment 19	Is the government going to provide the parks with extra people on the ground as there needs to be control of rubbish dumping, dogs/cats and bike activity, which are existing problems in Bernoulli Conservation Reserve?	

Public Submission 21 Comment 1	We are concerned that the status of orange-bellied parrot, a nationally endangered species, will be further compromised.	The potential risks to the Orange Bellied Parrot were detailed in the EIS, specifically Appendices 11 and 12, and have been determined to be very low. Nevertheless, the need for management of these potential effects is recognised and documented in the attached Vegetation MMP.
Public Submission 29 Comment 42	A large housing development and protection of coastal vegetation would seem to be mutually exclusive, as indicated by other developments around the coast.	This proposal specifically acknowledges the coastal dunes and vegetation and the need for their protection. These areas are to be retained and enhanced. Many examples of protection of coastal vegetation in developed areas exist. The key is to provide appropriate management measures and the resources to enact these plans in a coordinated manner. It should also be noted that, as much of this area is zoned for commercial/industrial and residential development, increased people pressure is inevitable. This proposal provides the opportunity for coordinated, appropriate management by all relevant parties that is sensitive to the needs of the receiving environment. The Vegetation Monitoring and Management Plan will incorporate detailed measures for the protection of these areas.
Public Submission 30 Comment 7g	As a compensatory measure, an island should be put in the middle of the reclaimed water storage dam to act as a bird refuge from cats and other feral predators	The need for adequate cat and other feral predator control is acknowledged and was discussed in the EIS. Further information is provided elsewhere in this response document. Refer Pest plant and animals response above. The provision of an island within the storage dam is not considered practical, given the engineering requirements associated with lining of the dam in order to protect the groundwater from potential impacts of the reclaimed water.
Late Submission 1 Comment 3	The extra population will have a major impact on Bernouilli Conservation Reserve	Much of the site is currently zoned for development and increased pressure from human activity will occur, regardless of this proposal. The need to care for the reserve is recognised in the proposal. Specific measures are proposed to be incorporated in the Vegetation Monitoring and Management Plan to assist in minimising the potential effects of increased population and liaison with relevant agencies will be conducted to assist with some aspects of reserve management. With an improved management regime and education about the reserve and a better surveillance of activities there will be increased awareness and interest in the protection of the Reserve from waste disposal and other harmful activities. An increased awareness and movement in the area will reduce the occurrence of these activities.

5.6 Risk and Hazard Management

5.6.1 Underground Fuel Storage Tanks

Government		Should underground storage facilities be developed they will be required, as part of licensing, to provide monitoring facilities. These requirements will be contained in the proposed Groundwater Monitoring and Management Plan (GWMMP). All relevant codes, guidelines and standards will apply to the provision of these facilities, should they be established and will be essential components in any licensing of facilities.
Gov Submission 12, Planning SA, Comment 62	Monitoring of adjacent groundwater should occur if there are underground fuel storage tanks to ensure early detection of potential impacts.	
Public		
Public Submission 30 Comment 21	The fuel and waste management faculties will result in an improvement. EPA guidelines should apply to any motor repair station activity.	

5.6.2 Household Use of Fertilisers and Chemicals

Government		A Risk Management Plan inclusive of spill management will be provided as part of the licensing application documentation. The following assessment assists in understanding the level of risk associated with household fertilisers. The type, strength and longevity of domestically available fertilisers and pesticides differ from agriculturally available chemicals, with domestically available chemicals less likely to impact on human health and the environment. Manufacturers undertake extensive research and are scrutinised by regulatory bodies to ensure that recommended application rates of fertilisers and pesticides are safe with regard to human health and the environment. As a result, domestic use of fertiliser and pesticides in accordance with manufacturer's specifications is considered to be a low risk for contamination. It is not legally possible for the Cape Jaffa Development Company to limit or prevent a resident from utilising a domestically available chemical and hence this cannot be managed for each resident. The proponent will implement appropriate measures in the proposed Waterways Water Quality Monitoring and Management Plan to ensure that fertiliser and pesticides used in public and open spaces areas are managed in accordance with the manufacturer's recommendations. In addition, appropriate guidelines and educational material will be provided to residents and land owners within the development in order to minimise risks to water quality and the marine environment.
Gov Submission 13, EPA, Comment 8	The impacts of garden fertilisers and pesticides may differ significantly from impacts associated with previous agricultural land use. A more detailed risk assessment and associated management plan is need to identify and address these risks.	
Gov Submission 13, EPA, Comment 12	The risk management option for toxic spill management is prevention and containment. Given that containment of soluble pollutants is unlikely to be possible in a tidally flushed system, a detailed risk assessment and management strategy will need to be developed for toxic spill management that includes risks associated with household chemicals and fertilisers.	

Public		In addition, an assessment of the potential effects of garden fertilisers on the marina waterways has been undertaken and is presented in Appendix C. It shows that total nitrogen and phosphorous loading to the waterways is in the range of 0.005 and 1.1 kg per day. The loadings are very small in the context of the significant volume of water in the marina waterways and the daily tidal exchange volume of between 336,000 and 840,000 cubic metres. The worst case scenario of 1.1 kg/day is based on very pessimistic assumptions and even these loadings present a very small risk to the marine environment. Further information on the risks to the marine environment is presented in Section 5.2.4 of this response document titled Effects on Marina Water Quality and Seagrasses in the Bay. It should be noted that this assessment is in no way intended to justify the irresponsible use of garden fertilisers. The proposed Waterways Monitoring and Management Plan incorporate measures for managing the risks associated with the use of household chemicals, including garden fertilisers. It does however provide a mechanism for assessing the risks to the marine environment. Further information on the Waterways Monitoring and Management Plan is presented in Section 5.6 of this response document titled Construction and Operational Effects. There is no evidence of the presence of the Leafy Sea Dragon in this part of Lacepede Bay either in the marine investigations undertaken by SARDI or other research into the marine habitat of this locality. Further, the habitat assessment performed and presented in the EIS, particularly Appendix 13, identifies that the marine habitat in the vicinity of the mouth of the breakwaters is not typical of the preferred habitat of this species. Potential habitat does exist in the general area, but is a significant distance form the site and the risks are considered to be negligible. See Section 4.7 and Appendix 13 of the EIS for a detailed description of the marine environment.
Public Submission 17 Comment 3	The area is only suitable for normal subdivision because the mixture of fresh water and herbicides may harm the Leafy Sea Dragon that I believe lives in Lacepede Bay.	
5.6.3 Potential Acid Sulphate Soils		
Government		Notwithstanding the low risk for CASS as acknowledged by SENRCC, it is appropriate to formalise compliance with CPB guidelines and accordingly an Acid Sulphate Soils Monitoring and Management Plan has been prepared.
Gov Submission 8/13, DEH, Comment 19.3	From the information provided, there appears to be no or low risk for the potential presence and disturbance of coastal acid sulphate soils (CASS) at the site. Adjoining land has not been investigated in much detail and the report suggests that there is a risk of the presence of CASS directly south of the site. DEH advise that works should comply with the Coastal Protection Board policies	

	and has released a set of guidelines that should be followed where acid sulphate soils may be likely. It is therefore recommended that the ASS Management Plan provided include compliance with the Coastal Protection Boards policies and be followed, especially with regard to seeking expert advice.	
Gov Submission 11, SENRCC, Comment 9	SENRCC supports the conclusion that there is low risk of adverse effects of potential acid sulphate soils.	
Public		
	There are no public submissions on this issue.	
5.6.4 Marine Pests		
Government		The opportunity to liaise with PIRSA is appreciated and acknowledged. Significant assessment and discussion of the risks and protection measures were presented in the EIS, particularly in Sections 5.2.15, 5.6.6 and Appendix 13. Details of the management of monitoring for marine pests will be incorporated in the proposed Marine Vegetation and Waterways Monitoring and Management Plan.
Gov Submission 4, PIRSA, Comment 2	The EPA is currently developing a draft 'code of practice for vessel and facility management, marina and inland waters' for public consultation. The PIRSA Fisheries Marine Biosecurity Program is also able to provide advice.	
Gov Submission 8/13, DEH, Comment 19.9	The EIS does no appear to have addressed management and monitoring marine pests in much detail. The assumption that good water quality and intact surrounding eco-systems will curtail potential outbreaks of marine pests can not be substantiated. The Appendix states that there is a high potential for the introduction of marine pests into the marina. The EIS states that spot checks for key species will be undertaken. DEH requests details of monitoring and contingency management plans for dealing with marine pest outbreaks.	
Gov Submission 13, EPA, Comment 13.2	Appendix 13 states that the dredge and barge used for all dredging in the marina would need to be cleaned if it came from a region with a high likelihood of marine pests. This is not repeated in the EIS where it should be reinforced.	The requirement for the cleaning of equipment to prevent the potential introduction of marine pests was restated in the EIS in Section 5.6.6 and will be incorporated in the proposed Marine Vegetation and Waterways Monitoring and Management Plans.
Public		
	There are no public submissions on this issue.	

5.7 Effects on Infrastructure Requirements

5.7.1 Infrastructure Required

Government		OFID acknowledges the proposals compliance with the Strategic Plan for South Australia and the benefits to the fishing and tourism industries in particular. It is also noteworthy that since the preparation of the EIS the States Draft Infrastructure Plan has been released which acknowledges Cape Jaffa and identifies the proposal as a priority 2 project. Improved infrastructure will lead to greater efficiency, safety and growth in the industry. Infrastructure upgrades are also identified. Submissions for upgrades for transportation and recreational boating have been made whilst the Kingston airport is well established and no upgrades have been identified. Education facilities exist which can readily accommodate anticipated growth as set out in Section 5.3.3 of this response. The combined interpretation of Aboriginal and European history has been raised in discussions with relevant members of the Aboriginal community. Further discussions will take place as part of a separate process. The proposal sets out the requirements for infrastructure in Sections 3.5.21 to 3.5.25.
Gov Submission 9, OFID, Comment 1	The proposal involves development of the Cape Jaffa foreshore for residential and commercial purposes, including the provision of a safe harbour for boating and the commercial fishing fleet. The Strategic Plan for South Australia identifies the provision of "marine facilities to support the fishing/aquaculture industries" as an ongoing need over the 10 year life of the plan. The Cape Jaffa development is essentially a private sector project that delivers improvements for the fishing fleet and for boating generally, as well as tourism development in the area.	
Gov Submission 9, OFID, Comment 2a	New or upgraded infrastructure is required as part of the development, including: • Transport – upgrading the junction of the Southern Ports Highway and Cape Jaffa Road • Marine – new boating launching facilities • Aviation – possible upgrade of Kingston airport • Education, health and community services – we assume these are available at Kingston and no upgrades are required • Culture and heritage – reference is made to a combined interpretation of Aboriginal and European history but no discussion of how this will be progressed • Energy –power supply • Water and wastewater	
Public		
Public Submission 3a Comment 1	We have developed growing Atlantic Salmon and Ocean Trout over the last 9 years and the industry has not moved ahead as the current infrastructure is inadequate and not suitable for the industry to expand.	

Public Submission 3a Comment 3	The infrastructure needed to run a substantial aquaculture industry is: • an all weather port; • a port that can handle reasonable sized vessels; • the ability to accommodate forklifts, cranes and trucks for loading and unloading; • close proximity to the processing facility; • power, water and wastewater disposal services; • boat storage and dry docking facilities; and • boat maintenance and service areas. These are currently non-existent at Cape Jaffa.	Refer to response above.
Public		The benefits that flow from the development of infrastructure as set out in the EIS is acknowledged.
Public Submission 19 Comment 2	Upgraded infrastructure including power, telecoms, mains water, roads and stormwater, will provide greater reliability and security for businesses and land owners.	
Public Submission 19 Comment 3	The boat ramp will create opportunity to expand tourism by providing a safe, secure and permanent year round access for recreational and professional boat users.	Council has identified the need for safe, secure year round boat ramp facilities as the conditions on the beach at times limit access and hence the desire to have Cape Jaffa as a destination at these times.
Public Submission 28 Comment 1	The supply of power has not been answered in the EIS. I believe augmentation costs will be significant, especially considering the feeder from Naracoorte is near capacity and Kingston will also need more power. Cape Jaffa is a windy location but wind power is only part of the answer and onsite generators are an expensive option. This will result in additional costs to residents.	Power supply options have been presented in Sections 3.5.24 and 5.7.4. There is currently no three phase power at Cape Jaffa and this will significantly enhance prospects for business development and employment growth.
Public Submission 29 Comment 19	Provision of three phase power will have little impact on power cuts in the area. Developing an alternative energy source would provide a greater service to the community and the State.	Provision of an independent three phase power supply would remove Cape Jaffa from the influence of grid based power outages. Alternative energy sources have been investigated however there are none at this time that are economically viable.
Public Submission 29 Comment 23	Mains water reticulation is not enormous benefit considering the initial and ongoing cost.	Assessments made by state agency DH advise that there are risks to health drawing water from the same locality as that into which effluent is disposed. There is

		therefore the benefit of removing that risk from the community. The water that is drawn from the ground incurs the costs of infrastructure and ongoing power costs to pump the water as well as the costs of storage and maintenance.
Public Submission 29 Comment 27	Cape Jaffa residents don't feel disadvantaged on the contrary we have a lifestyle many would envy, despite the lack of growth and the alleged benefits.	The provision of reticulated services is an inevitable consequence of the development of any settlement particularly those along the coast. Cape Jaffa has areas designated in the Development Plan for industrial and residential development and it would significantly increase risk to public health if the whole of the area was to be established without a more sophisticated and sustainable effluent treatment system and water supply.
Public Submission 29 Comment 29	Improving the power supply would be of great benefit but we don't hold out much hope until the supply to the whole state is satisfactory. Investigating alternative energy supply would be a positive initiative.	The benefits of an improved power supply are acknowledged however it is not necessarily contingent on the whole of the states network as this can be independent of the grid. This remains the subject of commercial analysis.
Public Submission 30 Comment 10	The EIS suggest that alternative energy is highly desirable but falls short of assuring alternative energy supply for the development. Incentives, penalties or conditions should apply to insist upon alternative energy. Wind generation is encouraged, but should not be used if flyways of migratory birds run over any proposed windfarm site. Solar streetlights and other infrastructure are highly recommended.	All possible commercial and affordable options for power supply are being investigated to maximise the short and long term benefits.
5.7.2 Funding of Public Infrastructure		
Government		Application has also been made to SABFAC for the allocation of funds to Council which proposes to match those funds for the development of safe public launch and retrieve boat ramp and associated facilities. Further, the area lacks three phase power, treatment of effluent and a reticulated water supply. To advance the industry and community at Cape Jaffa it is highly desirable that these basic services be established as is the expectation for most communities in the South East. The proponent will create suitable infrastructure for the development however the extent of public service will be dependent on the support from relevant funds including the RDIF.
Gov Submission 9, OFID, Comment 2b	The EIS does not detail how the required infrastructure will be provided and funded, although it sets out an expectation that the state government will provide financial assistance towards infrastructure costs. OFID is not aware of any submission to government for special consideration for infrastructure funding for the project. OFID note that representations may be made through the Regional Development Infrastructure Fund (RFID) and that funding may be available through the SA Boating Facilities Advisory Committee. OFID do not know whether funding through those sources will be sufficient to enable the project to proceed.	

Public		An application has been made to SABFAC for funding for the development of a public boat ramp and associated facilities. This process is the same as that undertaken by Council in relation to the development of the boat ramp at Kingston. The State Government has established a fund specifically from fees charged to recreational boat owners through the registration process for the provision of recreation facilities. It is entirely appropriate therefore that the creation of public boating facilities by tied to the provision of these allocated funds.
Public Submission 28 Comment 10	Boat launching fees are reasonable and would be accepted by amateur fishers. At this stage, it is not funded. Kingston Council ratepayers and the proposed users should know how much, who is paying for what and for what time, before the project begins. If the development was a fully private project, the developers / financiers / shareholders would be demanding it. The EIS should be clear and only a fully funded project should be given the go ahead.	
Public Submission 28 Comment 13	I do not oppose the marina at Cape Jaffa. I appreciate the employment opportunities and the flow on effect to the larger community. To give greater support I would need a positive response to my issues, in particular, the funding of key aspects of the project. I would like to see Kingston Council remove itself from any financial exposure to the project.	Council has no financial exposure other than in their normal function as the relevant local government authority for the area. Council undertook a Section 48 Review under the Local Government Act specifically to report into the project's relationship with Council's strategic management plan, the Development Plan, contribution to economic development, community consultation, projected revenue and financial risks, recurrent and whole of life costs, financial viability, risk management, and appropriate project mechanisms and arrangements. Refer to Appendix 24 of the EIS.

5.8 Native Title and Aboriginal Heritage		
Government		Since the preparation of the EIS The Minister for Aboriginal Affairs ad Reconciliation has authorised clearance of the land in accordance with Section 23 of the Aboriginal Heritage Act. The reference in the EIS to the 700 years was incorrectly attributed to the South East, whereas the text from which it derived referred to a cave having been occupied until about 700 years ago. Specifically: *"Koongine Cave yielded an occupation span commencing at about 9,500 years ago and continuing to 700 years ago."* Walshe & Bonell 2004 An aboriginal Heritage Monitoring and Management Plan will be prepared which amongst other things will acknowledges the legislation and the responsibilities under the Act. No issues have arisen since consultation with the Kungari Inc. The sites have been placed on the SA Register for Aboriginal Sites and Objects. The representative of the Kungari Inc prior to and during the consultation confirmed there are no native title claims or indigenous land use agreements for the site or the area, nor are there known intentions for a claim or agreement.
Gov Submission 5, DAAR, Comment 1	DAAR have no comment to make with regard to this EIS.	
Gov Submission 8/13, DEH, Comment 15.1	DEH have concern that "700 years" may be incorrect on Page 151.	
Gov Submission 12, Planning SA, Comment 24, 25, 26, 27 & 28	The information presented in the EIS and Archaeological Investigation (Appendix 10) provides useful information on the surveys undertaken and sites identified. Only minor comments are thus made: • it is assumed that the construction phase will always consider the potential for new sites to be identified, and that compliance with the Aboriginal Heritage Act will be undertaken; • are there any additional major issues that need to be raised since the consultation period with the Kungari Inc?; • have the archaeological sites identified yet been listed on the SA Register for Aboriginal Sites and Objects?; • is there any further information available on the Aboriginal Heritage Management Plan?; • can it still be confirmed that there are no native title claims or Indigenous Land Use Agreements for the site? Has any further consultation indicated otherwise? Are the any indications that there may be any possible future claims or agreements?	
Public		
	There are no public submissions on this issue.	

5.9 Planning and Environmental Legislation and Policies

5.9.1 Adequacy of Commercial / Industrial Area

Government		In terms of the anticipated commercial and industrial operations, the area of land which measures in excess of 2 ha provides an area for hardstand of about 3750 m2 and a similar area for marine service activities. Closer to the wharf are areas totalling 7000 m2 available for the fish industry such as processors and similar wharf front activities. It is acknowledged that the land to the south would provide a logical expansion of the marine related commercial and industrial activities in the central facilities area. This was identified in Section 5.5.6 of the EIS. In response to the Guideline question about future expansion the proponent has advised that: *"No expansion is currently envisaged thus none is included as part of this proposal."* It is appropriate to determine the extent and rate of uptake to ensure a consolidated, progressive and orderly form of development is undertaken without there being excessive land which can lead to inefficient infrastructure allocation and unnecessary costs. The proposed distribution of activities is such as to ensure adequate separation between residential and commercial/industrial activities. There is also proposed a reserve separation to the east of the area currently defined for industry however this area is likely to be developed in one of the last stages, the opportunity to expand the industrial activities in an easterly direction and the relocation of a buffer zone can be accommodated.
Gov Submission 1, DTED, Comment 2a	Concern over the size of the proposed commercial/industrial zone. However, the staging is flexible and could accommodate expansion of the commercial/industrial zone into the area set aside for Stage 7 if the need arises.	
Gov Submission 1, DTED, Comment 3	When Council considers the proposed zones, there is scope for the land south of Cape Jaffa Road adjacent to the commercial area to be zoned for industrial development for activities related to the fishing and aquaculture industries	
Gov Submission 1, DTED, Comment 4	DTED would like to see that adequate buffers are put in place to protect both the residential and commercial/industrial areas.	
Public		
	There are no public submissions on this issue.	

5.9.2 Zoning and Land Use Considerations

Government		The proposed wharf area allows for cages to be towed into the marina should this be necessary and to be lifted directly onto the wharf and maintained in the industrial area.
Gov Submission 12, Planning SA, Comment 39	Explain facilities to be provided for aquaculture cage maintenance. Would cages continue to be brought up onto the beach? Currently cages are relocated to the calmer waters of Beachport - would this continue or would the development offer an alternative?	
Gov Submission 12,	Clarify use of land between breakwaters near the coast designated 'future	At the time of preparing the EIS this land was not defined in terms of its land use although given its protected location and elevation is suited to development. The

Planning SA, Comment 41	development' and 'deferred urban'.	plan has been modified to include this land with residential allotments to take advantage of views and the primary location at the entrance to the marina. The Amended Concept R1 is attached.
Gov Submission 12, Planning SA, Comment 48	Discuss other recent examples where residential development is located close to marine industry areas, eg limitations on hours, agreements etc.	The Residential zone abuts the Industrial Zones at Cape Jaffa with a principle of development control recommending a 50 metre separation between industrial and residential development. The existing land use arrangements at Cape Jaffa has residential development opposite and in close proximity to the existing fish processors and the head of the jetty, from which the rock lobster fishers and the aquaculture business operate. This has been a long standing and satisfactory relationship in terms of residential/industrial interface. Similarly, Lake Butler at Robe has residential development fringing the southern side of the lake which is used significantly for commercial fishing industry purposes. Stage 2 basin of the Lincoln Cove development has established a significant area for commercial vessels together with some new residential apartments. There are no known controls beyond normal EPA and planning requirements. The separation proposed at Cape Jaffa is greater than at Lincoln Cove. Further, the nature, timing and frequency of movements at Cape Jaffa will be significantly less than say at Port Lincoln as the fishery is very different and there are significant limitations on the growth of the fishery and aquaculture. Gulf Point Marina at North Haven also has a number of examples where residential development abuts non residential marina related activities including the marine service and travel lift area. These represent recent and current circumstances where there is a direct interface between these residential and non-residential functions at marinas. It is also relevant to note that it is common practice in marina environments to create a relatively close association between the commercial and residential activities. One of the great attractions of these harbours is the working character and nature created by the presence of fishing vessels and the activity that results. Cape Jaffa has a small fleet in relative to say Port Lincoln and as such effects of their activities on the residential environment will be minimal and not dissimilar to the existing arrangements.
Gov Submission 12, Planning SA, Comment 49	Explain the rationale for location of the infrastructure area and the means of buffering/screening.	The infrastructure area is located away from the main development area to provide the best separation from residential development, where the water supply can be stored, the main power can be brought in should there be a connection to the main grid and there is room for expansion without effect on nearby development.

		The area is set behind existing roadside vegetation and there is an elevated area immediately west of the boundary. This area is to be raised and planted to reinforce the existing visual separation between the road and the lower land beyond which will be located the service infrastructure facilities. The general arrangements are shown on Figure R2.
Public		The space through which the proposed new road is located was set aside in an earlier plan of division as a roadway. The reserve width measures 18 m which readily satisfies standard practices and codes and allows for the necessary shoulder, footpath, road pavement and landscaping. Therefore no existing property owners will be pushed out.
Public Submission 24 Comment 3	There is insufficient space to construct a main road in the area through the centre of existing properties. It will be too close to houses and have no buffer zone. Does this mean existing property owners may need to be pushed out?	
Public Submission 27 Comment 3	The shortage of available residential land in Kingston and Robe is only limited by rezoning of appropriate land to residential use.	Limited opportunities exist at Kingston and Robe land for land division for a range of environmental and economic reasons. In particular, waterfront or near waterfront land division in these towns is extremely limited by extensive coastal vegetation and the desire not to have development extending along Guichen Bay
Public Submission 30 Comment 9c	Approval implies rezoning approval and the conservation principles of the existing development plan must be respected, the reserve areas be zoned for conservation and the areas surrounding these zones used sensitively. The foredune area, if rezoned, should be zoned for conservation. Under the proposed zoning, the wetland is zoned public purpose and abutted by deferred urban. Residential and local centre zones are changed/extended. There is no zoning for conservation. Energy efficient and water sensitive urban design should apply to apartment, motel and cabin accommodation. The EIS, in commenting on the Objectives of the Development Plan (Objectives 28, 29, 53 and 105), contains missing and inaccurate information on the protection of water resources and wetlands. Despite considerable research into groundwater, this part of the EIS was not finished.	The conservation provisions in the Development Plan will continue to apply. Further, the proposed Urban Coastal Zone is consistent with Government policy and incorporates conservation provisions. For comparison, the Butchers Gap Conservation Park is primarily in the Rural Coastal Zone with a small section in its northern extremities in the Urban Coastal Zone. The Bernouilli Conservation Reserve is in the Rural Coastal Zone. The “Paperbark Swamp”, the Tea Tree area in the east of the site is proposed to be dedicated as reserve as shown on Figure 3.12. The current plan incorporates Objectives and Principles of Development Control to ensure the protection of these areas. These policies include: ***Objective 35: The retention of environmentally significant areas of native vegetation.*** ***Objective 36: The retention of native vegetation where clearance is likely to lead to problems of soil erosion, soil slip and soil salinisation, flooding or a deterioration in the quality of surface waters.*** ***Objective 37: The retention of native vegetation for amenity purposes, for livestock shade and shelter and for the movement of native wildlife.*** ***Objective 43: The conservation and preservation of flora, fauna and scenery and the creation of recreation areas by establishing parks and reserves.***

		92 Development adjacent to substantial areas of native vegetation should use indigenous species in any site landscaping works. *106 Native vegetation should not be cleared if it:* *(a) provides important habitat for wildlife;* *(b) has a high plant species diversity or has rare or endangered plant species and plant associations;* *(c) has high amenity value;* *(d) contributes to the landscape quality of an area;* *(e) has high value as a remnant of vegetation associations characteristic of a district or region prior to extensive clearance for agriculture;* *(f) is associated with sites of scientific, archaeological, historic, or cultural significance; or* *(g) is growing in, or is characteristically associated with, a wetland environment.* The proposal is also particular in relation to this area and amongst others, Figure 3.12 shows the area as reserve. As the policy exists and the proposal clearly recognises this land as reserve a specific policy area or zone is not required. The protection of water resources is extensively considered in numerous parts of the EIS. The table within the EIS that comments on the Objectives of the Development Plan (Table 5.30 in Section 5.9.1 and Appendix 22) omitted to include detail that is provided elsewhere in the EIS Namely Sections 5.2.3, 5.2.4 and 5.2.5. The omission does not alter the validity or substance of the assessment made in the EIS.
5.9.3 Suggested Changes or Improvements to the Concept Plan		
Public		The realignment provides for a public walkway and allotments to its south. The 6 metre buffer will allow for landscaping and public access away from the road system. The section of King Drive proposed to be realigned is the eastern portion from near the eastern most dwelling to Cape Jaffa Road. It is not considered appropriate or necessary to make significant changes to the Concept Plan presented in the EIS. The protection and management of the receiving environment, including the nearby coastal dune areas is discussed in various sections of the EIS and elsewhere in this response document.
Public Submission 11 Comment 11	King Drive should not be realigned. The EIS is considered inaccurate as it says "the easternmost extent of King Drive will be realigned in a southward direction to accommodate a buffer walkway". Provision of a 6 metre buffer is an improvement on the original plan.	
Public Submission 11 Comment 12	There should be no houses adjacent to the channel between the alignment of King Drive and the beach.	This area is already significantly modified with the road, car parking and beach access and will comprise new formalised car parking, the channel walls and channel. This area is in a location protected from coastal processes as it is behind the proposed breakwaters.

Public Submission 13 Comment 2	At the pubic forum it was suggested that a rock groyne be constructed to provide an area for protected moorings in the sea for the fishing fleet. The land could then be subdivided for housing and the ground water table would be left alone.	There could be greater visually effect of an outer harbour with associated infrastructure than the breakwaters themselves. The further development of the area without a coordinated and comprehensive plan for effluent management will result in detrimental impacts to the groundwater.
Public Submission 15/22 Comment 3	The development should not proceed in its present form. An option would be to build a housing development on the land already purchased and improve boating and fishing facilities, eg upgrade the jetty provide improved boat launching facilities.	A key objective of the proposal is to provide the opportunity for industry development and expansion particularly the aquaculture activities. An upgrade to the jetty will not achieve this. Lengthening the jetty will not overcome the operational difficulties and costs that results from jetty operation. It is clear that the jetty provides a point of focus as a tourist attraction and will continue to do so, regardless of its future use for commercial purposes. The provision of a boat ramp for recreational boating is an integral part of the proposal. The proposal provides the opportunity to provide a boat ramp in protected waters in a location that allows safe and efficient use of the facilities.
Public Submission 18 Comment 11	Most of Council's objectives can be met by building a housing development on land already purchased for the project. The existing jetty could be upgraded and lengthened and the boat ramp access to the beach could be improved. This would not risk damage to groundwater, the beach, marine life or the quite, relaxing holiday settlement with ready access to the beach.	
Public Submission 29 Comment 2	An upgrade of the existing jetty and a decent amateur fishing boat ramp would meet the requirements of fishermen, aquaculture operators and residents with minimal impact on the environment. This would be a much cheaper and more satisfactory way of meeting the requirements of fishers and boaters and would be a drawcard for tourists. Everybody loves a jetty.	
Public Submission 29 Comment 7	Providing a decent boat ramp for recreational fishers and boaters would meet their requirements and be more welcome than a marina, as stated by many local and interstate visitors.	
Public Submission 18 Comments 16 & 17	We query the need for the marina as opposed to a housing development. An independent survey of land available for housing in Kingston is required. Input from local real estate agents re the market for a high priced marina as opposed to reasonably priced housing. A housing development with permanent residents would benefit Kingston more than a high priced marina where residents would only live for part of the year. There would be plenty of jobs and chances for people to improve business and tourism.	The proposal includes a range of allotment locations which creates opportunities for housing choice and affordability. It is also relevant to accommodate the recreational boating and holiday needs of the community that cannot be readily achieved in a standard land division. Due to the coastal location, it is appropriate to include marine related facilities consistent with strategic directions identified.

	We are not against the development and would encourage ways for Kingston and the area to improve, however the marina is not the way to go. Providing a housing development and upgrading the jetty would meet Council's objectives and create plenty of jobs and opportunity for improvements for business and tourism.	Refer to response above.
Public Submission 27 Comment 16	In the interest of the environment and sensibility, we propose that the current land be used for more affordable accommodation as the need arrises, thus leaving the waters of land and sea in their natural division.	
Public Submission 29 Comment 36	A small housing development with provision for expansion of the caravan park would allow Cape Jaffa to retain its easygoing charm and those with modest means to either live or holiday here and would be the best of both worlds.	
Public Submission 30 Comment 13	An environmental centre to provide a meeting place for 'friends' groups and a marine education centre is recommended to be included.	The provision of a meeting place for friends groups and a marine education centre is noted. Investigations into the potential for such facilities should be undertaken by the relevant bodies.
Public Submission 30 Comment 14	Bird hides for safe viewing should be provided for recreation and fauna monitoring. They should be raised to keep cats out and entered through a gate. The same should be done in the Bernouilli Conservation reserve and foredunes. This would aid in monitoring local species and the effects of the development.	The provision of bird hides in Bernouilli Conservation Reserve is the responsibility of National Parks. The proposal does not incorporate the establishment of bird hides. As part of the remediation to be incorporated in the Vegetation Management and Monitoring Plan, there will be some assistance for Regional Conservation in the management of Bernouilli Conservation Reserve. This assistance will be in line with the management priorities as determined by Regional Conservation.
Public Submission 30 Comment 15 Public Submission 30 Comment 25	Cycling and pedestrian access across the channels should be created. Pedestrian and cycle ways need to be straight so that people are making the shortest path between 2 destinations and avoid people making their own tracks. As a cyclist it is very frustrating to be expected to ride in zig-zags. The shortest route across a reserve is where you put the path, though it may not look as attractive. Cycling paths and pedestrian paths need to be utilitarian, not just decorative. A footbridge should be provided across the channels to allow trail bike riders to get access to the 'vehicle permitted' section of the beach instead of travelling around the entire marina.	There is no proposal to provide pedestrian or cycle access across the channel. The proposal incorporates extensive walkways/cycleways behind the dunes but do not connect the east and west sides of the channel. A bridge to achieve this connection would be costly and visually significant as it would need to be elevated well above the channel. These pathways are generally straight and punctuated by landscaping. They are not zig-zagged.

Public Submission 30 Comment 24	The EIS contains a breakdown of the open space areas provided and states that in excess of 22 ha of open space and reserves are provided. More than 81% of the developments open space is the existing native vegetation, which will have restricted access for recreation. Some of the reserves are well designed with good access to the waterways but most are too small to run a dog or play games. The western side has a large reserve but on the eastern side people will head for the beach, under any benefits of getting cars removed form this area and posing a risk to hooded plover and orange bellied parrot. A reserve on the eastern side is called for.	Open space should comprise a combination of types, some of which should be passive, some active, some conservation/vegetated and others open. The proposal has a good mix of all of these forms and sets aside what is currently private land and beach for public benefit and access. The wide open areas of the waterways and main basin also play a significant role in the open space system and recreational activities. Around the central facilities area there are reserve spaces and public access along the waterfront. To the north are the extensive beach areas and a large open space reserve behind the dunes. The dunes form an integral part of the total open space system and although not accessible to the public create a sense of space and separation as well as habitat.
Late Submission 2 Comment 10	Facilities to assist aquaculture can and should be installed without a marina.	Aquaculture is only one of a number of activities that can be properly managed and accommodated in a marina and cannot of itself justify the expenditure necessary for the type of infrastructure required.
Late Submission 2 Comment 11	I suggest a development of resident allotments using a 'Residential Village Concept' with associated recreational facilities and features to attract 'Sea Change relocation'.	The intent of the proposal is to provide a wide range of facilities available to the whole of the community centred on boating, fishing and coastal activities which in large part accords with the "sea change" phenomenon. The theme of the proposal is to encourage the seaside village style and to create opportunities and activities which reinforce and enhance a sense of community.
Late Submission 2 Comment 12	We would encourage a residential subdivision without an anchorage or risk of destroying underground water quality, spoiling our excellent beaches or altering the entry to the township via King Drive.	The investigations show that the development can proceed without destroying the groundwater. Further, the beaches are a significant asset to this area and to the proposal and can be maintained to continue to provide an excellent recreational and visually attractive space. The rearrangement of the town entry will result in the long term reduction of industry related traffic movements and hence effects on a number of residences particularly to the east of the new access point. This access point will provide good access to the jetty and beach area and the tourist park.
5.9.4 Design Guidelines and Encumbrances / Management Agreements		
Government		Proposed design guidelines will include the necessary principles to encourage ESD in the areas of water, energy, materials, building design, landscaping and biodiversity. The Building Code of Australia now requires a 5 star energy rating and the guidelines will reinforce these principles. Options for building in to the development more ambitious environmental benefits will continue to be investigated through the design and development phase and will be included in the guidelines.
Gov Submission 8/13, DEH, Comment 20.1	DEH encourage the use of design guidelines to pursue a development that can serve as an example of international best practice in innovative, ecologically sustainable development (ESD) in the areas of water, energy, materials, building design, landscaping and biodiversity.	
Public		

Public Submission 11 Comment 5	Clarify the required housing energy rating, as in a project like this a higher energy rating should be required.	Refer to response above.
Public Submission 30 Comment 9b	The proposed encumbrances or management agreements provides the opportunity to incorporate sustainable management and development guidelines, such as energy efficient design and water sensitivity. It would be good to have better defined and more ambitious environmental guidelines, eg incorporation of requirements for solar energy.	
5.9.5 Planning and Environmental Legislation / Policy		
Government		Support for the proposal and for the use of the narrow strip of Crown land is acknowledged. An application for the use of the Crown land has been made by Council and it is noteworthy that there are no native title claims for this area.
Gov Submission 8/13, DEH, Comment 17	DEH cannot comment on the Crown's ability to authorise access, ingress, egress and/or regress to, over along or from the narrow strip of Crown land where a channel will be required, as the Crown Solicitor has not yet determine native title for that area. DEH recognises that the portion of Crown land adjacent the marina proposal is narrow and supports the use of Crown land to enable the marina to be connected to the sea, in exchange for increase in the depth of land being made available for public use within the coastal dune area, as proposed.	
Gov Submission 13, NVC, Comment 27	Under the *Native Vegetation Act 1991*, a significant environmental benefit (SEB) need to be achieved to be exempt under Regulation 5(1)(c) of the *Native Vegetation Act 1991*. Possible ways in which the property can achieve a significant environmental benefit include the preparation and implementation of the above mentioned documents or additional actions, for example including a buffer zone within the fenced area adjacent to the swamp to allow for regeneration to increase habitat value. The requirement for an SEB and methodology to achieve that requirement needs to be addressed.	Proposed SEB (Significant Environmental Benefit) will be detailed in the Vegetation Monitoring and Management Plan. There are numerous and significant environmental benefits that flow from this development including: • The transfer of a significant area of fore dune from private ownership to community ownership; • The fencing of this area in a manner that guides the public and contains pest animals to a reasonable extent from entering this area; • The creation of defined walkways through the dune areas; • Collaboration with relevant authorities for the rehabilitation of this area; • Fencing of the Crown owned fore dune to the west of Cape Jaffa Road to control the public and pest animals from entering this area;
Public		
Late Submission 3 Comment 3	I am not against the development as long as no animals die unnecessarily and the local environment benefits.	

		• The creation of defined walkways through this Crown owned dune area and thus remove indiscriminate access; • The removal of introduced species including Cypress trees and the overall rehabilitation of this area; • Collaborative input with the relevant authorities and local friends of the Bernouilli Conservation Reserve to develop schemes for the care of the reserve; • The collaborative rehabilitation and management of roadside vegetation adjacent the development area; • The fencing of the Paperbark area in the south eastern corner of the land including a buffer zone; • The creation of Vegetation Monitoring and Management Plans: • The encouragement of the relocation of the fishing vessels from the Rock Lobster sanctuary and the associated seagrass beds; • The provision of signs and controls to prohibit pets from roaming free; • The creation of facilities to remove activities away from sensitive beach and dune areas; • The creation of a reticulated effluent treatment system to which the existing community can connect thereby removing on site effluent disposal activities from the coastal area; and • The reuse of treated water for improved primary production outcomes.
Public Submission 30 Comment 19	Many of the benefits of the proposal bring a corresponding drawback.	The proposal will result in significant benefits as identified earlier which collectively achieve strategic directions and objectives set out in various state and local plans.
Public Submission 30 Comment 9a	This development provides an opportunity to seek creative solutions to wetland care, energy generation, wastewater management and marine management for conservation, aquaculture and tourism/recreation. Carefully designed stormwater and wastewater management could work in with the vegetation and wetland management. Development at Cape Jaffa must follow ecologically sustainable development principles and be a win-win situation. The EIS adheres to some planning and	It is acknowledged that ESD principles and the principles of the existing development plan are appropriate to the area and the development Wetlands are located some distance from the site, the closest being Hog Lake 5 kilometres to the north east. The areas of Tea Tree and fore-dune vegetation on the site can be protected and enhanced by this proposal. The potential connection of this area to the Coorong is enhanced by these measures.

	strategy objectives but conflicts with others. The principles of the original Development Plan for the areas must be adhered to, particularly in regard to protecting wetlands and areas of conservation significance. There are many goals and objectives of relevant strategic plans that would be compromised by the development, including Environmental Leadership, Alternative Energy, Greenhouse gasses, Biodiversity and Wetland protection. The ecological connectivity between the Coorong and the wetland adjacent to the site is clear. It is a priority of the states Strategic Plan to link areas of conservation significance to achieve long term biodiversity targets.	The creation of the facilities in the preferred location away from wetlands and where sustainable development principles can be promoted in an affordable manner and where community needs can be reasonably met, is a most desirable outcome.
Late Submission 3 Comment 4	The development could be one that the State is proud of and hold as an example of commitment to ESD.	Acknowledged. The proposed Development Plan policy and the Design Guidelines aim to achieve a practical and affordable approach to sensitive and sustainable development. Features of the proposal inherently result in improvements to better achieve sustainable development by reducing existing risks to the environment and providing alternate means of managing activities such as: waste water treatment, reuse of treated water, an alternate location for rock lobster vessels away from the sanctuary and in a protected, safer and more manageable environment.
Public Submission 30 Comment 23	The native vegetation of the area is protected by The Native Vegetation Act 1991 under schedule 1(e) and 1(f).	Acknowledged that the Native Vegetation Act 1991 has application within the area of the project and that the proposal will provide a net significant benefit to native vegetation in the area.
5.9.6 Housing Types		
Government		The proposal provides a range of allotment types and further detailed design work will be undertaken to refine and create a greater range and variety of allotment sizes, thus enabling greater choice in the context of this marina development. The guidelines will assist in the ongoing review for the provision of housing at Cape Jaffa.
Gov Submission 6, DFC, Comment 3	The Housing Plan for South Australia (7 March 2005, www.familiesandcommunities.sa.gov.au/housingplan) ensures housing responses are appropriate to the present and future needs of South Australians. The Housing Plan includes a commitment to achieve targets for affordable and high needs housing in order to achieve a diversity of housing stock appropriate for community needs and priced across market segments. The DFD and Planning SA are developing information and guidelines that are expected to be available over the coming months.	

Public		The proposal results from the considered analysis of many submissions ideas and propositions relevant to Cape Jaffa made at all three levels of government and cannot be attributed to a single person. The proposal will meet goals and strategies set in the public realm for improving well being, creating employment opportunities, tourism and industry. There is no benefit to the community to ignore the pressing infrastructure needs of industry where it is appropriately located and where appropriate development satisfies the needs of the wider community for coastal living. There are a range of allotment types included in the development and combined with policy for affordable housing, the proposal will provide opportunities for a wide range of interests and needs as stated above in relation to the Housing Plan. Housing shortages at Mount Gambier or Keith are not considered to be relevant to this assessment.
Public Submission 2 Comment 7	Proposal is the thoughts of an individual and will result in development that is above the current living standards of the local community.	
Public Submission 11 Comment 3	The need for housing is acknowledged. Nevertheless, the proposal does not address the housing needs of the average person.	
Public Submission 27 Comment 5	Exclusive sea frontage at a high price can hardly be classed as relieving housing shortages.	
Public Submission 29 Comment 28	This development will not address housing shortages in the South East; it will not solve shortages in say Mount Gambier or Keith. The proposal has taken no heed of communities needs; it is only addressing the developer's greed.	
Public Submission 29 Comment 35	The development will be creating a new settlement, because there is no infrastructure in place to support it. It is not aimed at meeting housing needs in the Kingston/Cape Jaffa area, as indicated by the estimated rateable values, which tend to be conservative. As such, it will be an elite development and out of reach of average incomes.	The proposal will not prejudice current land division in Kingston, rather it will enhance the range of allotment types in the district and accordingly improve potential for housing choice. A range of allotment types are provided in the proposal. This will ensure a mix for the varied interests of those attracted to Cape Jaffa.
Public Submission 29 Comment 38	There are also several land divisions in Kingston and Rosetown within the financial reach of locals.	
Public Submission 29 Comment 43	The cost of allotments will not provide greater housing choice for local residents as the allotments will be too expensive. Kingston residents will be unlikely to move to Cape Jaffa if they work and their children are at school in Kingston. The cost of travelling to/from Kingston is a considerable additional expense.	
Late Submission 2 Comment 13	A residential subdivision would be affordable to more people. This would achieve more for the developers and Cape Jaffa's growing popularity as a quite and unique holiday and residential location.	

5.9.7 Number of Allotments		
Government		The Concept Plan, presented as Figure 3.6 of the EIS, sets out the allotment arrangement for a standard subdivision. This arrangement will invariably change to ensure a greater variety of allotment sizes to allow housing choice. There will therefore be further variation to the allotment numbers. This does not alter the effects of the proposal in any material respect. The wastewater treatment facilities will be designed as a modular system that will relate directly to demand. Similarly the reclaimed water treatment area and winter storage facilities can be sized according to demand as there is ample land to accommodate these facilities. Therefore, in general terms, there are proposed about 542 allotments shown on the Staging Plan Figure 3.24 from the EIS and it is acknowledged that the stated numbers are incorrect. As indicated however, these numbers will inevitrably vary with changes in housing requirements over time and the refinement of the proposal to achieve the first detailed land division design. In terms of the current zoning and based on 0.5 ha minimum allotment size, the Industry (Cape Jaffa) Zone has the capacity for about 20 allotments. This is based on the need to accommodate on-site waste water disposal. A common effluent treatment system would allow smaller allotments, a more environmentally sustainable means of effluent and waste water disposal and also reflect the greater range of industry needs and more efficient use of land in the fishing and aquaculture industries. This is evidenced in the size of facilities and land areas occupied by the existing processors, which are considerably smaller than 0.5 ha. The current zoning also allows for about 150 residential allotments each at 1000 m2. This is based on no common effluent treatment facility but rather individual on-site disposal. Alternatively, with an appropriate effluent treatment system, the density of development could be significantly enhanced, with potential for about 300 residents or thereabouts. The demand for residential allotments is evidenced in the registrations of interest recorded without the project being marketed. Section 5.1 of the EIS sets out identified need and demand for the development. The proposal has been designed to enable practical staging such that should the demand be low or slow the extent of the development can be contained. The industry zoned land is to be relocated as part of the proposal and will not be lost, whilst the primary industry land will be changed. It is noteworthy that the Primary Industry land is marginal and PIRSA has reviewed the proposal and support the
Gov Submission 2, Dept. of Health, Comment 6	The number of allotments is uncertain with different numbers stated in different parts of the EIS: greater certainty is required.	
Gov Submission 6, DFC, Comment 4	The number of allotments needs clarification as different numbers are referred to in different sections of the EIS.	
Gov Submission 12, Planning SA, Comment 45	Provide assessment of the number of residential dwellings under current zoning verses under the proposal. Provide information/research that demonstrates the demand for residential lots to justify rezoning land from existing industry/primary industry use.	
Gov Submission 12, Planning SA, Comment 50		
Public		
	There are no public submissions on this issue.	

		scheme. Further, adjoining land is to be used for irrigation of the reclaimed water which will enhance the productivity of that part of the primary production land. It is noteworthy that other government agencies have commented that additional land should be considered for rezoning to ensure adequate space is available in the long term. Given the coastal demand for housing and the lack of this type of property in the area and the registrations of interest recorded without marketing, there is suitable demand for the residential allotments.
5.9.8 Presentation of Heritage / History of the Area		
Government		The proposition to develop a combined facility in a collaborative venture was raised during the investigations into the Aboriginal archaeology of the land. The concept incorporates a display or interpretation of both Aboriginal and European heritage relevant to the use and the development of the area in a single location available for public viewing. At this time there is no interpretation of this history at Cape Jaffa. There is European heritage interpretation in the Cape Jaffa Lighthouse now located at Kingston and the Lighthouse cottage ruins within Bernouilli Conservation Reserve. There are books available which tourists and visitors to Kingston and the South East purchase. Those that read these are fascinated by the tenacity of our pioneers and the lives they led. The EIS acknowledges that preliminary investigations could be undertaken to determine whether a collaborative research, interpretation and presentation is possible.
Gov Submission 8/13, DEH, Comment 16	The EIS refers to the opportunity to present aboriginal and European history of the area. DEH has the following concerns: • Who will be responsible for research & interpretation? • What does "collaborative venture" and "combined facility" mean? • Does the development include an interpretive centre or simply opportunities for an interpretive centre, and • Is Indigenous & European history currently interpreted or presented at Cape Jaffa? If not, how can tourist & visitors be fascinated by it?	
Public		
	There are no public submissions on this issue.	
5.9.9 Relocation of Rock Lobster Industry Infrastructure and Swing Moorings		
Government		The rock lobster fleet is moored in an area not in the ownership or control of the proponent. Therefore neither Council nor the Cape Jaffa Development Company can relocate the infrastructure or moorings. The moorings proper are owned by the individuals who have placed them on the sea bed. The proposal presents the opportunity for mooring of vessels at floating pontoon style marina berths within the harbour and it is noteworthy that 21 fishers have indicated their interest. Details of rehabilitation of the swing mooring area will be incorporated in the proposed Marine Vegetation Monitoring and Management Plan.
Gov Submission 12, Planning SA, Comment 38	Clarify ownership and responsibility for relocation of the rock lobster industry infrastructure and swing moorings.	

Public		Acknowledged. This proposal does not propose the removal of this infrastructure nor can the proponent affect the existing use rights of lawfully operating development.
Public Submission 11 Comment 6	I agree that the land where fish processors are located should be returned to public ownership as it becomes available.	
Public Submission 28 Comment 5	It is important to allow moorings to continue to remain in the existing area. It may be ideal to have boats in the Marina, however the area they are now in is safe and to ban them would create a monopoly, which could be anti-competitive. The marina floor is only going to be 3.5 mAHD, which may not suit all craft. What of the marina fees become too expensive?	The current mooring is generally safe however there have been events where vessels have broken their moorings and been washed onto the beach. It is therefore a safer proposition ie. less risk of personal, property and environmental damage in a secure marina facility. The proponent has no control over the use of the mooring area and there is no suggestion in the EIS to ban the use of this area. The sea bed at the end of the jetty is in fact about -1.8 mAHD therefore the marina is significantly deeper and hence will accommodate a greater range and depth of vessel. There are operational cost implications for the use of the jetty including time and convenience penalties. The protection of vessels, which are high capital cost items, within a marina is prudent and will occur on the basis of financial viability, insurance, occupational health and safety and related assessments.
Public Submission 29 Comment 17	There have been two incidents of vessels breaking their moorings and beaching in the last ten years so it is unlikely that significant environmental problems would occur.	Any accident of this type poses risks to the environment, as there is greater potential from oil or fuel spills where a vessel is beached out of control. Further, if a vessel has broken its mooring in a storm and hits the jetty, there is the potential for the fuel line to be severed, the jetty to be damaged, other boats in its path damaged and personal injury to third parties or those undertaking emergency activities and rescues.
Public Submission 29 Comment 21	The removal of swing moorings is not a foregone conclusion as it is dependent upon the professional fishermen buying moorings in the marina. The fleet overwinters on land.	The EIS does not propose the mandatory removal of the swing moorings. It is noteworthy however that 21 fishers have registered their interest in the purchase of berths and hard stand space.
Public Submission 29 Comment 40	There have never been a significant fuel spill on the jetty and recent upgrades of the fuel facility have addressed this situation.	The risk of spills remains whilst the facilities are exposed and vessels lie at the open moorings.
Public Submission 29 Comment 39	The existing jetty has to be maintained whether this development proceeds or not, and is a significant tourist drawcard, as are the adjacent lobster depots.	The jetty is the subject of review by the State Government and Council. It is readily acknowledged that the jetty plays an important role as a tourist attraction.

5.10 EIS Typographic / Reproduction Issues

5.10.1 Correct Name for DEH

Government		The correct name is acknowledged and all future references where the name is stated in full will read accordingly.
Gov Submission 8/13, DEH, Comment 20.2	DEH advises that the correct name for the department is the Department for Environment and Heritage. It would be appreciated if all references to the Department are corrected accordingly.	

5.10.2 Incomplete Paragraph on Page 5-156 of the EIS

Government		Missing text from the end of the last paragraph on page 5-156 of the EIS is: *"stay at Cape Jaffa and others will result from visiting cruisers. A manager will also be employed to manage the facilities in accordance with licensing and other statutory requirements."* There are no missing pages, pages 5-157 and 5-158 are Figure 5.50.
Gov Submission 12, Planning SA, Comment 46	Text appears to be missing from the last paragraph of page 5-156. Confusion exists regarding page numbering for pgs 5-157 and 5-158: are any pages missing?	

5.10.3 File Missing on some CDs

Government		A replacement CD was provided following the consultation meeting with DEH dated 22nd March 2005.
Gov Submission 8/13, DEH, Comment 19.13	The EIS makes reference to the Site Construction Management Plan, however the CD provided does not detail Appendix 8 (or Appendices 4,5,6,7,9)	
Gov Submission 11, SENRCC, Comment 2	Appendices 4 to 9 were missing from the information CD.	
Gov Submission 13, EPA, Comment 2	The EIS references a draft Site Construction Management Plan contained in Appendix 8. Appendix 8 contains no such plan.	
Public		
	There are no public submissions on this issue.	

5.11 Other Issues

5.11.1 Earthquakes

Government		A preliminary assessment of the effects of earthquakes and liquefaction on the development has been conducted by Coffey Geosciences Pty Ltd and is attached in Appendix G. The report reviews the historical occurrences of earthquakes and liquefaction, the ground conditions at the site and the potential consequences for the development, particularly the potential impacts on: • Waterway slopes • Building foundation areas • Breakwater foundations, and • Foundation of the reclaimed water winter storage dam A summary of it's conclusions and relevant issues includes: • a liquefaction hazard could exist in the loose, saturated shallow (Semaphore or St Kilda) sands and that detail design should include consideration of this hazard; • various mitigation measures can reasonably be included to manage this hazard; • the breakwater is unlikely to experience founding issues, although some differential settlement may occur; • the wharf edge treatment is unlikely to experience issues as it is founded in the limestones, provided soils retained behind the wall are suitably engineered; • the base of the waterways is into the limestone and below the zone of likely liquefaction. Nevertheless, in places, loose sandy soils may be found on submerged batters and beneath the wall that forms part of the waterways edge treatment. Where they are encountered ground improvement treatment is likely be required. These are expected to be manageable and may include over excavation and replacement with selected fill, flatter batter
Gov Submission 12, Planning SA, Comments 64 & 65	In light of historical earthquakes in the area (approximately 6.5 in 1897 and 5.6 in 1948), provide assessment of the potential impacts of an earthquake on the development, including slopes of waterways, building foundation areas, breakwater foundations and base of the storage pond. In addition, housing, buildings and the wastewater treatment plant should comply with the applicable earthquake code.	
Public		
	There are no public submissions on this issue.	

		slopes or in-situ densification. This will form part of the normal detailed design and geotechnical assessment processes; • the risk of liquefaction of loose sandy soils below the groundwater level beneath buildings is expected to be no different than for large parts of the southeast coastline, where development occurs without specific mitigation measures. If a potential liquefaction zone is more than about 3 metres below a residential building, it is unlikely to present a risk and the risk is particularly reduced if it is a flexible structure on stiffened raft footings. Large areas of the development will require engineered fill to achieve the required design levels, and this will also minimise potential risks; and • If loose, unconsolidated sands are present below the groundwater level beneath or in the sides of the storage dam, remedial treatment may be required. The storage dam is required to be built above the groundwater and is required to be appropriately engineered in any case, and the potential need for ground improvement will be considered in the detailed design and construction of the storage dam. In summary, potential liquefaction will be considered as part of the normal detail design, geotechnical investigation, construction and construction supervision processes, in order to ensure that the major structures are constructed appropriately and that residential householders do not need to take additional specific measures to reduce this risk to normally acceptable levels.
5.11.2 Assessment and Approval Process		
Government		The Guidelines and EIS contain an outline of the Major Development Process as it pertains to developments requiring an EIS, as is applicable to this project. The process from this time includes: • Response to submissions advertised; • Preparation of Assessment Report by Planning SA; and • Governor's decision. Issues raised by DEH and NVC have been considered in this response including; • Heritage; • Crown Land;
Gov Submission 6, DFC, Comment 5	It is understood that the Minister for Urban Planning will prepare an Assessment Report for public release prior to final decision-making.	
Gov Submission 8/13, DEH, Comment 19.14	The EIS addresses DEH concerns with regard to potential hazard risks pertaining to erosion and flooding, however DEH raise concern to regard to other environmental concerns. DEH requests that concerns regarding the adequacy of the EIS be addressed prior to final consideration of the EIS.	
Public		

	There are no public submissions on this issue.	• Biodiversity Conservation; and • Coastal Issues. Further assessment has also been undertaken in relation to groundwater, seagrass wrack, coastal acid sulphate soils, marina water quality, seagrasses, marine pests, public access along the beach and visual amenity. These are contained in the sections above. These matters will now be the subject of review and assessment by the Minister as part of the final consideration of this EIS, following which the Governor makes a decision.
5.11.3 Public Consultation		
Government		The community has had numerous opportunities to comment on the proposal. Additional meetings were held with groups including the local fishers. These meetings were held at Council chambers, and at the Lacepede Bay Motel. The meeting at Council included residents from Cape Jaffa and fishers operating from Cape Jaffa. The meeting was in the form of a workshop where all participants had the opportunity to identify requirements and issues. The meeting at the Lacepede Bay Motel involved only Cape Jaffa Fishers and representatives of the fishers association to discuss the proposal, their need for space, type of facilities proposed and any concerns or issues with the development. These meetings were valuable and resulted in amendments to the concept. In addition there have been a number of opportunities for individuals to state or write comment on the proposal with numerous invitations at a number of meetings and events including the Cape Jaffa Seafood and Wine Festival for three years.
	There are no Government submissions on this issue.	
Public		
Public Submission 8 Comment 2	Local fishing fleet has had minimal consultation on the development of the marina.	
Public Submission 18 Comment 9	We have not been invited to meetings or discussion regarding future expansion of the development (EIS Section 5.5.6) onto our land.	The EIS Guidelines sought a response to the question 5.5.6: *"Outline the provisions for any expansion beyond Stage 7".* The response is clear as follows:: *"No expansion is currently envisaged thus none is included as part of this proposal."* There have been many meetings and opportunities to discuss further expansion of the development beyond the defined boundary, had individuals wished to do so.
Public Submission 29 Comment 1	Having attended the workshop in July 2002, the so-called key stakeholders were not highly supportive and were not canvassed at all on the subject of	The purpose of this and other early meetings and discussions were to inform the community of the proposal in concept terms and to identify and discuss issues and not to have a vote on a scheme. The meeting was in fact very interested in the

	support.	proposal and many made comments on the benefits that could flow from this type of proposal.
Public Submission 30 Comment 8	The community consultation period was too short and needs to reflect the size and scope of the EIS. The period may have been based on a smaller development. A simplified submission form that facilitates public submissions should accompany plans or reports that are released for public consultation. Accurate information does not appear to have been available during the public consultation process. The concept plan has changed since it was initially presented to the public in January 2002	The formal consultation period was appropriate to the scope of the scheme, the detailed investigations undertaken and the issues and guidelines established. The exposure of the proposal in many venues and meetings over several years also ensured good public awareness and knowledge of the scheme. Further, the major development process of notification and consultation involves not one opportunity but several for interested parties to consider the issues, the guidelines and then the investigations prepared by the proponent. This period has extended over two years during which interested parties could consider the proposal first in the broad terms of the initial concept and more latterly the concept as presented. The difference between those concepts in real terms is minor. The invitation for submissions without proforma allows individuals to prepare in their own terms their comments and thoughts about the proposal without feeling constrained by forms. The public consultation has been an extensive and valuable process commencing well before the EIS was prepared. Through the process there have also been information sheets, displays videos and invitations to discuss any issue with the Cape Jaffa Development Company. As a consequence of these consultations and the detailed investigations, the proposal has been improved and enhanced to achieve better environmental, social and economic outcomes. The concept resulting from the investigations is that which was presented in the EIS and accordingly the information remains accurate.

APPENDIX A

Submission Authors

Submissions

The following table identifies those parties who made submissions on the Cape Jaffa Anchorage Marina EIS document and where appropriate, comment is made to provide context to that submission. Submission Numbers reflect the number allocation made by Planning SA and the Comment Numbers are those allocated to the issues by the proponent. These numbers are referenced in the body of the response document for ease of reference.

The first part of this table lists the Government Agency submissions each with the preface G, the second part, the Private submissions, with the preface P and the last part of the table Late submissions with the preface L.

Government Agency Submissions

SUBMISSION NUMBER	COMMENT NUMBERS	AUTHOR	ADDRESS	COMMENT
G 1	1-4	Department of Trade and Economic Development	GPO Box 1264 Adelaide SA 5001	
G 2	1-11	Department of Health	PO Box 287, Rundle Mall Adelaide SA 5000	
G 3	1-3	Primary Industries and Resources SA	GPO Box 1625 Adelaide SA 5001	
G 4	1-2	Primary Industries and Resources SA	GPO Box 1671 Adelaide SA 5001	
G 5	1	South Australian Department of Aboriginal Affairs and Reconciliation	PO Box 3140, Rundle Mall Adelaide SA 5000	
G 6	1-5	Department for Families and Communities	GPO Box 292 Adelaide SA 5001	
G 7	See G 13	Department of Water, Land and Biodiversity Conservation	GPO Box 2834 Adelaide SA 5001	Incorporated in Submission G 13
G 8	See G 13	Department for Environment and Heritage	GPO Box 1047 Adelaide SA 5001	Incorporated in Submission G 13
G 9	1-2b	Office for Infrastructure Development	GPO Box 1533 Adelaide SA 5001	
G 10	1-8	South East Catchment Water Management Board	PO Box 30 Mount Gambier SA 5290	
G 11	1-12	South East Natural Resource Consultative Committee	PO Box 1445 Mount Gambier SA 5290	
G 12	1-72	Planning SA	GPO 1815 Adelaide SA 5001	
G 13	1-27	Environment Protection Authority	GPO Box 2607 Adelaide SA 5001	Compiled EPA, DEH, DWLBC and NVC comments

Public Submissions

SUBMISSION NUMBER	COMMENT NUMBERS	AUTHOR	ADDRESS	COMMENT
P 1	1-5	E H Davis	39 Pigeon Road Bordertown SA 5268	
P 2	1-8	T A R Smith	PO Box 117 Kingston SA 5275	
P 3	1	C A Smith	Limestone Coast Road Cape Jaffa SA 5275	
P 3A	1-6	D Peel	South East Atlantic Salmon PO Box 43 Robe SA 5276	
P 4	1-2	K, P & A Smith, & A Montogmery	34 Darlot Street Horsham Vic 3400	
P 5	1-3	G Doyle	30 Cooke Street Kingston SA 5275	
P 6	1-2	T W Flint	Po Box 125 Kingston SA 5275	
P 7	1-9	A Bing	Po Box 270 Kingston SA 5275	
P 8	1-5	M Rothall	PO Box 293 Kingston SA 5275	
P 9	1-4	M E & J M Rivett	Avenue Range South East 5275	
P 10	1	B Onderstal	PO Box 37 Kingston SA 5275	Also refer to P11
P 11	1-22	J Copping	PO Box 37 Kingston SA 5275	Also refer to P10
P 12	1	E Leta Padman	PO Box 173 Murray Bridge SA 5253	
P 13	1-2	T Starling	PO Box 202 Kingston SA 5275	
P 14	1-4	Mrs H Parker	PO Box 137 Kingston SA 5275	
P 15	1-4	C J, B D & D G Mackereth	“Paringa Park” Cape Jaffa SA 5275	Duplicate of P 22
P 16	1-7	T & M Small	PO Avenue Range SA 5275	
P 17	1-4	R Holme	PO Box 41 Kingston SA 5275	
P 18	1-16	A & S Niejalke	PO Box 138 Kingston SA 5275	
P 19	1-5	L Gilchrist & P Rowland	Cape Jaffa Caravan Park 18 King Drive Cape Jaffa SA 5275	

Public Submissions (continued)

SUBMISSION NUMBER	COMMENT / ISSUE NUMBERS	AUTHOR	ADDRESS	COMMENT
P 20	1-3	V Natt & E Lawson	Whynunga Bush Foods PO Box 71 Robe SA 5275	Also refer to P21
P 21	1-7	E Lawson & V Natt	Friends of Butcher Gap Conservation Park 11 Wilhelmina Street Kingston SA 5275	Also refer to P20
P 22	1-4	CJ, BD & DG Mackereth	"Paringa Park" Cape Jaffa SA 5275	Duplicate of P 15
P 23	1-5	Rohan Parker	PO Box 137 Kingston SA 5275	
P 24	1-7	David and Margaret Waterhouse	R.M.B 3282 Horsham VIC 3401	
P 25	1-3	Michael R Newton	5 Joseph Street Kingston SA 5275	
P 26	1-5	Mrs G M Rochall	PO Box 33 Kingston SA 5275	
P 27	1-16	B A & V A Browne	25 Wilpena Terrace Aldgate SA 5154	
P 28	1-13	Angas Bawden	8 Barrowman Drive Kingston SA 5275	
P 29	1-63	K S & J Rayner	PO Box 271 Kingston SA 5275	
P 30	1-26	C Crago Conservation Council of South Australia Inc	120 Wakefield Street Adelaide SA 5275	
Late Submissions				
L 1	1-4	J Bell	9 Kokoda Avenue Warracknabeal Vic 3393	
L 2	1-13	D Smith	PO Box 105 Kingston SA 5275	
L 3	1-6	C Crago	CassiaCrago@optusnet.com.au	

Appendix B

Soil Sampling Results

ADELAIDE
TONKIN CONSULTING
5 Cooke Terrace
Wayville SA 5034
T +61 8 8273 3100
F +61 8 8273 3110
adelaide@tonkin.com.au

MOUNT GAMBIER
JONES TONKIN
1 Krummel Street
Mount Gambier SA 5290
PO BOX 1192
Mount Gambier SA 5291
T +61 8 8723 5002
F +61 8 8723 5004
mtgambier@tonkin.com.au

www.tonkin.com.au

20030318LA5/GRP/GRP

20 June 2005

Cape Jaffa Development Company
PO Box 150
BRIGHTON SA 5048

Attention: Rob Gabb

Dear Rob

CAPE JAFFA ANCHORAGE MARINA – SOIL SAMPLING RESULTS

On 12 May 2005, soil samples were collected from the proposed Cape Jaffa Anchorage Marina in proximity to wells CJ15 and CJ15A (refer Attachment 1). The objective of the work was to assess whether there is a soil source of arsenic, cyanide and nutrients at this location.

The following letter details the methodology and results of the work undertaken.

Background

In July 2003, wells CJ15 and CJ15A were sampled and analysed for a range of analytes. The results of this groundwater sampling revealed elevated concentrations of arsenic, cyanide and several nutrient parameters compared to the *Environment Protection (Water Quality) Policy 2003* for marine waters. These wells were sampled again in October 2004 for metals, speciated arsenic and free and total cyanide. These results are presented in Table 1.

In our letter dated 25 November 2004, the following was concluded from these sampling rounds:

- Arsenic and Cyanide had reduced between July 2003 and October 2004.
- Cyanide is likely to exist in the form of the less toxic metallo-cyanide and organic complexes.
- Arsenic and Cyanide may have resulted from natural sources, such as geology and plant production, with the elevated concentrations recorded in July 2003 related to evapo-concentration, as suggested by changes in salinity in CJ15A (Table 1).

T & R Nominees PTY LTD ACN 007 860 586 as Trustee for T & R Unit Trust ABN 99 630 962 951
Trading as TONKIN CONSULTING and JONES TONKIN
Members of The Association of Consulting Engineers Australia

Table 1 July 2003 and October 2004 Analyte Concentrations (µg/L)

			Well	
Sampling Round	**Analyte**	**Units**	**CJ15**	**CJ15A**
July 2003	Arsenic (Total)	µg/L	31	92
	Cyanide (Total)		26	265
	Salinity (TDS)	mg/L	4,300	14,900
October 2004	Arsenic (V)	µg/L	2	<1
	Arsenic (III)		22	<1
	Total Arsenic		24	<2
	Free Cyanide		<5	<5
	Total Cyanide		21	11
	Cadmium		0.2	<0.2
	Chromium		<0.5	0.7
	Copper		<1	<1
	Lead		<0.2	<0.2
	Mercury		<0.1	<0.1
	Nickel		<0.5	<0.5
	Zinc		<5	<5
	Salinity (TDS)	mg/L	5,600	7,600

As presented in the EIS, Arsenic and Cyanide could have resulted from a number of sources. These include natural sources, such as from rock/soil minerals (Arsenic) and plant production (Cyanide) or anthropogenic sources, such as historical application of pesticides. The source of nutrients may also be natural, such as the degradation of organic matter. Potential anthropogenic sources of nutrients include the application of fertilisers or the application of animal effluent.

Assessment of soils adjacent to and surrounding wells CJ15 and CJ15A was considered necessary to assess the following:

- Whether there is a soil source of contamination contributing to groundwater contamination;
- Whether soil contamination, if present, is likely to be a risk to the health of future users of the site;
- Whether soil sources of contamination are natural or anthropogenic.

In addition, sampling was required to satisfy comments received from Planning SA which requested assessment of the likely extent and nature of potential soil contamination.

Sampling was focussed to surface soils as anthropogenic sources of soil contamination are likely to be concentrated in this horizon due to the method of application of fertilisers, pesticides and animal effluent.

Methodology

Sampling

On 12 May 2005, Tonkin Consulting personnel retrieved soil samples over a broad area adjacent to and surrounding wells CJ15 and CJ15A. Nine samples (BH1 to BH9) were collected from the surface using a shovel and stainless steel trowel. A duplicate sample (DUP) was retrieved at sampling location BH8. Sampling locations are included as Attachment 1.

Samples were retrieved while wearing clean nitrile gloves, to minimize cross contamination between samples, and placed in unpreserved glass jars provided by the analysing laboratory. Once collected, samples were placed in chilled storage and transported to the laboratory with chain of custody documentation.

Laboratory Program

The samples were submitted to Australian Laboratory Services (ALS) for analysis. ALS is NATA accredited for the analyses undertaken. The samples were analysed as indicated in Table 2.

Table 2 – Laboratory Analysis

Sample No.	Analytes *				
	pH soil	8 Metals	Total Cyanide	Total P / Total N / TOC	VicEPA Screen
BH1	✓	✓	✓	✓	
BH2	✓	✓	✓	✓	
BH3	✓	✓	✓	✓	
BH4	✓	✓	✓	✓	
BH5					✓
BH6	✓	✓	✓	✓	
BH7	✓	✓	✓	✓	
BH8	✓	✓	✓	✓	
BH9	✓	✓	✓	✓	
DUP	✓	✓	✓	✓	

* 8 Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc
Total P – Total Phosphorus
VicEPA Screen – Total Petroleum Hydrocarbons, Benzene, Toluene, Ethylbenzene, Xylenes, Polycyclic Aromatic Hydrocarbons, Phenols, Heavy Metals (Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Tin, Zinc), Organochlorine Pesticides, Total Cyanide, Soluble Fluoride.

Results

Results have been compared to the National Environment Protection (Assessment of Site Contamination) Measure 1999:

- Health Investigation Levels, Setting A, Standard Residential
- Ecological Investigation Levels, Interim Urban

The analytical results are presented in the Attachment 2 and the laboratory report is provided in Attachment 3.

In summary, the concentrations of all analytes were below the guideline investigation levels referenced above.

pH for all samples and duplicates ranged from 7.7 to 8.7 indicating the soil is moderate to strongly alkaline, reducing the solubility of cationic metals.

A summary of Quality Assurance and Quality Control procedures and results are included in Attachment 4.

Conclusions

The analysis of surface soil samples collected from the site have not indicated the presence of a soil source of the contaminants identified in groundwater at wells CJ15 and CJ15A.

In addition, comparison to NEPM HIL A (standard residential) guidelines indicates that there is minimal health risks associated with arsenic and cyanide within the sampled soils.

The absence of cadmium in both soil and groundwater at this location suggests that the source of nutrients is unlikely to be the application of superphosphate.

This assessment supports the hypothesis that the elevated concentration of analytes in CJ15 and CJ15A in July 2003 was related to evapo-concentration and indicates that these contaminants have not resulted from surface-applied anthropogenic sources.

Should you have any questions or comments please contact the undersigned on 8273 3100.

Yours faithfully
TONKIN CONSULTING

GRA Passfield, MIEAust
Chartered Professional Engineer

Enc Attachment 1 Sampling Locations
Attachment 2 Results Table
Attachment 3 Laboratory Reports
Attachment 4 Quality Assurance and Quality Control

Attachment 1

ATTACHMENT 1

ADELAIDE
TONKIN CONSULTING
5 COOKE TERRACE
WAYVILLE SA 5034
T +61 8 8273 3100
F +61 8 8273 3110
E adelaide@tonkin.com.au

Cape Jaffa Anchorage Marina

Soil Sampling Location Plan

JOB NO. : 2003.0318

June 2005

Attachment 2

Project name/number:	2003.0318	Sample ID (Primary):		BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8	BH9	DUP	RPD (%)
Project site:	Cape Jaffa													
			Sample date:	11/05/2005	11/05/2005	11/05/2005	11/05/2005	11/05/2005	11/05/2005	11/05/2005	11/05/2005	11/05/2005	11/05/2005	
Analyte grouping / Analyte	Units	NEPM HIL A	NEPM EIL											
EA002 : pH (Soils)														
pH Value	pH Unit			8.1	7.9	7.7	7.8	- - -	7.9	7.8	8.4	8.7	8.5	
EA055: Moisture Content														
Moisture Content (dried @ 103°C)	%			11.7	2	4.4	4	9.7	4.4	<1.0	1.3	1.3	1.2	
EG005T: Total Metals by ICP-AES														
Arsenic	mg/kg	100	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cadmium	mg/kg	20	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Chromium	mg/kg	120000	400	6	7	6	7	4	6	8	7	8	7	0%
Cobalt	mg/kg	100		- - -	- - -	- - -	- - -	<2	- - -	- - -	- - -	- - -	- - -	
Copper	mg/kg	1000	100	7	7	6	5	5	<5	<5	<5	<5	<5	
Lead	mg/kg	300	600	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Molybdenum	mg/kg			- - -	- - -	- - -	- - -	<2	- - -	- - -	- - -	- - -	- - -	
Nickel	mg/kg	600	60	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Selenium	mg/kg			- - -	- - -	- - -	- - -	64	- - -	- - -	- - -	- - -	- - -	
Tin	mg/kg			- - -	- - -	- - -	- - -	<5	- - -	- - -	- - -	- - -	- - -	
Zinc	mg/kg	7000	200	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
EG035T: Total Mercury by FIMS														
Mercury	mg/kg	15	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
EK026: Total Cyanide														
Total Cyanide	mg/kg	250		2	1	1	1	<1	2	<1	1	<1	1	0%
EK040T: Fluoride Total														
Fluoride	mg/kg			- - -	- - -	- - -	- - -	1240	- - -	- - -	- - -	- - -	- - -	
EK059: Nitrite plus Nitrate as N (NOx)														
Nitrite + Nitrate as N (Sol.)	mg/kg			0.7	6.8	4	4	- - -	89.5	3.2	2.2	1.4	2.1	-5%
EK061: Total Kjeldahl Nitrogen (TKN)														
Total Kjeldahl Nitrogen as N	mg/kg			8650	6710	8010	10800	- - -	4890	2200	3670	2830	3510	-4%
EK062: Total Nitrogen as N (TKN + NOx)														
Total Nitrogen as N	mg/kg			8650	6720	8010	10800	- - -	4980	2200	3670	2830	3510	-4%
EK067: Total Phosphorus as P														
Total Phosphorus as P	mg/kg		2000	553	642	441	893	- - -	247	301	656	519	517	-24%
EP004: Organic Matter														
Organic Matter	%			7.6	4.4	4.4	4.7	- - -	4.3	1	1.3	<0.5	0.8	-48%
Total Organic Carbon	%			4.4	2.6	2.5	2.7	- - -	2.5	0.6	0.7	<0.5	<0.5	
EP068A: Organochlorine Pesticides (OC)														
alpha-BHC	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Hexachlorobenzene (HCB)	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
beta-BHC	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
gamma-BHC	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
delta-BHC	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Heptachlor	mg/kg	10		- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Aldrin	mg/kg	10		- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Dieldrin	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Heptachlor epoxide	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
trans-Chlordane	mg/kg	50		- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
cis-Chlordane	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
alpha-Endosulfan	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
4.4'-DDE	mg/kg	200		- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
4.4'-DDD	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
4.4'-DDT	mg/kg			- - -	- - -	- - -	- - -	<0.2	- - -	- - -	- - -	- - -	- - -	
Endrin	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
beta-Endosulfan	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Endrin aldehyde	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Endosulfan sulfate	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Endrin ketone	mg/kg			- - -	- - -	- - -	- - -	<0.05	- - -	- - -	- - -	- - -	- - -	
Methoxychlor	mg/kg			- - -	- - -	- - -	- - -	<0.2	- - -	- - -	- - -	- - -	- - -	
EP074A: Monocyclic Aromatic Hydrocarbons														
Benzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Toluene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Ethylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
meta- & para-Xylene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Styrene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
ortho-Xylene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Isopropylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
n-Propylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
1.3.5-Trimethylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
sec-Butylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
1.2.4-Trimethylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
tert-Butylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
p-Isopropyltoluene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
n-Butylbenzene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
EP075(SIM)A: Phenolic Compounds														
Phenol	mg/kg	8500		- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2-Chlorophenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2-Methylphenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
3- & 4-Methylphenol	mg/kg			- - -	- - -	- - -	- - -	<1.0	- - -	- - -	- - -	- - -	- - -	
2-Nitrophenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2.4-Dimethylphenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2.4-Dichlorophenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2.6-Dichlorophenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
4-Chloro-3-Methylphenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2.4.6-Trichlorophenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
2.4.5-Trichlorophenol	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Pentachlorophenol	mg/kg			- - -	- - -	- - -	- - -	<1.0	- - -	- - -	- - -	- - -	- - -	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons														
Naphthalene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Acenaphthylene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Acenaphthene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Fluorene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Phenanthrene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Anthracene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Fluoranthene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Pyrene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Benz(a)anthracene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Chrysene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Benzo(b)fluoranthene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Benzo(k)fluoranthene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Benzo(a)pyrene	mg/kg	1		- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Indeno(1.2.3.cd)pyrene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Dibenz(a.h)anthracene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Benzo(g.h.i)perylene	mg/kg			- - -	- - -	- - -	- - -	<0.5	- - -	- - -	- - -	- - -	- - -	
Total PAHs	mg/kg	20		- - -	- - -	- - -	- - -	<8	- - -	- - -	- - -	- - -	- - -	
EP080/071: Total Petroleum Hydrocarbons														
C6 - C9 Fraction	mg/kg			- - -	- - -	- - -	- - -	<2	- - -	- - -	- - -	- - -	- - -	
C10 - C14 Fraction	mg/kg			- - -	- - -	- - -	- - -	<50	- - -	- - -	- - -	- - -	- - -	
C15 - C28 Fraction	mg/kg			- - -	- - -	- - -	- - -	<100	- - -	- - -	- - -	- - -	- - -	
C29 - C36 Fraction	mg/kg			- - -	- - -	- - -	- - -	230	- - -	- - -	- - -	- - -	- - -	

Attachment 3

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	:	**TONKIN CONSULTING**	**Laboratory**	:	ALS Environmental Melbourne	**Page**	: **1 of 8**
Contact	:	MR TONY PAPARELLA	**Contact**	:	Tim Kilmister		
Address	:	1 KRUMMEL ST MT GAMBIER SA AUSTRALIA 5290	**Address**	:	Unit 6, 2 Sarton Road Clayton VIC Australia 3168	**Work order**	: **EM0502937**
Project	:	2003.0318	**Quote number**	:	----	**Date received**	: 13 May 2005
Order number	:	- Not provided -				**Date issued**	: 24 May 2005
C-O-C number	:	- Not provided -					
Site	:	Cape Jaffa					
E-mail	:	tony.paparella@tonkin.com.au	**E-mail**	:	Tim.Kilmister@alsenviro.com	**No. of samples**	
Telephone	:	08 8723 5004	**Telephone**	:	61-3-95384444	**Received**	: 11
Facsimile	:	08 8723 5002	**Facsimile**	:	61-3-95384400	**Analysed**	: 11

This final report for the ALSE work order reference EM0502937 supersedes any previous reports with this reference.
Results apply to the samples as submitted. All pages of this report have been checked and approved for release.
This report contains the following information:

- Analytical results for samples submitted
- Surrogate control limits

Work order specific comments

Poor duplicate result for Chromium due to sample heterogenity.

Excellence in Analytical Testing

NATA WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory - 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Herman Lin	Inorganics - NATA 13778 (Melbourne)
Ken Reid	Newcastle - NATA 825 (Newcastle)
Tim Kilmister	Organics - NATA 13778 (Melbourne)

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits).
Abbreviations: ***CAS number*** = *Chemical Abstract Services number*, ***LOR*** = *Limit of Reporting*. # ***Indicates a raised LOR***, **** Indicates failed Surrogate Recoveries.***
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes.

Analytical Results

				Client Sample ID :	**BH1**	**BH2**	**BH3**	**BH4**	**BH5**
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00
				Laboratory Sample ID :	**EM0502937-001**	**EM0502937-002**	**EM0502937-003**	**EM0502937-004**	**EM0502937-005**
Analyte	***CAS number***	***LOR***	***Units***						
EA002 : pH (Soils)									
pH Value	12408-02-5	0.1	pH Unit		8.1	7.9	7.7	7.8	----
EA055: Moisture Content									
Moisture Content (dried @ 103°C)		1.0	%		11.7	2.0	4.4	4.0	9.7
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		6	7	6	7	4
Cobalt	7440-48-4	2	mg/kg		----	----	----	----	<2
Copper	7440-50-8	5	mg/kg		7	7	6	5	5
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	<5
Molybdenum	7439-98-7	2	mg/kg		----	----	----	----	<2
Nickel	7440-02-0	2	mg/kg		<2	<2	<2	<2	<2
Selenium	7782-49-2	5	mg/kg		----	----	----	----	64
Tin	7440-31-5	5	mg/kg		----	----	----	----	<5
Zinc	7440-66-6	5	mg/kg		<5	<5	<5	<5	<5
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EK026: Total Cyanide									
Total Cyanide	57-12-5	1	mg/kg		2	1	1	1	<1
EK040T: Fluoride Total									
Fluoride	16984-48-8	40	mg/kg		----	----	----	----	1240
EK059: Nitrite plus Nitrate as N (NOx)									
Nitrite + Nitrate as N (Sol.)		0.1	mg/kg		0.7	6.8	4.0	4.0	----
EK061: Total Kjeldahl Nitrogen (TKN)									
Total Kjeldahl Nitrogen as N		20	mg/kg		8650	6710	8010	10800	----
EK062: Total Nitrogen as N (TKN + NOx)									
Total Nitrogen as N		20	mg/kg		8650	6720	8010	10800	----
EK067: Total Phosphorus as P									
Total Phosphorus as P		2	mg/kg		553	642	441	893	----
EP004: Organic Matter									
Organic Matter		0.5	%		7.6	4.4	4.4	4.7	----
Total Organic Carbon		0.5	%		4.4	2.6	2.5	2.7	----

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: BH1	BH2	BH3	BH4	BH5
Sample Matrix Type / Description				SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
Sample Date / Time				11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00
Laboratory Sample ID				EM0502937-001	EM0502937-002	EM0502937-003	EM0502937-004	EM0502937-005
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	----	<0.05
4,4'-DDE	72-55-9	0.05	mg/kg	----	----	----	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	----	----	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	----	<0.05
4,4'-DDD	72-54-8	0.05	mg/kg	----	----	----	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	----	<0.05
4,4'-DDT	50-29-3	0.2	mg/kg	----	----	----	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	----	<0.2
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	0.5	mg/kg	----	----	----	----	<0.5
Toluene	108-88-3	0.5	mg/kg	----	----	----	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	----	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	----	----	<0.5
Styrene	100-42-5	0.5	mg/kg	----	----	----	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	----	----	<0.5
Isopropylbenzene	98-82-8	0.5	mg/kg	----	----	----	----	<0.5
n-Propylbenzene	103-65-1	0.5	mg/kg	----	----	----	----	<0.5
1,3,5-Trimethylbenzene	108-67-8	0.5	mg/kg	----	----	----	----	<0.5
sec-Butylbenzene	135-98-8	0.5	mg/kg	----	----	----	----	<0.5
1,2,4-Trimethylbenzene	95-63-6	0.5	mg/kg	----	----	----	----	<0.5
tert-Butylbenzene	98-06-6	0.5	mg/kg	----	----	----	----	<0.5
p-Isopropyltoluene	99-87-6	0.5	mg/kg	----	----	----	----	<0.5
n-Butylbenzene	104-51-8	0.5	mg/kg	----	----	----	----	<0.5

ALS Environmental

Analytical Results

				Client Sample ID :	BH1	BH2	BH3	BH4	BH5
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00
				Laboratory Sample ID :	EM0502937-001	EM0502937-002	EM0502937-003	EM0502937-004	EM0502937-005
Analyte	***CAS number***	***LOR***	***Units***						
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		----	----	----	----	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg		----	----	----	----	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg		----	----	----	----	<0.5
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg		----	----	----	----	<1.0
2-Nitrophenol	88-75-5	0.5	mg/kg		----	----	----	----	<0.5
2,4-Dimethylphenol	105-67-9	0.5	mg/kg		----	----	----	----	<0.5
2,4-Dichlorophenol	120-83-2	0.5	mg/kg		----	----	----	----	<0.5
2,6-Dichlorophenol	87-65-0	0.5	mg/kg		----	----	----	----	<0.5
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg		----	----	----	----	<0.5
2,4,6-Trichlorophenol	88-06-2	0.5	mg/kg		----	----	----	----	<0.5
2,4,5-Trichlorophenol	95-95-4	0.5	mg/kg		----	----	----	----	<0.5
Pentachlorophenol	87-86-5	1.0	mg/kg		----	----	----	----	<1.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		----	----	----	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		----	----	----	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		----	----	----	----	<0.5
Fluorene	86-73-7	0.5	mg/kg		----	----	----	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		----	----	----	----	<0.5
Anthracene	120-12-7	0.5	mg/kg		----	----	----	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		----	----	----	----	<0.5
Pyrene	129-00-0	0.5	mg/kg		----	----	----	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		----	----	----	----	<0.5
Chrysene	218-01-9	0.5	mg/kg		----	----	----	----	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		----	----	----	----	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		----	----	----	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		----	----	----	----	<0.5
Indeno(1,2,3,cd)pyrene	193-39-5	0.5	mg/kg		----	----	----	----	<0.5
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg		----	----	----	----	<0.5
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		----	----	----	----	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction		2	mg/kg		----	----	----	----	<2
C10 - C14 Fraction		50	mg/kg		----	----	----	----	<50
C15 - C28 Fraction		100	mg/kg		----	----	----	----	<100
C29 - C36 Fraction		100	mg/kg		----	----	----	----	230
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE		0.1	%		----	----	----	----	86.7

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Analytical Results

				Client Sample ID :	BH1	BH2	BH3	BH4	BH5
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00
				Laboratory Sample ID :	EM0502937-001	EM0502937-002	EM0502937-003	EM0502937-004	EM0502937-005
Analyte	*CAS number*	*LOR*	*Units*						
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		----	----	----	----	94.8
EP074S: VOC Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%		----	----	----	----	74.4
Toluene-D8	2037-26-5	0.1	%		----	----	----	----	70.9
4-Bromofluorobenzene	460-00-4	0.1	%		----	----	----	----	75.9
EP075(SIM)S: Phenolic Compound Surrogates									
2-Fluorophenol	367-12-4	0.1	%		----	----	----	----	102
Phenol-d6	13127-88-3	0.1	%		----	----	----	----	98.6
2-Chlorophenol-D4	93951-73-6	0.1	%		----	----	----	----	103
2,4,6-Tribromophenol	118-79-6	0.1	%		----	----	----	----	92.3
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		----	----	----	----	95.8
Anthracene-d10	1719-06-8	0.1	%		----	----	----	----	92.7
4-Terphenyl-d14	1718-51-0	0.1	%		----	----	----	----	104
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%		----	----	----	----	74.4
Toluene-D8	2037-26-5	0.1	%		----	----	----	----	70.9
4-Bromofluorobenzene	460-00-4	0.1	%		----	----	----	----	75.9

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: BH6	BH7	BH8	BH9	DUP
Sample Matrix Type / Description				SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
Sample Date / Time				11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00	11 May 2005 15:00
Laboratory Sample ID				EM0502937-006	EM0502937-007	EM0502937-008	EM0502937-009	EM0502937-010
EA002 : pH (Soils)								
pH Value	12408-02-5	0.1	pH Unit	7.9	7.8	8.4	8.7	8.5
EA055: Moisture Content								
Moisture Content (dried @ 103°C)		1.0	%	4.4	<1.0	1.3	1.3	1.2
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	6	8	7	8	7
Copper	7440-50-8	5	mg/kg	<5	<5	<5	<5	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	<5	<5	<5	<5	<5
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK026: Total Cyanide								
Total Cyanide	57-12-5	1	mg/kg	2	<1	1	<1	1
EK059: Nitrite plus Nitrate as N (NOx)								
Nitrite + Nitrate as N (Sol.)		0.1	mg/kg	89.5	3.2	2.2	1.4	2.1
EK061: Total Kjeldahl Nitrogen (TKN)								
Total Kjeldahl Nitrogen as N		20	mg/kg	4890	2200	3670	2830	3510
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N		20	mg/kg	4980	2200	3670	2830	3510
EK067: Total Phosphorus as P								
Total Phosphorus as P		2	mg/kg	247	301	656	519	517
EP004: Organic Matter								
Organic Matter		0.5	%	4.3	1.0	1.3	<0.5	0.8
Total Organic Carbon		0.5	%	2.5	0.6	0.7	<0.5	<0.5

ALS Environmental

Analytical Results

				Client Sample ID :	**Council**			
				Sample Matrix Type / Description :	WATER / WATER			
				Sample Date / Time :	11 May 2005 15:00			
				Laboratory Sample ID :	**EM0502937-011**			
Analyte	***CAS number***	***LOR***	***Units***					
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C		1	µS/cm		1780			

ALS Environmental

Surrogate Control Limits

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP068: Pesticides by GCMS			
EP068S: Organochlorine Pesticide Surrogate	Dibromo-DDE		
EP068T: Organophosphorus Pesticide Surrogate	DEF		
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	70	130
	Toluene-D8	70	130
	4-Bromofluorobenzene	70	130
EP075(SIM): PAH/Phenols (SIM)			
EP075(SIM)S: Phenolic Compound Surrogates	2-Fluorophenol	61	121
	Phenol-d6	63	123
	2-Chlorophenol-D4	66	126
	2,4,6-Tribromophenol	59	119
EP075(SIM)T: PAH Surrogates	2-Fluorobiphenyl	61	121
	Anthracene-d10	58	118
	4-Terphenyl-d14	63	123
EP080: TPH Volatiles/BTEX			
EP080S: TPH(V)/BTEX Surrogates	1,2-Dichloroethane-D4	70	130
	Toluene-D8	70	130
	4-Bromofluorobenzene	70	130

ALS Environmental

QUALITY CONTROL REPORT

Client	:	**TONKIN CONSULTING**	**Laboratory**	:	ALS Environmental Melbourne	**Page**	: **1 of 21**
Contact	:	MR TONY PAPARELLA	**Contact**	:	Tim Kilmister		
Address	:	1 KRUMMEL ST MT GAMBIER SA AUSTRALIA 5290	**Address**	:	Unit 6, 2 Sarton Road Clayton VIC Australia 3168	**Work order**	: **EM0502937**
						Amendment No.	:
Project	:	2003.0318	**Quote number**	:	----	**Date received**	: 13 May 2005
Order number	:	- Not provided -				**Date issued**	: 24 May 2005
C-O-C number	:	- Not provided -					
Site	:	Cape Jaffa					
E-mail	:	tony.paparella@tonkin.com.au	**E-mail**	:	Tim.Kilmister@alsenviro.com	**No. of samples**	
Telephone	:	08 8723 5004	**Telephone**	:	61-3-95384444	**Received**	: 11
Facsimile	:	08 8723 5002	**Facsimile**	:	61-3-95384400	**Analysed**	: 11

This final report for the ALSE work order reference EM0502937 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

Work order specific comments

Poor duplicate result for Chromium due to sample heterogenity.

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NATA Accredited Laboratory - 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IED 17025

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Herman Lin	Inorganics - NATA 13778 (Melbourne)
Ken Reid	Newcastle - NATA 825 (Newcastle)
Tim Kilmister	Organics - NATA 13778 (Melbourne)

ALS Environmental

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** = *Limit of Reporting,* ***RPD*** = *Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting:- Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EA002 : pH (Soils)						
EA002 : pH (Soils) - (QC Lot: 71275)				**pH Unit**	**pH Unit**	**%**
EM0502920-001	Anonymous	pH Value	0.1 pH Unit	12.2	12.2	0.0
EM0502936-003	Anonymous	pH Value	0.1 pH Unit	8.1	8.1	0.0
EA002 : pH (Soils) - (QC Lot: 71278)				**pH Unit**	**pH Unit**	**%**
EM0502937-010	DUP	pH Value	0.1 pH Unit	8.5	8.5	0.0
EA055: Moisture Content						
EA055: Moisture Content - (QC Lot: 71400)				**%**	**%**	**%**
EM0502937-002	BH2	Moisture Content (dried @ 103°C)	1 %	2.0	1.9	6.9
EM0502937-009	BH9	Moisture Content (dried @ 103°C)	1 %	1.3	1.3	0.0

ALS Environmental

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 71170)				mg/kg	mg/kg	%
EM0502773-001	Anonymous	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	40	32	23.7
		Cobalt	2 mg/kg	7	6	0.0
		Copper	5 mg/kg	14	12	19.5
		Lead	5 mg/kg	18	16	11.9
		Molybdenum	2 mg/kg	<2	<2	0.0
		Nickel	2 mg/kg	15	12	18.2
		Selenium	5 mg/kg	<5	<5	0.0
		Tin	5 mg/kg	<5	<5	0.0
		Zinc	5 mg/kg	20	16	27.1
EM0502936-002	Anonymous	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	4	5	0.0
		Cobalt	2 mg/kg	5	5	0.0
		Copper	5 mg/kg	12	14	16.5
		Lead	5 mg/kg	8	9	0.0
		Molybdenum	2 mg/kg	<2	<2	0.0
		Nickel	2 mg/kg	6	8	22.0
		Selenium	5 mg/kg	<5	<5	0.0
		Tin	5 mg/kg	<5	<5	0.0
		Zinc	5 mg/kg	31	32	0.0
EG005T: Total Metals by ICP-AES - (QC Lot: 71172)				mg/kg	mg/kg	%
EM0502937-009	BH9	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	7	7	0.0
		Cobalt	2 mg/kg	<2	<2	0.0
		Copper	5 mg/kg	<5	<5	0.0
		Lead	5 mg/kg	<5	<5	0.0
		Molybdenum	2 mg/kg	<2	<2	0.0
		Nickel	2 mg/kg	<2	<2	0.0
		Selenium	5 mg/kg	80	73	8.8
		Tin	5 mg/kg	<5	<5	0.0
		Zinc	5 mg/kg	<5	<5	0.0

ALS Environmental

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EG035T: Total Mercury by FIMS						
EG035T: Total Mercury by FIMS - (QC Lot: 71171)				mg/kg	mg/kg	%
EM0502773-001	Anonymous	Mercury	0.1 mg/kg	0.1	0.1	0.0
EM0502936-002	Anonymous	Mercury	0.1 mg/kg	<0.1	<0.1	0.0
EG035T: Total Mercury by FIMS - (QC Lot: 71173)				mg/kg	mg/kg	%
EM0502937-009	BH9	Mercury	0.1 mg/kg	<0.1	<0.1	0.0
EK026: Total Cyanide						
EK026: Total Cyanide - (QC Lot: 71165)				mg/kg	mg/kg	%
EM0502909-001	Anonymous	Total Cyanide	1 mg/kg	<1	<1	0.0
EM0502934-042	Anonymous	Total Cyanide	1 mg/kg	4	<1	123
EK026: Total Cyanide - (QC Lot: 71166)				mg/kg	mg/kg	%
EM0502937-009	BH9	Total Cyanide	1 mg/kg	<1	<1	0.0
EK040T: Fluoride Total						
EK040T: Fluoride Total - (QC Lot: 73018)				mg/kg	mg/kg	%
EM0502909-001	Anonymous	Fluoride	40 mg/kg	520	510	3.1
EK059: Nitrite plus Nitrate as N (NOx)						
EK059: Nitrite plus Nitrate as N (NOx) - (QC Lot: 71277)				mg/kg	mg/kg	%
EM0502937-001	BH1	Nitrite + Nitrate as N (Sol.)	0.1 mg/kg	0.7	0.7	0.0
EK061: Total Kjeldahl Nitrogen (TKN)						
EK061: Total Kjeldahl Nitrogen (TKN) - (QC Lot: 72095)				mg/kg	mg/kg	%
EM0502835-016	Anonymous	Total Kjeldahl Nitrogen as N	20 mg/kg	1700	1700	0.0
EM0502937-006	BH6	Total Kjeldahl Nitrogen as N	20 mg/kg	4890	4890	0.0
EK067: Total Phosphorus as P						
EK067: Total Phosphorus as P - (QC Lot: 72096)				mg/kg	mg/kg	%
EM0502835-016	Anonymous	Total Phosphorus as P	2 mg/kg	631	631	0.0
EM0502937-006	BH6	Total Phosphorus as P	2 mg/kg	247	247	0.0
EP004: Organic Matter						
EP004: Organic Matter - (QC Lot: 72288)				%	%	%
EM0502937-001	BH1	Organic Matter	0.5 %	7.6	8.1	6.0
		Total Organic Carbon	0.5 %	4.4	4.7	6.0

ALS Environmental

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP068A: Organochlorine Pesticides (OC)						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 71065)				mg/kg	mg/kg	%
EM0502914-001	Anonymous	alpha-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		Hexachlorobenzene (HCB)	0.05 mg/kg	<0.05	<0.05	0.0
		beta-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		gamma-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		delta-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		Heptachlor	0.05 mg/kg	<0.05	<0.05	0.0
		Aldrin	0.05 mg/kg	<0.05	<0.05	0.0
		Heptachlor epoxide	0.05 mg/kg	<0.05	<0.05	0.0
		trans-Chlordane	0.05 mg/kg	<0.05	<0.05	0.0
		alpha-Endosulfan	0.05 mg/kg	<0.05	<0.05	0.0
		cis-Chlordane	0.05 mg/kg	<0.05	<0.05	0.0
		Dieldrin	0.05 mg/kg	<0.05	<0.05	0.0
		4,4'-DDE	0.05 mg/kg	<0.05	<0.05	0.0
		Endrin	0.05 mg/kg	<0.05	<0.05	0.0
		beta-Endosulfan	0.05 mg/kg	<0.05	<0.05	0.0
		4,4'-DDD	0.05 mg/kg	<0.05	<0.05	0.0
		Endrin aldehyde	0.05 mg/kg	<0.05	<0.05	0.0
		Endosulfan sulfate	0.05 mg/kg	<0.05	<0.05	0.0
		4,4'-DDT	0.2 mg/kg	<0.2	<0.2	0.0
		Endrin ketone	0.05 mg/kg	<0.05	<0.05	0.0
		Methoxychlor	0.2 mg/kg	<0.2	<0.2	0.0
EM0502934-033	Anonymous	alpha-BHC	0.50 mg/kg	<0.50	<0.50	0.0
		Hexachlorobenzene (HCB)	0.50 mg/kg	<0.50	<0.50	0.0
		beta-BHC	0.50 mg/kg	<0.50	<0.50	0.0
		gamma-BHC	0.50 mg/kg	<0.50	<0.50	0.0
		delta-BHC	0.50 mg/kg	<0.50	<0.50	0.0
		Heptachlor	0.50 mg/kg	<0.50	<0.50	0.0
		Aldrin	0.50 mg/kg	<0.50	<0.50	0.0
		Heptachlor epoxide	0.50 mg/kg	<0.50	<0.50	0.0
		trans-Chlordane	0.50 mg/kg	<0.50	<0.50	0.0
		alpha-Endosulfan	0.50 mg/kg	<0.50	<0.50	0.0
		cis-Chlordane	0.50 mg/kg	<0.50	<0.50	0.0
		Dieldrin	0.50 mg/kg	<0.50	<0.50	0.0
		4,4'-DDE	0.50 mg/kg	<0.50	<0.50	0.0
		Endrin	0.50 mg/kg	<0.50	<0.50	0.0
		beta-Endosulfan	0.50 mg/kg	<0.50	<0.50	0.0
		4,4'-DDD	0.50 mg/kg	<0.50	<0.50	0.0
		Endrin aldehyde	0.50 mg/kg	<0.50	<0.50	0.0

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Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EM0502934-033	Anonymous	Endosulfan sulfate	0.50 mg/kg	<0.50	<0.50	0.0
		4,4'-DDT	2.0 mg/kg	<2.0	<2.0	0.0
		Endrin ketone	0.50 mg/kg	<0.50	<0.50	0.0
		Methoxychlor	2.0 mg/kg	<2.0	<2.0	0.0
EP074A: Monocyclic Aromatic Hydrocarbons						
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 71036)				mg/kg	mg/kg	%
EM0502909-001	Anonymous	Benzene	0.5 mg/kg	<0.5	<0.5	0.0
		Toluene	0.5 mg/kg	<0.5	<0.5	0.0
		Ethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		meta- & para-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Styrene	0.5 mg/kg	<0.5	<0.5	0.0
		ortho-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Isopropylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Propylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,3,5-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		sec-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,4-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		tert-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		p-Isopropyltoluene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
EM0502934-037	Anonymous	Benzene	0.5 mg/kg	<0.5	<0.5	0.0
		Toluene	0.5 mg/kg	<0.5	<0.5	0.0
		Ethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		meta- & para-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Styrene	0.5 mg/kg	<0.5	<0.5	0.0
		ortho-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Isopropylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Propylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,3,5-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		sec-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,4-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		tert-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		p-Isopropyltoluene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0

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Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EP075(SIM)A: Phenolic Compounds						
EP075(SIM)A: Phenolic Compounds - (QC Lot: 71064)				mg/kg	mg/kg	%
EM0502908-001	Anonymous	Phenol	0.5 mg/kg	<0.5	<0.5	0.0
		2-Chlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2-Methylphenol	0.5 mg/kg	<0.5	<0.5	0.0
		3- & 4-Methylphenol	1.0 mg/kg	<0.5	<1.0	66.7
		2-Nitrophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4-Dimethylphenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4-Dichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,6-Dichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		4-Chloro-3-Methylphenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4,6-Trichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4,5-Trichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		Pentachlorophenol	1.0 mg/kg	<1.0	<1.0	0.0
EM0502934-002	Anonymous	Phenol	0.5 mg/kg	<0.5	<0.5	0.0
		2-Chlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2-Methylphenol	0.5 mg/kg	<0.5	<0.5	0.0
		3- & 4-Methylphenol	1.0 mg/kg	<0.5	<1.0	66.7
		2-Nitrophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4-Dimethylphenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4-Dichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,6-Dichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		4-Chloro-3-Methylphenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4,6-Trichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		2,4,5-Trichlorophenol	0.5 mg/kg	<0.5	<0.5	0.0
		Pentachlorophenol	1.0 mg/kg	<1.0	<1.0	0.0

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Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons						
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - (QC Lot: 71064)				mg/kg	mg/kg	%
EM0502908-001	Anonymous	Naphthalene	0.5 mg/kg	<0.5	<0.5	0.0
		Acenaphthylene	0.5 mg/kg	0.9	0.5	50.4
		Acenaphthene	0.5 mg/kg	<0.5	<0.5	0.0
		Fluorene	0.5 mg/kg	<0.5	<0.5	0.0
		Phenanthrene	0.5 mg/kg	2.3	1.7	31.0
		Anthracene	0.5 mg/kg	1.3	1.0	34.2
		Fluoranthene	0.5 mg/kg	8.6	6.3	31.4
		Pyrene	0.5 mg/kg	9.3	6.5	34.8
		Benz(a)anthracene	0.5 mg/kg	5.4	3.7	36.9
		Chrysene	0.5 mg/kg	5.3	3.7	34.6
		Benzo(b)fluoranthene	0.5 mg/kg	6.3	3.8	50.1
		Benzo(k)fluoranthene	0.5 mg/kg	2.7	2.3	16.8
		Benzo(a)pyrene	0.5 mg/kg	6.0	3.9	42.7
		Indeno(1,2,3,cd)pyrene	0.5 mg/kg	3.0	1.7	55.8
		Dibenz(a,h)anthracene	0.5 mg/kg	1.0	0.5	62.7
		Benzo(g,h,i)perylene	0.5 mg/kg	3.7	1.9	62.5
EM0502934-002	Anonymous	Naphthalene	0.5 mg/kg	<0.5	<0.5	0.0
		Acenaphthylene	0.5 mg/kg	<0.5	<0.5	0.0
		Acenaphthene	0.5 mg/kg	<0.5	<0.5	0.0
		Fluorene	0.5 mg/kg	<0.5	<0.5	0.0
		Phenanthrene	0.5 mg/kg	<0.5	<0.5	0.0
		Anthracene	0.5 mg/kg	<0.5	<0.5	0.0
		Fluoranthene	0.5 mg/kg	<0.5	<0.5	0.0
		Pyrene	0.5 mg/kg	<0.5	<0.5	0.0
		Benz(a)anthracene	0.5 mg/kg	<0.5	<0.5	0.0
		Chrysene	0.5 mg/kg	<0.5	<0.5	0.0
		Benzo(b)fluoranthene	0.5 mg/kg	<0.5	<0.5	0.0
		Benzo(k)fluoranthene	0.5 mg/kg	<0.5	<0.5	0.0
		Benzo(a)pyrene	0.5 mg/kg	<0.5	<0.5	0.0
		Indeno(1,2,3,cd)pyrene	0.5 mg/kg	<0.5	<0.5	0.0
		Dibenz(a,h)anthracene	0.5 mg/kg	<0.5	<0.5	0.0
		Benzo(g,h,i)perylene	0.5 mg/kg	<0.5	<0.5	0.0

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Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EP080/071: Total Petroleum Hydrocarbons						
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 71037)				**mg/kg**	**mg/kg**	**%**
EM0502909-001	Anonymous	C6 - C9 Fraction	2 mg/kg	<2	<2	0.0
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 71063)				**mg/kg**	**mg/kg**	**%**
EM0502905-018	Anonymous	C10 - C14 Fraction	50 mg/kg	<50	<50	0.0
		C15 - C28 Fraction	100 mg/kg	<100	<100	0.0
		C29 - C36 Fraction	100 mg/kg	<100	<100	0.0
EM0502934-002	Anonymous	C10 - C14 Fraction	50 mg/kg	<50	<50	0.0
		C15 - C28 Fraction	100 mg/kg	<100	150	39.8
		C29 - C36 Fraction	100 mg/kg	180	140	22.2

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EA010P: Conductivity by PC Titrator						
EA010P: Conductivity by PC Titrator - (QC Lot: 71451)				**µS/cm**	**µS/cm**	**%**
EM0502933-001	Anonymous	Electrical Conductivity @ 25°C	1 µS/cm	11000	11000	0.3

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

The quality control term **Method / Laboratory Blank** refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term **Laboratory Control Sample (LCS)** refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Abbreviations: LOR = Limit of

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

			Actual Results		Recovery Limits	
				Spike Recovery	Dynamic Recovery Limits	
Analyte name	*LOR*	*Method blank result*	*Spike concentration*	*LCS*	*Low*	*High*

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Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 71170)		mg/kg	mg/kg	%	%	%
Arsenic	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	13.6	96.9	70	130
Cadmium	1 mg/kg	<1	----	----	----	----
	1 mg/kg	----	2.8	98.8	70	130
Chromium	2 mg/kg	<2	----	----	----	----
	2 mg/kg	----	60.9	98.6	70	130
Cobalt	2 mg/kg	<2	----	----	----	----
Copper	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	55.1	91.6	70	130
Lead	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	54.9	92.9	70	130
Molybdenum	2 mg/kg	<2	----	----	----	----
Nickel	2 mg/kg	<2	----	----	----	----
	2 mg/kg	----	55.1	90.7	70	130
Selenium	5 mg/kg	<5	----	----	----	----
Tin	5 mg/kg	<5	----	----	----	----
Zinc	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	105	96.8	70	130
EG005T: Total Metals by ICP-AES - (QC Lot: 71172)		mg/kg	mg/kg	%	%	%
Arsenic	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	13.6	111	70	130
Cadmium	1 mg/kg	<1	----	----	----	----
	1 mg/kg	----	2.8	112	70	130
Chromium	2 mg/kg	<2	----	----	----	----
	2 mg/kg	----	60.9	114	70	130
Cobalt	2 mg/kg	<2	----	----	----	----
Copper	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	55.1	108	70	130
Lead	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	54.9	108	70	130
Molybdenum	2 mg/kg	<2	----	----	----	----
Nickel	2 mg/kg	<2	----	----	----	----
	2 mg/kg	----	55.1	106	70	130
Selenium	5 mg/kg	<5	----	----	----	----
Tin	5 mg/kg	<5	----	----	----	----
Zinc	5 mg/kg	<5	----	----	----	----
	5 mg/kg	----	105	112	70	130

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Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EG035T: Total Mercury by FIMS						
EG035T: Total Mercury by FIMS - (QC Lot: 71171)		mg/kg	mg/kg	%	%	%
Mercury	0.1 mg/kg	<0.1	----	----	----	----
	0.1 mg/kg	----	1.47	103	70	130
EG035T: Total Mercury by FIMS - (QC Lot: 71173)		mg/kg	mg/kg	%	%	%
Mercury	0.1 mg/kg	<0.1	----	----	----	----
	0.1 mg/kg	----	1.47	104	70	130
EK026: Total Cyanide						
EK026: Total Cyanide - (QC Lot: 71165)		mg/kg	mg/kg	%	%	%
Total Cyanide	1.0 mg/kg	----	50	97.7	70	130
	1 mg/kg	<1	----	----	----	----
EK026: Total Cyanide - (QC Lot: 71166)		mg/kg	mg/kg	%	%	%
Total Cyanide	1.0 mg/kg	----	50	97.7	70	130
	1 mg/kg	<1	----	----	----	----
EK040T: Fluoride Total						
EK040T: Fluoride Total - (QC Lot: 73018)		mg/kg	mg/kg	%	%	%
Fluoride	40 mg/kg	----	950	84.0	70	130
	40 mg/kg	<40	----	----	----	----
EK059: Nitrite plus Nitrate as N (NOx)						
EK059: Nitrite plus Nitrate as N (NOx) - (QC Lot: 71277)		mg/kg	mg/kg	%	%	%
Nitrite + Nitrate as N (Sol.)	0.1 mg/kg	<0.1	----	----	----	----
	0.1 mg/kg	----	5	100	70	130
EK061: Total Kjeldahl Nitrogen (TKN)						
EK061: Total Kjeldahl Nitrogen (TKN) - (QC Lot: 72095)		mg/kg	mg/kg	%	%	%
Total Kjeldahl Nitrogen as N	20 mg/kg	<20	----	----	----	----
	20 mg/kg	----	4000	126	70	130
EK067: Total Phosphorus as P						
EK067: Total Phosphorus as P - (QC Lot: 72096)		mg/kg	mg/kg	%	%	%
Total Phosphorus as P	2 mg/kg	----	881	112	70	130
	2 mg/kg	<2	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EP004: Organic Matter						
EP004: Organic Matter - (QC Lot: 72288)		%	%	%	%	%
Organic Matter	0.5 %	<0.5	----	----	----	----
	0.5 %	----	2.3	2670	----	----
Total Organic Carbon	0.5 %	<0.5	----	----	----	----
	0.5 %	----	1.3	2740	----	----

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Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EP068A: Organochlorine Pesticides (OC)						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 71065)		mg/kg	mg/kg	%	%	%
alpha-BHC	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	98.3	57	120
Hexachlorobenzene (HCB)	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.8	60	118
beta-BHC	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	100	60	119
gamma-BHC	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	96.2	60	119
delta-BHC	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	96.8	60	119
Heptachlor	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.0	60	118
Aldrin	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	96.6	58	117
Heptachlor epoxide	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	98.3	60	118
trans-Chlordane	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.2	61	119
alpha-Endosulfan	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.5	58	121
cis-Chlordane	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.2	60	121
Dieldrin	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	98.3	59	121
4,4'-DDE	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	98.7	59	119
Endrin	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	99.8	58	126
beta-Endosulfan	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.7	57	123
4,4'-DDD	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	99.1	61	119
Endrin aldehyde	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	89.7	58	119
Endosulfan sulfate	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	101	52	133
4,4'-DDT	0.2 mg/kg	<0.2	----	----	----	----

ALS Environmental

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EP068A: Organochlorine Pesticides (OC)						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 71065)		mg/kg	mg/kg	%	%	%
4,4'-DDT	0.2 mg/kg	----	0.25	99.5	60	122
Endrin ketone	0.05 mg/kg	<0.05	----	----	----	----
	0.05 mg/kg	----	0.25	97.7	60	120
Methoxychlor	0.2 mg/kg	<0.2	----	----	----	----
	0.2 mg/kg	----	0.25	101	58	130
EP074A: Monocyclic Aromatic Hydrocarbons						
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 71036)		mg/kg	mg/kg	%	%	%
Benzene	0.5 mg/kg	<0.5	----	----	----	----
	0.2 mg/kg	----	1	99.8	77	119
Toluene	0.2 mg/kg	----	1	98.4	77	119
	0.5 mg/kg	<0.5	----	----	----	----
Ethylbenzene	0.2 mg/kg	----	1	97.8	75	117
	0.5 mg/kg	<0.5	----	----	----	----
meta- & para-Xylene	0.2 mg/kg	----	2	96.2	74	116
	0.5 mg/kg	<0.5	----	----	----	----
Styrene	0.2 mg/kg	----	1	90.7	75	117
	0.5 mg/kg	<0.5	----	----	----	----
ortho-Xylene	0.2 mg/kg	----	1	91.0	76	118
	0.5 mg/kg	<0.5	----	----	----	----
Isopropylbenzene	0.2 mg/kg	----	1	92.4	75	117
	0.5 mg/kg	<0.5	----	----	----	----
n-Propylbenzene	0.2 mg/kg	----	1	93.0	75	117
	0.5 mg/kg	<0.5	----	----	----	----
1,3,5-Trimethylbenzene	0.2 mg/kg	----	1	89.6	75	117
	0.5 mg/kg	<0.5	----	----	----	----
sec-Butylbenzene	0.2 mg/kg	----	1	93.1	76	118
	0.5 mg/kg	<0.5	----	----	----	----
1,2,4-Trimethylbenzene	0.2 mg/kg	----	1	89.0	75	117
	0.5 mg/kg	<0.5	----	----	----	----
tert-Butylbenzene	0.2 mg/kg	----	1	98.2	76	118
	0.5 mg/kg	<0.5	----	----	----	----
p-Isopropyltoluene	0.2 mg/kg	----	1	97.4	76	118
	0.5 mg/kg	<0.5	----	----	----	----
n-Butylbenzene	0.2 mg/kg	----	1	95.0	74	116
	0.5 mg/kg	<0.5	----	----	----	----

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Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EP075(SIM)A: Phenolic Compounds						
EP075(SIM)A: Phenolic Compounds - (QC Lot: 71064)		mg/kg	mg/kg	%	%	%
Phenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	94.4	62	122
2-Chlorophenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	76.5	61	121
2-Methylphenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	92.3	63	123
3- & 4-Methylphenol	1.0 mg/kg	<1.0	----	----	----	----
	1.0 mg/kg	----	20	92.2	62	122
2-Nitrophenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	87.8	63	123
2,4-Dimethylphenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	90.4	62	122
2,4-Dichlorophenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	88.9	62	122
2,6-Dichlorophenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	88.6	62	122
4-Chloro-3-Methylphenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	84.5	62	122
2,4,6-Trichlorophenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	84.2	59	119
2,4,5-Trichlorophenol	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	77.9	60	120
Pentachlorophenol	1.0 mg/kg	<1.0	----	----	----	----
	1.0 mg/kg	----	10	62.4	45	105

ALS Environmental

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons						
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - (QC Lot: 71064)		mg/kg	mg/kg	%	%	%
Naphthalene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	93.8	62	122
Acenaphthylene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	92.8	62	122
Acenaphthene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	91.1	62	122
Fluorene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	109	64	124
Phenanthrene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	92.3	61	121
Anthracene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	96.3	63	123
Fluoranthene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	94.9	62	122
Pyrene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	95.2	62	122
Benz(a)anthracene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	82.6	62	122
Chrysene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	105	64	124
Benzo(b)fluoranthene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	81.9	59	119
Benzo(k)fluoranthene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	107	62	122
Benzo(a)pyrene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	92.6	60	120
Indeno(1,2,3,cd)pyrene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	100	59	119
Dibenz(a,h)anthracene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	118	60	120
Benzo(g,h,i)perylene	0.5 mg/kg	<0.5	----	----	----	----
	0.5 mg/kg	----	10	99.3	58	118

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EP080/071: Total Petroleum Hydrocarbons						
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 71037)		mg/kg	mg/kg	%	%	%
C6 - C9 Fraction	2 mg/kg	<2	----	----	----	----
	2 mg/kg	----	32	88.3	81	123
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 71063)		mg/kg	mg/kg	%	%	%
C10 - C14 Fraction	50 mg/kg	<50	----	----	----	----
	50 mg/kg	----	524	98.8	68	128
C15 - C28 Fraction	100 mg/kg	<100	----	----	----	----
	100 mg/kg	----	1326	109	74	134
C29 - C36 Fraction	100 mg/kg	<100	----	----	----	----
	100 mg/kg	----	480	86.2	59	119

Matrix Type: WATER

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
				LCS	*Low*	*High*
EA010P: Conductivity by PC Titrator						
EA010P: Conductivity by PC Titrator - (QC Lot: 71451)		µS/cm	µS/cm	%	%	%
Electrical Conductivity @ 25°C	1 µS/cm	----	1413	98.4	70	130
	1 µS/cm	<1	----	----	----	----

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Quality Control Report - Matrix Spikes (MS)

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** *= Limit of Reporting,* ***RPD*** *= Relative Percent Difference.*

* Indicates failed QC

Matrix Type: SOIL

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
EG005T: Total Metals by ICP-AES								
EG005T: Total Metals by ICP-AES - (QC Lot: 71170)				mg/kg	mg/kg	%	%	%
Arsenic	EM0502773-002	Anonymous	5 mg/kg	50	<5	101	70	130
Cadmium			1 mg/kg	50	<1	100	70	130
Chromium			2 mg/kg	50	26	111	70	130
Copper			5 mg/kg	50	10	108	70	130
Lead			5 mg/kg	50	14	107	70	130
Molybdenum			2 mg/kg	50	<2	70.2	70	130
Nickel			2 mg/kg	50	12	97.7	70	130
Selenium			5 mg/kg	50	29	86.5	70	130
Zinc			5 mg/kg	50	15	98.4	70	130
EG005T: Total Metals by ICP-AES - (QC Lot: 71172)				mg/kg	mg/kg	%	%	%
Arsenic	EM0502937-010	DUP	5 mg/kg	50	<5	104	70	130
Cadmium			1 mg/kg	50	<1	96.9	70	130
Chromium			2 mg/kg	50	7	104	70	130
Copper			5 mg/kg	50	<5	115	70	130
Lead			5 mg/kg	50	<5	106	70	130
Molybdenum			2 mg/kg	50	<2	91.5	70	130
Nickel			2 mg/kg	50	<2	93.4	70	130
Selenium			5 mg/kg	50	67	84.4	70	130
Zinc			5 mg/kg	50	<5	98.7	70	130
EG035T: Total Mercury by FIMS								
EG035T: Total Mercury by FIMS - (QC Lot: 71171)				mg/kg	mg/kg	%	%	%
Mercury	EM0502773-002	Anonymous	0.1 mg/kg	5.0	<0.1	104	70	130
EK026: Total Cyanide								
EK026: Total Cyanide - (QC Lot: 71165)				mg/kg	mg/kg	%	%	%
Total Cyanide	EM0502914-001	Anonymous	1.0 mg/kg	50	<1	96.2	70	130
EK026: Total Cyanide - (QC Lot: 71166)				mg/kg	mg/kg	%	%	%
Total Cyanide	EM0502937-010	DUP	1.0 mg/kg	50	1	95.7	70	130

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Matrix Type: SOIL

Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration	Actual Results: Sample Result	Actual Results: Spike Recovery MS	Recovery Limits: Static Limits Low	Recovery Limits: Static Limits High
EK040T: Fluoride Total								
EK040T: Fluoride Total - (QC Lot: 73018)				mg/kg	mg/kg	%	%	%
Fluoride	EM0502909-001	Anonymous	40 mg/kg	400	520	72.0	70	130
EK061: Total Kjeldahl Nitrogen (TKN)								
EK061: Total Kjeldahl Nitrogen (TKN) - (QC Lot: 72095)				mg/kg	mg/kg	%	%	%
Total Kjeldahl Nitrogen as N	EM0502835-017	Anonymous	20 mg/kg	25	970	* Not Determined	70	130
EK067: Total Phosphorus as P								
EK067: Total Phosphorus as P - (QC Lot: 72096)				mg/kg	mg/kg	%	%	%
Total Phosphorus as P	EM0502835-017	Anonymous	2 mg/kg	5	387	* Not Determined	70	130
EP068A: Organochlorine Pesticides (OC)								
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 71065)				mg/kg	mg/kg	%	%	%
gamma-BHC	EM0502905-011	Anonymous	0.05 mg/kg	0.25	<0.05	81.2		
Heptachlor			0.05 mg/kg	0.25	<0.05	67.4		
Aldrin			0.05 mg/kg	0.25	<0.05	75.0		
Dieldrin			0.05 mg/kg	0.25	0.10	74.0		
Endrin			0.05 mg/kg	0.25	<0.05	77.5		
4,4'-DDT			0.02 mg/kg	0.25	<0.2	57.6		
EP074A: Monocyclic Aromatic Hydrocarbons								
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 71036)				mg/kg	mg/kg	%	%	%
Benzene	EM0502909-001	Anonymous	0.5 mg/kg	2	<0.5	73.8		
Toluene			0.5 mg/kg	2	<0.5	70.9		
EP075(SIM)A: Phenolic Compounds								
EP075(SIM)A: Phenolic Compounds - (QC Lot: 71064)				mg/kg	mg/kg	%	%	%
Phenol	EM0502909-001	Anonymous	0.5 mg/kg	10	<0.5	83.6		
2-Chlorophenol			0.5 mg/kg	10	<0.5	67.6		
2-Nitrophenol			0.5 mg/kg	10	<0.5	78.2		
4-Chloro-3-Methylphenol			0.5 mg/kg	10	<0.5	73.0		
Pentachlorophenol			1.0 mg/kg	10	<1.0	56.6		
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - (QC Lot: 71064)				mg/kg	mg/kg	%	%	%
Acenaphthene	EM0502909-001	Anonymous	0.5 mg/kg	10	<0.5	77.6		
Pyrene			0.5 mg/kg	10	<0.5	81.6		
EP080/071: Total Petroleum Hydrocarbons								
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 71037)				mg/kg	mg/kg	%	%	%

Matrix Type: SOIL

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	***Laboratory Sample ID***	***Client Sample ID***	***LOR***	***Spike Concentration***		***MS***	***Low***	***High***
C6 - C9 Fraction	EM0502909-001	Anonymous	2 mg/kg	20	<2	102		
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 71063)				mg/kg	mg/kg	%	%	%
C10 - C14 Fraction	EM0502905-019	Anonymous	50 mg/kg	524	<50	99.2	60	130
C15 - C28 Fraction			100 mg/kg	1326	<100	109	60	130
C29 - C36 Fraction			100 mg/kg	480	<100	84.2	60	130

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INTERPRETIVE QUALITY CONTROL REPORT

Client	:	**TONKIN CONSULTING**	**Laboratory**	:	ALS Environmental Melbourne	**Page**	: **1 of 9**
Contact	:	MR TONY PAPARELLA	**Contact**	:	Tim Kilmister		
Address	:	1 KRUMMEL ST MT GAMBIER SA AUSTRALIA 5290	**Address**	:	Unit 6, 2 Sarton Road Clayton VIC Australia 3168	**Work order**	: **EM0502937**
						Amendment No.	:
Project	:	2003.0318	**Quote number**	:	----	**Date received**	: 13 May 2005
Order number	:	- Not provided -				**Date issued**	: 24 May 2005
C-O-C number	:	- Not provided -					
Site	:	Cape Jaffa					
E-mail	:	tony.paparella@tonkin.com.au	**E-mail**	:	Tim.Kilmister@alsenviro.com	**No. of samples**	
Telephone	:	08 8723 5004	**Telephone**	:	61-3-95384444	**Received**	: 11
Facsimile	:	08 8723 5002	**Facsimile**	:	61-3-95384400	**Analysed**	: 11

This Interpretive Quality Control Report was issued on 24 May 2005 for the ALS work order reference EM0502937 and supersedes any previous reports with this reference.
This report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Type Frequency Compliance
- Summary of all Quality Control Outliers
- Brief Method Summaries

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Interpretive Quality Control Report - Analysis Holding Time

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the sample aliquot was taken. Elapsed time to analysis represents time from sampling where no extraction / digestion is involved or time from extraction / digestion where this is present. For composite samples, sampling date/time is taken as that of the oldest sample contributing to that composite. Sample date/time for laboratory produced leaches are taken from the completion date/time of the leaching process. Outliers for holding time are based on USEPA SW846, APHA, AS and NEPM (1999). Failed outliers, refer to the 'Summary of Outliers'.

Matrix Type: SOIL ***Analysis Holding Time and Preservation***

Method / **Container /** Client Sample ID(s)	**Date Sampled**	**Extraction / Preparation**			**Analysis**		
		Date extracted	Due for extraction	Pass?	Date analysed	Due for analysis	Pass?
EA002: pH (1:5)							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**17 May 2005**	7 Nov 2005	Pass	**17 May 2005**	7 Nov 2005	Pass
EA055-103: Moisture Content							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH5, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	----	----	----	**16 May 2005**	18 May 2005	Pass
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH5, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**16 May 2005**	7 Nov 2005	Pass	**16 May 2005**	7 Nov 2005	Pass
EG035T: Total Mercury by FIMS							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH5, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**16 May 2005**	8 Jun 2005	Pass	**16 May 2005**	8 Jun 2005	Pass
EK026: Total Cyanide							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH5, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**18 May 2005**	7 Nov 2005	Pass	**19 May 2005**	7 Nov 2005	Pass
EK040T: Total Fluoride							
Pulp Bag							
BH5	**11 May 2005**	----	----	----	**19 May 2005**	7 Nov 2005	Pass

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Matrix Type: SOIL ***Analysis Holding Time and Preservation***

Method / **Container /** Client Sample ID(s)	**Date Sampled**	**Extraction / Preparation**			**Analysis**		
		Date extracted	Due for extraction	Pass?	Date analysed	Due for analysis	Pass?
EK059: Nitrite and Nitrate as N (NOx) - Soluble							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**17 May 2005**	7 Nov 2005	Pass	**23 May 2005**	7 Nov 2005	Pass
EK061: TKN as N							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**18 May 2005**	7 Nov 2005	Pass	**19 May 2005**	7 Nov 2005	Pass
EK067: Total Phosphorus as P							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	**18 May 2005**	7 Nov 2005	Pass	**19 May 2005**	7 Nov 2005	Pass
EP004: Organic Matter							
Soil Glass Jar - Unpreserved							
BH1, BH2, BH3, BH4, BH6, BH7, BH8, BH9, DUP	**11 May 2005**	----	----	----	**19 May 2005**	7 Nov 2005	Pass
EP068: Pesticides by GCMS							
Soil Glass Jar - Unpreserved							
BH5	**11 May 2005**	**16 May 2005**	25 May 2005	Pass	**17 May 2005**	25 Jun 2005	Pass
EP071: TPH - Semivolatile Fraction							
Soil Glass Jar - Unpreserved							
BH5	**11 May 2005**	**16 May 2005**	25 May 2005	Pass	**16 May 2005**	25 Jun 2005	Pass
EP074: Volatile Organic Compounds							
Soil Glass Jar - Unpreserved							
BH5	**11 May 2005**	**16 May 2005**	25 May 2005	Pass	**16 May 2005**	25 May 2005	Pass
EP075(SIM): PAH/Phenols (SIM)							
Soil Glass Jar - Unpreserved							
BH5	**11 May 2005**	**16 May 2005**	25 May 2005	Pass	**16 May 2005**	25 Jun 2005	Pass
EP080: TPH Volatiles/BTEX							
Soil Glass Jar - Unpreserved							
BH5	**11 May 2005**	**16 May 2005**	25 May 2005	Pass	**16 May 2005**	25 May 2005	Pass

Matrix Type: WATER ***Analysis Holding Time and Preservation***

Matrix Type: WATER

Analysis Holding Time and Preservation

Method / **Container /** Client Sample ID(s)	**Date Sampled**	**Extraction / Preparation**			**Analysis**		
		Date extracted	Due for extraction	Pass?	Date analysed	Due for analysis	Pass?
EA010-P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural							
Council	**11 May 2005**	**----**	----	----	**16 May 2005**	8 Jun 2005	Pass

Interpretive Quality Control Report - Frequency of Quality Control Samples

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which this work order was processed. Actual rate should be greater than or equal to the expected rate.

Matrix Type: SOIL ***Frequency of Quality Control Samples***

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
EA002: pH (1:5)	3	21	**14.3**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EA055-103: Moisture Content	2	20	**10.0**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EG005T: Total Metals by ICP-AES	3	22	**13.6**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EG035T: Total Mercury by FIMS	3	21	**14.3**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK026: Total Cyanide	3	22	**13.6**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK040T: Total Fluoride	1	9	**11.1**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK059: Nitrite and Nitrate as N (NOx) - Soluble	1	9	**11.1**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK061: TKN as N	2	14	**14.3**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK067: Total Phosphorus as P	2	16	**12.5**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP004: Organic Matter	1	9	**11.1**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP068: Pesticides by GCMS	2	18	**11.1**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP071: TPH - Semivolatile Fraction	2	17	**11.8**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP074: Volatile Organic Compounds	2	12	**16.7**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP075(SIM): PAH/Phenols (SIM)	2	16	**12.5**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP080: TPH Volatiles/BTEX	1	10	**10.0**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Laboratory Control Samples (LCS)					
EG005T: Total Metals by ICP-AES	2	22	**9.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EG035T: Total Mercury by FIMS	2	21	**9.5**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK026: Total Cyanide	2	22	**9.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK040T: Total Fluoride	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK059: Nitrite and Nitrate as N (NOx) - Soluble	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK061: TKN as N	1	14	**7.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK067: Total Phosphorus as P	1	16	**6.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP004: Organic Matter	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP068: Pesticides by GCMS	1	18	**5.6**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP071: TPH - Semivolatile Fraction	1	17	**5.9**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP074: Volatile Organic Compounds	1	12	**8.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP075(SIM): PAH/Phenols (SIM)	1	16	**6.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP080: TPH Volatiles/BTEX	1	10	**10.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Matrix Type: SOIL ***Frequency of Quality Control Samples***

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Method Blanks (MB)					
EG005T: Total Metals by ICP-AES	2	22	**9.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EG035T: Total Mercury by FIMS	2	21	**9.5**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK026: Total Cyanide	2	22	**9.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK040T: Total Fluoride	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK059: Nitrite and Nitrate as N (NOx) - Soluble	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK061: TKN as N	1	14	**7.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK067: Total Phosphorus as P	1	16	**6.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP004: Organic Matter	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP068: Pesticides by GCMS	1	18	**5.6**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP071: TPH - Semivolatile Fraction	1	17	**5.9**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP074: Volatile Organic Compounds	1	12	**8.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP075(SIM): PAH/Phenols (SIM)	1	16	**6.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP080: TPH Volatiles/BTEX	1	10	**10.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Matrix Spikes (MS)					
EG005T: Total Metals by ICP-AES	2	22	**9.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EG035T: Total Mercury by FIMS	1	21	**4.8**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK026: Total Cyanide	2	22	**9.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK040T: Total Fluoride	1	9	**11.1**	**5.0**	ALS QCS3 requirement
EK061: TKN as N	1	14	**7.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EK067: Total Phosphorus as P	1	16	**6.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP068: Pesticides by GCMS	1	18	**5.6**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP071: TPH - Semivolatile Fraction	1	17	**5.9**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP074: Volatile Organic Compounds	1	12	**8.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP075(SIM): PAH/Phenols (SIM)	1	16	**6.3**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EP080: TPH Volatiles/BTEX	1	10	**10.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Matrix Type: WATER ***Frequency of Quality Control Samples***

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
EA010-P: Conductivity by PC Titrator	1	9	**11.1**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Laboratory Control Samples (LCS)					
EA010-P: Conductivity by PC Titrator	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Method Blanks (MB)					
EA010-P: Conductivity by PC Titrator	1	9	**11.1**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Interpretive Quality Control Report - Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged on the 'Quality Control Report'. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot.

Non-surrogates

Matrix Type: SOIL

Summary of Outliers - Quality Control Samples

ALS QC Lot	Matrix Type	Laboratory Sample ID	Client Sample ID	Analyte	Data	Limits	Comment
Laboratory Duplicates (DUP)							
EG005T: Total Metals by ICP-AES	SOIL	EM0502773-001	Anonymous	Chromium	23.7 %	0-50 %	RPD exceeds LOR based limits
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	SOIL	EM0502908-001	Anonymous	Benzo(b)fluoranthene	50.1 %	0-50 %	RPD exceeds LOR based limits
Matrix Spikes (MS)							
EK061: Total Kjeldahl Nitrogen (TKN)	SOIL	EM0502835-017	Anonymous	Total Kjeldahl Nitrogen as N	ND	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK067: Total Phosphorus as P	SOIL	EM0502835-017	Anonymous	Total Phosphorus as P	ND	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP068A: Organochlorine Pesticides (OC)	SOIL	EM0502905-011	Anonymous	4,4'-DDT	57.6 %		Recovery less than lower control limit

- **For all matrices, no method blank result outliers occur.**
- **For all matrices, no laboratory spike recoveries breaches occur.**

Surrogates

- **For all matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time

The following report highlights outliers within this 'Interpretive Quality Control Report - Analysis Holding Time'.

- **No holding time outliers occur.**

Outliers : Frequency of Quality Control Samples

The following report highlights outliers within this 'Interpretive Quality Control Report - Frequency of Quality Control Samples'.

- **No frequency outliers occur.**

Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL ***Method Reference Summary***

Preparation Methods

EK026PR : NaOH leach for TCN in Soils - APHA 20th ed., 4500 CN- C & N. Samples are extracted by end-over-end tumbling with NaOH.

EK061/EK067 : TKN/TP Digestion - APHA 20th ed., 4500 Norg- D; APHA 20th ed., 4500 P - H. Macro Kjeldahl digestion.

EN34 : 1:5 solid / water leach for soluble analytes - 10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

EN69 : Hot Block Digest for metals in soils sediments and sludges - USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)

GEO30 : Dry and Pulverise (up to 100g) -

ORG16 : Methanolic Extraction of Soils for Purge and Trap - (USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.

ORG17A : Tumbler Extraction of Solids (Option A - Concentrating) - In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

ORG17B : Tumbler Extraction of Solids (Option B - Non-concentrating) - In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.

Analytical Methods

EA002 : pH (1:5) - (APHA 20th ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)

EA055-103 : Moisture Content - A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)

EG005T : Total Metals by ICP-AES - (APHA 20th ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)

EG035T : Total Mercury by FIMS - AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the extract. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.

EK026 : Total Cyanide - APHA 20th 4500 CN - C & N. Caustic leach extracts of the sample are distilled with sulphuric acid, converting all CN species to HCN. The distillates are analyzed for CN by FIA. This method is compliant with NEPM (1999) Schedule B(3) (Method 403)

EK040T : Total Fluoride - (In-house) Total fluoride is determined by ion specific electrode (ISE) in a solution obtained after a Sodium Carbonate / Potassium Carbonate fusion dissolution.

EK059 : Nitrite and Nitrate as N (NOx) - Soluble - APHA 20th ed., 4500 NO3- I. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Cadmium Reduction, and direct colourimetry by FIA.

Matrix Type: SOIL ***Method Reference Summary***

Analytical Methods

EK061 : TKN as N - APHA 20th ed., 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by FIA.

EK062 : Total Nitrogen as N (TKN + NOx) - APHA 20th ed., 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.

EK067 : Total Phosphorus as P - APHA 20th ed., 4500 P-B&H This procedure involves sulfuric acid digestion and quantification using FIA.

EP004 : Organic Matter - AS1289.4.4.4 - 1997., Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (1999) Schedule B(3) (Method 105)

EP068 : Pesticides by GCMS - (USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (1999) Schedule B(3) (Method 504,505)

EP071 : TPH - Semivolatile Fraction - (USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (1999) Schedule B(3) (Method 506.1)

EP074 : Volatile Organic Compounds - (USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)

EP075(SIM) : PAH/Phenols (SIM) - (USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 502 and 507)

EP080 : TPH Volatiles/BTEX - (USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)

Matrix Type: WATER ***Method Reference Summary***

Analytical Methods

EA010-P : Conductivity by PC Titrator - APHA 20th ed., 2510 This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

CHAIN OF CUSTODY REF: Cape Jaffa - soil samples 2003.0318

Job No:	2003.0318	**Laboratory Name:**	ALS Environmental - Melbourne
Details:	Cape Jaffa Soil Samples	**Laboratory Address:**	Unit 6, 2 Sarton Rd CLAYTON VIC 3168
Date Sampled:	11/05/2005 **Sampled by:** Tony Paparella	**Laboratory Contact:**	Tim Kilmister **phone:** 03 9538 4444
Consultant:	Jones Tonkin (Tonkin Consulting) **Address:** 1 Krummel St, Mt Gambier, 5290	**Quotation No:**	**email:** tim.kilmister@alsenviro.com
Contact:	**Tony Paparella** **Fax:** (08) 8723 5004	**Delivery by:** AAE	**fax** 03 9538 4400
email:	tony.paparella@tonkin.com.au **Phone:** (08) 8723 5002	**Consignment Note:** 05784595	

Lab Sample Identification	Sample Identification	Matrix Container / Preservation	Archive	pH	8 metals	Total Cyanide	Total P	Total N	TOC	Vic EPA Screen (short)	EC											Notes / Deviations from Standard Protocols
1	BH1	soil		/	/	/	/	/	/													Metals are the standard 8 metals
2	BH2	soil		/	/	/	/	/	/													
3	BH3	soil		/	/	/	/	/	/													
4	BH4	soil		/	/	/	/	/	/													
5	BH5	soil								/												
6	BH6	soil		/	/	/	/	/	/													
7	BH7	soil		/	/	/	/	/	/													
8	BH8	soil		/	/	/	/	/	/													
9	BH9	soil		/	/	/	/	/	/													
10	DUP	soil		/	/	/	/	/	/													
11	Council	water									/											
	Number of Samples:			9	9	9	9	9	9	1	1											**Sample Preservation:** ice / esky

ALS Environmental
Melbourne
Work Order
EM0502937

Report Version: WOLabel 1.00

Telephone : 61-3-95384444

Relinquished by:	Tony Paparella	Relinquished by:	Relinquished by:
Date and time:	12/5/05 3pm	Date and time:	Date and time:
Company:	Jones Tonkin	Company:	Company:
Signature	Paparella	Signature	Signature
Received in good condition by:	Peter Rawlic	Received in good condition by:	Received in good condition by:
Date and Time:	13/5/5	Date and Time:	Date and Time:
Company:	ALS	Company:	Company:
Signature		Signature	Signature

Samples must be transported and stored in a chilled or cold condition at all times

COC must remain with samples

ANALYSING LABORATORY:
Please fax to the nominated Tonkin Consulting contact a signed COC showing assigned lab ID numbers IMMEDIATELY on receipt of samples and return original COC with final results

Attachment 4

Quality Assurance and Quality Control

Field QA/QC

QA/QC procedures undertaken during the soil investigations included:

- Changing disposable gloves after each sampling event;
- Sealing samples in new glass jars;
- Storing samples in cool conditions until delivery to the laboratory for analysis;
- Collecting a duplicate sample and submitting it to the laboratory for analysis;
- Using chain of custody procedures and forms;
- Using a NATA accredited laboratory with in-house QA/QC procedures for the analyses requested.

Duplicate sample DUP (duplicate sample of BH8) was submitted to the primary laboratory (ALS) as a blind field duplicate sample. The number of duplicate analyses is greater than the minimum criterion of 1 in 10 primary samples (AS4482-1997) for these analytes.

To assess the quality of the duplicates, relative percentage difference (RPD) values are calculated. The RPD is the difference in concentration between the primary sample and its duplicate, expressed as a percentage of the mean concentration. RPDs are not able to be calculated where the concentration of one or both samples is below the laboratory level of reporting. The calculated RPDs are presented in Table 1 below.

Table 1 – Summary of RPDs

Sample	Laboratory Results (mg/kg)						
	Chromium	Total Cyanide	Nitrate/ Nitrite	TKN	Total N	Total P	Organic Matter
BH8	7	1	2.2	3670	3670	656	1.3
DUP	7	1	2.1	3510	3510	517	0.8
RPD (%)	**0**	**0**	**5**	**4**	**4**	**24**	**48**

AS4482.1-1997 indicates that typical RPDs for quality control samples should be between 30-50% and can be higher for organic analytes. Of the seven RPDs that could be calculated, all were less than 50%. Therefore, it is considered that the sampling procedures adopted produced results that were repeatable.

Laboratory QA/QC

Analyses was completed within the recommended holding times for each analyte.

Laboratory QA/QC procedures were undertaken by ALS and included the analysis of laboratory duplicates, blanks, matrix spikes and recoveries. A review of the available QA/QC data accompanying the laboratory reports (Attachment 3) indicated that:

- all method blank analyses were below the laboratory levels of reporting;
- laboratory duplicate RPDs were within an acceptable range except for Chromium and Benzo(b)fluoranthene, however this is not considered to have affected the assessment of the results;
- spike recoveries were within an acceptable range except for DDT, however this is not considered to have affected the assessment of the results.

It is therefore considered that the laboratory results are accurate and repeatable.

Appendix C

Sensitivity Assessment of Nutrient Concentrations Entering the Marine Environment

20030318LA6/GP/PF

13 July 2005

Cape Jaffa Development Company
PO Box 150
BRIGHTON SA 5048

Attention: Rob Gabb

Dear Rob

CAPE JAFFA ANCHORAGE - NUTRIENT AND INORGANIC COMPOUNDS ENTERING THE MARINE ENVIRONMENT VIA THE WATERWAYS

Please find below an assessment of the sensitivities of the concentration of nutrient and inorganic compounds entering the marine environment via the waterways for the proposed Cape Jaffa Anchorage. This assessment has been developed in consultation with the Cape Jaffa Development Company.

Introduction

The EIS presents, in Section 5.2.6, an assessment of the concentration of various nutrients and compounds in the groundwater that, if present in excessive concentrations, could have an adverse effect on water quality within the waterways and the nearby marine environment / habitat. The assessment performed was conservative and indicated that the compounds identified in the groundwater would result in concentrations in the marine environment that are less than the criteria defined in the *Environment Protection (Water Quality) Policy 2003* for marine environments. Further information is available in Section 5.2.22 and Appendices 14 and 21 of the EIS.

The factors governing the concentrations of nutrients and inorganic compounds entering the marine environment includes:

- concentrations of nutrients and inorganic compounds in the groundwater that is entering the waterways;
- the rate and distribution of groundwater outflow to the waterways;
- the rate of additional nutrient flow to the waterways from nearby use of garden fertilisers; and
- the tidal exchange, dispersion and mixing within the waterways, which control the transportation of nutrients and inorganic compounds from the waterways to the mouth of the breakwaters.

ADELAIDE
TONKIN CONSULTING
5 Cooke Terrace
Wayville SA 5034
T +61 8 8273 3100
F +61 8 8273 3110
adelaide@tonkin.com.au

MOUNT GAMBIER
JONES TONKIN
1 Krummel Street
Mount Gambier SA 5290
PO BOX 1192
Mount Gambier SA 5291
T +61 8 8723 5002
F +61 8 8723 5004
mtgambier@tonkin.com.au

www.tonkin.com.au

T & R Nominees PTY LTD ACN 007 860 586 as Trustee for T & R Unit Trust ABN 99 630 962 951
Trading as TONKIN CONSULTING and JONES TONKIN
Members of The Association of Consulting Engineers Australia

The assessment provided in Section 5.2.6 of the EIS is elaborated and expanded upon below in order to provide a more comprehensive assessment. It has been broadened to investigate a range of scenarios that effectively provide a best case, expected case and worst case for the various factors that govern water quality within and nearby the waterways. Note that the worst case scenario assumes that all of the factors listed above are in the worst case condition simultaneously, to give a combined worst case result, and so on with the expected and best case scenarios.

The scenario presented in the EIS is also presented below for comparison purposes. It can be seen that the "EIS" scenario and the "worst case" or "max" scenario are similar, thereby confirming that the assessment in the EIS was conservative. Although the EIS did not assess the nutrient loadings that might result from garden/household fertiliser use, as it was considered to be minor, this effect has been included in this assessment.

The establishment of the waterways does not result in increased total groundwater outflow to the sea. The effect of the waterways is to divert the groundwater and associated nutrients and inorganic compounds that currently flow out to sea along the coast, such that they continue to flow out to sea albeit via the mouth of the breakwaters into the marine environment. As a result, it must be noted that the nutrients that flow to the sea from the groundwater outflow via the waterways is not an additional nutrient loading to the sea. Nevertheless, assessment of concentrations in and near the waterways is appropriate in order to assess the potential effects on the marine environment and the water quality within the waterways.

Concentration of Compounds in Groundwater

Analysis of groundwater samples from the 31 bores on and around the site assessed the groundwater for heavy metals, nutrients, volatile and semi-volatile organics, pesticides, hydrocarbons and general chemistry. Comparison to the *Environment Protection (Water Quality) Policy 2003* (EPP) Criteria for marine environments indicated that most compounds in groundwater were less than the EPP Marine Criteria, although some samples identified concentrations above those criteria and this assessment focuses on those nutrients and inorganic compounds.

The level of nutrients in the groundwater varies across the site. Cyanide, arsenic and cadmium were identified in groundwater in the initial sampling performed, particularly at one location to the east of the site. Additional sampling indicated that this is likely to be the result of evapo-concentration effects i.e. the concentration of natural background levels of these compounds, and of possible inaccuracies in the initial sampling related to the high salinities. Additional groundwater sampling was performed and recently, soil sampling has been performed in order to further assess the cause and determine if soil sources of contamination exist. This assessment has indicated that there is no evidence of a potential contamination source and further discussion of the groundwater sampling and soil sampling is presented in our earlier correspondence dated 20th June 2005 (reference 20030318LA5/GRP/GRP). Nevertheless, for the purposes of assessing the potential effects

on marine water quality, the initial maximum readings of inorganic compounds have been included.

Table 1 below shows minimum, average and maximum levels of the nutrients and inorganic compounds identified above the EPP Marine Criteria in any of the groundwater samples, and for comparison it also shows the levels of these compounds that were utilised for the assessment presented in the EIS.

Table 1: Range of Concentrations of Compounds in Groundwater

Range of Concentrations in Groundwater					
		Min	Average	Max	EIS
Total Organic Carbon	mg/L	3	9.7	78	78
Oxidised Nitrogen	mg/L	0.01	1.2	12.2	12.2
Total Nitrogen	mg/L	0.11	2.1	12.5	12.5
Phosphorous	mg/L	0.02	0.120	1.04	1.04
Cyanide	mg/L	0.005	0.051	0.265	0.265
Arsenic	mg/L	0.001	0.017	0.092	0.092
Cadmium	mg/L	0.0001	0.0003	0.0028	0.0028

Groundwater Flowrate to the Waterways

The groundwater model presented in Section 5.2.2 and 5.2.3 of the EIS assessed the groundwater outflow to the waterways from the unconfined aquifer and it's distribution around the waterways and the results are presented in Section 5.2.6 of the EIS. The model was calibrated to the measured groundwater levels at October 2003 and thus the modelled groundwater outflow represents the outflow at that time. The unconfined aquifer levels vary seasonally, thus the groundwater flow rates to the waterways will vary seasonally, so comparison of the regional groundwater levels in October 2003 to the historical groundwater level variations enables assessment of an expected range of seasonal groundwater levels. Using the range of regional groundwater levels, a range of groundwater outflow to the waterways has been determined by linear scaling of the groundwater modelling results.

Section 4.14.9 and Figure 4.78 of the EIS discusses the historical groundwater levels and it's seasonal fluctuations in the region and presents data from nearby regional monitoring bores. The nearest regional bore is MTB006, located approximately 2 kilometres south of the waterways. Data provided by DWLBC from historical monitoring on this bore from 1970 to 1978 and 1994 to 2004 shows seasonal fluctuations with highs in September/October and lows in about April, depending on weather, and exhibits fluctuations from 0.80 to 1.86 mAHD. In October 2003, when the model was calibrated, the measured level was 1.52 mAHD and this corresponds well to the modelled groundwater level at that location. In addition, in order to be conservative, it has been assumed that the minimum groundwater flow (in very dry years) is 10% less than that indicated by scaling of the model using the MTB006 data, and the maximum groundwater flow is 10% more than that indicated from

scaling of MTB006, thereby adding some conservatism to the range of groundwater outflows assessed. Table 2 presents the assessment of the range of groundwater outflows to the waterways.

Table 2: Range of Groundwater Flowrate to the Waterways

Range of Groundwater Outflows to the Waterway					
		Best	Typical	Worst	EIS
MTB006 Level	mAHD	0.82	1.25	1.86	1.52
Date		Mar 2000	n/a	Dec 2001	Oct 2003
Groundwater Outflow	m3/day	437	740	1211	900

Concentrations Resulting from Groundwater Outflow

Combining the ranges of concentrations in groundwater with the ranges of groundwater outflow rates enables assessment of a range of nutrient and inorganic loadings that outflow to the waterways, as shown in Table 3 below.

Table 3: Daily Loadings to the Waterways from Groundwater Outflow

Range of Concentrations Resulting from Groundwater Outflow					
		Best	Typical	Worst	EIS
Total Organic Carbon	kg/Day	1.31	7.16	94.49	70.20
Oxidised Nitrogen	kg/Day	0.00	0.89	14.78	10.98
Total Nitrogen	kg/Day	0.05	1.54	15.14	11.25
Phosphorous	kg/Day	0.009	0.089	1.260	0.936
Cyanide	kg/Day	0.002	0.038	0.321	0.239
Arsenic	kg/Day	0.0004	0.0123	0.1115	0.0828
Cadmium	kg/Day	0.0000	0.0002	0.0034	0.0025

Nutrient Loadings to the Waterways from Garden Fertilisers

Garden fertilisers, particularly if used inappropriately, could effect water quality within the waterways and hence the nearby marine environment. As this is expected to be small in comparison with the nutrient flow resulting from groundwater outflow, these loadings were not included in the EIS assessment. Nevertheless, a conservative assessment can be made by assuming the quantity of garden fertiliser used and the proportion that might reach the waterways.

A number of commonly available garden fertiliser products have been compared and the assessment is made on the basis of a range of application rates from 2.5 to 4.5 grams per square metre per year of both nitrogen and phosphorous. The assessment further assumes

that this average application rate is applied to a range of areas based on 150 to 450 households, each applying fertiliser to areas ranging from 100 to 200 square metres.

Although the majority of the nutrient application would be expected not to reach the waterways, being absorbed by plants, bound in the soil or lost to the atmosphere, the assessment has been made assuming a range of 5% to 100% of the nutrient reaches the waterways. This results in nutrient loadings to the waterways of between 0.005 and 1.1 kg per day of phosphorous and nitrogen, and in order to be conservative, it is assumed all of the total nitrogen is in the form of oxidised nitrogen.

This assessment is not intended to justify the irresponsible use of garden fertilisers and the proposed control mechanisms are to form part of the Waterways Water Quality Management and Monitoring Plan, which is under preparation. The results are presented in Table 4 below.

Table 4: Daily Loadings from Garden Fertiliser Use

Range of Nutrient Loading from Garden fertilisers					
		Best	Typical	Worst	EIS
Application rate	kg/m2/yr	0.05	0.05	0.05	0
Total N in fertiliser	%	6%	9%	9%	0
Total P in fertiliser	%	5%	9%	9%	0
N application rate	gm/m2/yr	3.1	4.5	4.5	0
P application rate	gm/m2/yr	2.5	4.5	4.5	0
Households	ea	150	300	450	0
Area per household	m2	100	150	200	0
% to waterways	%	5%	25%	100%	0
Oxidised N Loading	kg/day	0.006	0.14	1.10	0
Total N Loading	kg/day	0.006	0.14	1.10	0
Total P Loading	kg/day	0.005	0.14	1.10	0

Total Nutrient and Inorganic Compound Loading to the Waterways of Nutrients and Inorganic Compounds

Combining the groundwater and garden fertiliser loadings to provide the total loadings to the waterways are shown below in Table 5.

Table 5: Daily Loadings from Combined Groundwater Outflow and Garden Fertiliser Use

Range of Daily Loadings from Combined Groundwater and Garden Fertiliser Use					
		Best	Typical	Worst	EIS
Total Organic Carbon	kg/Day	1.31	7.16	94.49	70.20
Oxidised Nitrogen	kg/Day	0.011	1.03	15.88	10.98
Total Nitrogen	kg/Day	0.054	1.68	16.24	11.25
Phosphorous	kg/Day	0.014	0.226	2.357	0.936
Cyanide	kg/Day	0.002	0.038	0.321	0.239
Arsenic	kg/Day	0.0004	0.0123	0.1115	0.0828
Cadmium	kg/Day	0.0000	0.0002	0.0034	0.0025

Transport and Mixing in the Waterways

The tidal exchange, dispersion and mixing within the waterways controls the transportation of nutrients and inorganic compounds from the waterways to the mouth of the breakwaters and nearby marine environment. The EIS presents modelling of the flushing effect of the waterways in Sections 5.2.6, 5.2.22 and Appendix 21. The effectiveness of tidal exchange, dispersion and mixing is quantified as a waterways mixing factor, which is the ratio of concentration of a compound at the mouth of the breakwaters compared to it's concentration in the groundwater flowing into the waterways.

The scenarios modelled in the EIS were based on a groundwater outflow to the waterways of 900 cubic metres per day and two tidal scenarios. One scenario examined a worst case of continuous neap tides of 0.4 metres and the other examined a more typical scenario of 0.7 metres.

Table 6 presented below provides a range of waterways mixing factors that have been determined on the basis of a range of the groundwater outflow rate, as per the assessment presented above, and a range of tidal scenarios based on continuous 1.0, 0.7 and 0.4 metre tides.

Table 6: Waterways Flushing Factor

Range of Tidal Exchange, Groundwater Outflows and Waterway s Mixing Factors					
		Best	Typical	Worst	EIS
Tidal Range	m	1	0.7	0.4	0.4
Daily exchange	m3/day	840000	588000	336000	336000
Groundwater Outflow	m3/day	437	740	1211	900
Mixing Factor	%	0.052%	0.126%	0.361%	0.295%

Concentration of Nutrients and Inorganic Compounds Entering the Marine Environment

Combining the loadings, flushing factors and groundwater outflows enables assessment of the range of concentrations of compounds entering the marine environment, as set out below in Table 7.

Comparison to the EPP Water Quality Criteria for Marine Environments

Comparison has been made with the criteria defined in the *Environment Protection (Water Quality) Policy 2003* for discharges to marine waters and is presented below Table 7, which also presents the concentrations as a percentage of the EPP Marine Criteria. As the EPP does not define criteria for cyanide in marine environments, comparison of cyanide concentrations has been made to both the EPP Potable Water Criteria and to the NEPM Marine trigger level, which is intended as a guideline to trigger further investigations.

Table 7: Concentration Entering the Marine Environment as a Percentage of the EPP Marine Criteria

Range of Concentrations Entering the Marine Environment										
			Concentration (mg/L)				Percentage of Criteria			
	Criteria	mg/L	Best	Typical	Worst	EIS	Best	Typical	Worst	EIS
Total Organic Carbon	EPP-M	10	0.00	0.01	0.28	0.23	0.02%	0.12%	2.8%	2.3%
Oxidised Nitrogen	EPP-M	0.2	0.000	0.002	0.047	0.036	0.01%	0.88%	23%	18%
Total Nitrogen	EPP-M	5	0.000	0.003	0.048	0.037	0.00%	0.06%	0.97%	0.74%
Phosphorous	EPP-M	0.100	0.000	0.000	0.007	0.003	0.02%	0.38%	7.0%	3.0%
Cyanide	EPP-Pot	0.080	0.0000	0.0001	0.0010	0.0008	0.00%	0.08%	1.2%	0.98%
"	NEMP-M	0.005	"	"	"	"	0.05%	1.3%	19%	15%
Arsenic	EPP-M	0.050	0.0000	0.0000	0.0003	0.0003	0.00%	0.04%	0.66%	0.54%
Cadmium	EPP-M	0.002	0.000000	0.000000	0.000010	0.000008	0.00%	0.02%	0.50%	0.41%

Concentration of Nutrients and Inorganic Compounds Within the Waterways

The modelling of tidal exchange, dispersion and mixing within the waterways in the EIS presented the waterways mixing factor as the ratio of concentration of a compound at the mouth of the breakwaters compared to its concentration in the groundwater flowing into the waterways.

The modelling has also assessed the distribution of concentrations within the waterways, and presents figures that indicate the anticipated distribution of mixing factor around the waterways – see Figure 5.17 in Section 5.2.5 and Appendix 21 of the EIS. This assessment indicates that the highest concentrations exist at the ends of the waterways furthest from the open sea, as is to be expected. The maximum concentration/mixing factor within the southeastern arms of the waterways is about 0.66% of the concentrations in the

groundwater flows and the maximum for the southwestern arm is 0.57%. At the entrance itself, that figure falls to less than 0.3% of the concentration in the groundwater flows.

This indicates that the maximum concentration within the waterways is approximately 2.24 times the concentration entering the marine environment at the mouth of the breakwaters, located at the end of the southeastern arm of the waterways furthest from the open sea. Applying this to the range of concentrations entering the marine environment presented above enables assessment of best, typical and worst case scenarios for the maximum concentration within the waterways and this range is presented in Table 8 below.

Table 8: Concentration Entering the Marine Environment as a Percentage of the EPP Marine Criteria

Range of Maximum Concentrations within the Marina Waterways				
		Best	Typical	Worst
Total Organic Carbon	mg/L	0.00	0.03	0.63
Oxidised Nitrogen	mg/L	0.000	0.004	0.106
Total Nitrogen	mg/L	0.000	0.006	0.108
Phosphorous	mg/L	0.000	0.001	0.016
Cyanide	mg/L	0.0000	0.0001	0.0021
Arsenic	mg/L	0.0000	0.0000	0.0007
Cadmium	mg/L	0.000000	0.000001	0.000023

Discussion and Conclusions

Three scenarios have been examined that defined the expected minimum, typical and maximum concentrations of nutrients and inorganic compound for both the water entering the marine environment and at the expected location of maximum concentration within the waterways. These have been defined by examining best, expected and worst cases of the concentrations of compounds within the groundwater, the groundwater flowrate, the garden fertiliser loadings and the transportation and mixing that occurs within the waterways with the nearby sea.

Expected Typical Concentrations Entering the Marine Environment

The expected typical assessment is based on:

- concentrations of compounds in groundwater equal to the average measured concentrations (assuming no dispersion of attenuation in the groundwater system);
- the expected seasonal average groundwater outflow rate of 740 cubic metres per day;
- 25% of the household application of nitrogen and phosphorous in garden fertilisers leaches to the waterways, with the loading based on 300 households each applying a typical garden fertiliser to 150 square metres; and

- a typical average mixing and dispersion scenario corresponding to 0.7 metre tides.

The expected typical concentrations entering the marine environment are less than the assessment criteria, up to approximately 1 % of the criteria, for all of the nutrients and inorganic compounds. Further, these expected typical concentrations are all undetectable by normal sampling methods as they are less than the limit of reporting of normal laboratory assessment procedures.

Worst Case Concentrations Entering the Marine Environment

The worst case scenario is a very conservative model as it is based on all of the worst case conditions existing at the same time. It assumes that the following occur simultaneously:

- all of the groundwater entering the waterways contains the compounds at concentrations equal to the highest concentrations measured anywhere on or off the site during both rounds of groundwater sampling (assuming no dispersion of attenuation in the groundwater system);
- the maximum rate of groundwater outflow to the waterways of about 1200 cubic metres per day, 10% greater than that indicated by scaling of the groundwater modelling results using the highest measured groundwater level in the nearby DWLCB monitoring well;
- all of the garden fertiliser nutrients applied are leached to the waterways, with nitrogen and phosphorous loadings calculated assuming 450 households all fertilising 200 square metres each; and
- waterways mixing and dispersion that corresponds to continuous dodge (neap) tides, which results in a mixing factor of 0.361 %.

Even for the combined worst case scenario, the concentrations entering the marine environment are less than the assessment criteria. The only compound that might be detectable by normal sampling methods is nitrogen (both oxidised and total nitrogen).

Maximum Concentrations within the Waterways

None of the nutrients or inorganic compounds are expected to be detectable within the waterways using normal sampling methods, as indicated by the results of the expected typical scenario.

Comparison to the Assessment Presented in the EIS

The results of assessment presented in the EIS are similar to the worst case scenario presented in this report. The concentrations indicated by the worst case scenario are slightly greater than the EIS assessment as it is based on a higher groundwater flowrate and includes the nutrient loadings from garden fertiliser use.

We trust the above meets your needs at this time. Should you have any queries, please contact the undersigned on (08) 8273 3100.

Yours faithfully
TONKIN CONSULTING

GRA Passfield, MIEAust
Chartered Professional Engineer

Appendix D

Seagrass Assessment

EIS Cape Jaffa Anchorage:

Responses to Government and Public Submissions on Seagrass and Related Topics

for

Tonkin Consulting

Hugh Kirkman

August 2005

Hugh Kirkman
PO Box 610
Normanville
South Australia 5204
Telephone: 08 8558 3176
Email: hughkirkman@ozemail.com.au

Table of Contents

Executive summary

This report details the potential effects of the proposed Cape Jaffa Marina development on the seagrass meadows into which the marina will flow. A description of the seagrass diversity and abundance is given in the Environmental Impact Statement (EIS). This report singles out nutrients flowing from the marina due to accumulations from groundwater and runoff. In particular it describes the problems associated with raised levels of nitrogen causing high epiphyte loads and possible plankton blooms. Experience is taken from other work on similar problems.

The report also mentions the possible pesticides that may enter the marine environment through the marina and describes previous knowledge on marine environmental effects of these chemicals.

Finally, the report answers the public's and government departments' submissions on the EIS and discusses previous knowledge, available through the literature as reports or journal papers, which relate to the concerns of the public and government. Many submissions related to scouring and erosion from dredged channel banks. This concern will be covered by monitoring for such risks and if found to be occurring will be mediated by contingency plans. Monitoring schemes for possible erosion and to test the health of seagrass and contingency actions if deleterious effects are detected are in a separate report.

Seagrass health concerns

The usual problem for seagrass in sheltered bays and estuaries is an increase in nutrient concentration in surrounding water. In Australia the typical examples of loss of seagrass due to eutrophication are Cockburn Sound (Silberstein *et al.*), the Albany harbours (Masini *et al.*), in WA and the Adelaide coast (Neverauskas, 1987). In WA the effect was on *Posidonia australis* whereas, in Adelaide it was on *P. sinuosa* and *P. angustifolia*. The problem with raised concentrations of nutrients is that opportunistic macroalgae growing on the leaves of *Posidonia* shade the plant and it eventually dies. These macroalgae are epiphytic on seagrass leaves. Because epiphytes and phytoplankton take up the nutrients so rapidly, the high concentration of nutrients is not detected in the surrounding water. Some other indicator than water quality must be used to determine water concentration levels and the health of the seagrass. Complicated models based on point sources like mouths of drains or rivers and diverse sources like runoff from the land can be used. A seagrass health parameter may also be used to determine seagrass health. The health of seagrass relies on its ability to capture light, once light is reduced for lengthy periods productivity is reduced and shoot density decreases. Nutrients are used by opportunistic macroalgae growing on seagrass leaves, called epiphytes. The epiphytes shade seagrass photosynthetic apparatus and the leaves die. Sometimes for monitoring purposes, epiphytes from problem areas are scraped from leaves, dried and weighed and compared in weight with epiphyte weights from control areas. The biomass of epiphytes can be used as a negative surrogate for seagrass health, i.e. the more epiphyte biomass the less healthy the seagrass plants are likely to be. It should be remembered, however, that epiphyte loads are seasonal in natural circumstances. The most efficient and reliable way of measuring seagrass health is by counting shoots.

There is little previous data in this area to use but investigations are underway to determine the effect of drainage channels on seagrass in Lacepede Bay and at Beachport further east of Cape Jaffa. Water samples were collected from the mouth of the Maria Creek and Blackford drains west of Cape Jaffa near Kingston, but results are not available. Health of seagrass at these sites and at control sites was estimated by measuring leaf length, shoot density, photosynthesis and biomass, but these results too, are not available (Were, SADI, pers. comm.). These results may give some indication of the amounts of nutrients coming from drains and their effect on *Posidonia* health.

Dissolved inorganic nitrogen is the problem nutrient in marine ecosystems. In Marmion Lagoon near Perth, ambient sea nitrate concentrations vary from undetectable in summer months to about 0.06mgN/L in winter (Kirkman *et al*., 1991). Note, this report is rather obscure but the data showing concentration ranges of nitrate from 0.005-0.06mgN/L and negligible ammonia concentrations in seawater in Marmion Lagoon are available from CSIRO Marine Research, Perth. Marmion Lagoon holds dense beds of *Posidonia sinuosa* and *P. angustifolia* as well as other seagrasses and is about 6m deep at its deepest edge.

The elevated concentrations of nitrate (nitrite concentrations were negligible) occurred immediately after storms and persisted for two or three days. Unless daily sampling programmes were initiated, these elevated concentrations would not be detected as they were always associated with storms. It can be assumed that elevated concentrations should not persist for periods longer than a week.

It is proposed that seagrass shoot density is monitored 3 or 4 times a year and that, if lower shoot density than controls is found, the proponent must take action to remedy the situation. This action will be the contingency plan assuming that nutrient levels are the causal agent for decreased density of seagrass leaves. Nutrients can be reduced in run-off by passing the water through an artificial wetland, recycling the water through ponds or using slow release fertilizer added at strategic times only.

The concentration of nitrate added to the sea at the breakwater by the marina will be rapidly diluted. There will be a dilution zone supposedly similar to that at the Maria Creek or Blackford Drains.

Potential for generating nuisance algal blooms

Algal blooms occur when high nutrients in the water column occur at the same time that calm weather prevails. They are of concern in two ways: first they may smell offensively and cause irritation to humans and second they may reduce available photosynthetic radiation to seagrass. The levels of nitrate predicted in this project will not normally cause an algal bloom. Outside the breakwater, nutrient and microalgal concentrations will quickly be diluted unless there are some days of calm. The other point to keep in mind is that the deeper seagrass plants will be affected first as they have the least light. These deeper seagrasses are further from the source of microalgae and thus, due to the dilution effect, less likely to be shaded by high concentrations of microalgae.

The WBM modeling provides the expected concentrations at various locations around the waterways and at the mouth, with the southeast arm being the worst case, at about 2.25 times the concentration at the mouth of the breakwaters (mixing factor 0.66% vs 0.295% at the mouth). Using the same scenarios that are discussed in the sensitivity figures provided we get:

	Best case	expected	worst case	modeled case
Total N mg/L	0.0002	0.006	0.108	0.083

Note also that the worst case scenario of 0.108 mgN/L is based on continuous neap tides, highest measured groundwater concentration, all of pessimistic garden fertilizer reaching the waterways and peak (spring) groundwater flow rates, i.e. all contributing factors being worst-case coincidently. Also, note that all of these calculated concentrations are in addition to the background concentrations of nitrogen in the seawater, i.e. 0- 0.02 mgN/L.

In summary, the WBM report and EIS talk about Total N levels of 0.037 mgN/L at the mouth, and hence 0.083 mgN/L at southeastern arm. If we extend that using the sensitivity analysis, the worst case scenario becomes 0.048 at the mouth and 0.108 at the southeastern arm. The expected case is 0.0028 mgN/L at the mouth and 0.006 mgN/L at the southeastern arm (all assuming a negligible concentration of nitrogen in the marine environment).

Pesticides and Herbicides

Groundwater was tested for major pesticides, e.g. OCPs and OPPs. For all pesticides assessed, the measured concentrations in groundwater, before mixing in the waterways, were well below EPP-Marine guidelines. Glyphosate is a very widely used non-selective herbicide and is used domestically and agriculturally. Despite its extensive use, it is

classified as relatively non-toxic to aquatic flora, with concentrations ranging from 1 to 100 mg/L having no effect on the photosynthetic capacity of the seagrasses investigated (Westphalen *et al.* 2004).

Atrazine, a herbicide, at 30 ppm caused a significant reduction in survival of shoots and production of new shoots, above ground biomass and growth of *Halodule wrightii* when compared with plants not exposed to atrazine in Redfish Bay, Texas. This was less sensitive than for *Zostera marina* in Chesapeake Bay (Correll and Wu, 1982).

In Chesapeake Bay Kemp *et al.* (1985) found that levels of atrazine or linuron above 50ppm caused decline in primary production but levels in Chesapeake were not high enough to have caused decline of the submerged vascular plants tested.

Atrazine has a use as a selective broad leaf weed control in establishing pines and some crops. Near Cape Jaffa, its use is very unlikely with the only potential use being in establishing pines, but use is unlikely within about 10 km of the site, although there are (established pines) near Mount Benson

Responses

Public Submission 1 Comment 3.

Is there any evidence of a decline in seagrass in the Kingston area in the last four years?

Is the decline a reduction in area of seagrass or a reduced density of shoots? Seagrass biomass varies considerably within and between years. Is there evidence of more bare areas or the maximum depth of seagrass getting shallower or the shallow edge moving out to sea?

Herbicides and other agricultural chemicals are being used in the area now. An increase in run-off from pesticides used on the gardens of the development can be expected. From worst scenario projections these amounts will have no effect on the marine environment. Note that the street run off is directed to holding ponds and wetlands for nutrient stripping. It is only in an exceptionally large rainstorm that runoff will enter the marina. There is no scientific evidence of seagrasses being destroyed by run-off containing pesticides or herbicides, see response to Government Submission 13, EPA, Comment 7.

Public Submission 2 Comment 4.

The waterways will concentrate groundwater which will discharge through the harbour mouth. However, the concentration of nutrients is not enough to affect seagrass past the outlet.

Public Submission 7 Comment 7.

The rotting seagrass along the beach at Kingston is a natural phenomenon that has been going on for probably hundreds of years. Evidence of this is the remains of seagrass leaves a few hundred metres inland from the present shoreline. This is discussed in Kirkman and Kendrick (1997).

The seagrass wrack at Cape Jaffa, as distinct from the beach at Kingston, clears from the beach seasonally and there is no evidence of decomposing masses of seagrass from test-pits, boreholes etc.

Public Submission 9 Comment 3.

There is no evidence that freshwater from drains and creeks is killing seagrass offshore. It is proposed to monitor water from the harbour mouth at strategic times to ensure that levels of nutrients and pesticides are below concentrations used as worst scenarios in models.

Public Submission 27 Comment 10.

The evidence of seagrass decline at the end of drains is localized and not large areas have been lost compared with the area of seagrass in Lacepede Bay. After looking at georectified aerial photos there was no evidence of seagrass loss at Maria Creek breakwater. The best photography was taken in 2000.

Government Submission 8/13, DEH, Comment 19.7.

The time for seagrass to restore to its original form and function is unknown. Many examples have been used in Australia to suggest that *Posidionia* takes decades to return and this may also be true of *Amphibolis*. There is a research program on restoring *Amphibolis* to areas of Adelaide coastal waters but these studies are in their infancy. The obvious solution is to destroy as little as possible of existing seagrass meadows. Scouring around the Maria Creek breakwater was not observed from georectified aerial photos taken in 2000 and 1997. It is fairly obvious that the distribution of rotted and dissolved material from wrack is dispersed along the beach by tides and wind so that an interruption of the long-shore drift will probably make little difference to the distribution of nutrients through natural nutrient recycling.

Government Submission DEH, Comment 19.7: 1st half

The marine studies mention that *Posidonia* spp. may take up to 50 years to recolonise and notes some settlement of seedlings of *A. antartica* where moorings/cages have left scours. No information about these settling seedlings is available but SARDI has a research program to determine survival and colonisation rates of *Amphibolis* seedlings.

Government Submission DEH, Comment 19.7: 2nd half

A review of georectified aerial photos taken in 2000 has revealed little scouring around an existing breakwater at Maria Creek. The sand bypass modelling shows that the management will limit sand build-up to the area close to the breakwater and will have minimal impact on the seagrasses.

Government Submission 13, NVC, Comment 25.2.

The direct damage to seagrass is documented in the EIS as 3.0 ha. Indirect damage may come from sediment disruption during dredging, i.e. turbidity, blowouts occurring along the dredged channel, possible scouring at the breakwater ends and higher than expected

nutrients discharging from the harbour mouth. A monitoring program for all these events will be developed and contingency plans offered.

Public Submission 30 Comment 3.

Video transects are unlikely to detect most of the invertebrates living in seagrass beds. Many of these are cryptic and well camouflaged. The risk of blowouts along the dredged channel is discussed elsewhere and a monitoring program and contingency plans are in place and described in the seagrass management document.

Public Submission 11 Comment 8.

The bare areas left by the swinging chains of the boat moorings will take a long time (decades) to recover.

Public Submission 18 Comment 13.

The visible sand patches at each mooring site are caused by the swing of the mooring chains. Other bare patches are blowouts that may have occurred in a one in a hundred year storm and are slowly recovering (Kirkman, 1985). The proposed channel will result in the removal of seagrass and the edges of the channel will be monitored carefully to determine any erosion. If erosion occurs there is a contingency plan in place. Freshwater input is negligible once it reaches the sea because of the great dilution effect.

Government Submission 10, SECWMB, Comment 6.

Seagrass wrack at Kingston is a natural phenomenon and is described by Kirkman and Kendrick (1997). It should be noted that the wrack is mostly old leaves that have been sloughed off *Posidonia* plants and washed up on the beach after storms. The early winter storms bring the most because the leaves lay where they fell until enough disturbance occurs to bring them ashore. An erosion blowout may be the result of a one in a hundred year storm.

The edges of the channel will be monitored and if they should erode, a contingency plan will be in place to stabilize them. The risk of channel bank erosion is present but unknown. The problem is there are no data on the surge, current or wave action needed to knock out *Posidonia* rhizomes. The seagrass bed is damaged by about one in a hundred year storms and this is the degree of activity required to undermine seagrass mat.

Government Submission 13, NVC, Comment 26.5.

A monitoring plan will be submitted for seagrass beds. The concerns over erosion from the channel, scouring around the breakwater and unforeseen damage generally to seagrass within 500m of the harbour entrance will be covered by a monitoring program.

Government Submission 12, Planning SA, Comment 43.

Three metres is well within the light requirements of seagrass in Lacepede Bay. Although *Posidonia* takes a long time to recover, there is the possibility of channel walls and floor recolonisation and recovery in many years.

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Appendix E

Wetlands Assessment

Prepared by RMP Environmental Pty Ltd

Wetlands, Lakes and Periodically Inundated Land in the Region

Some Background Information

To the east of the site there are a wetland, a number of lakes and areas of low lying, periodically inundated agricultural land. Butcher Gap Conservation Park contains the Butchers and Salt Lakes and is located approximately 10 km northeast of the site, at the southern extremity of the developed area of Kingston/Wyomi/Pinks Beach. These lakes are listed in the Directory of Important Australian Wetlands as the "Butchers & Salt Lakes Wetland" and defined as a "wetland of national significance" covering approximately 40 hectares (Environment Australia 2001). The information sheet for this wetland (Australian Wetlands Database, http://www.deh.gov.au/water/wetlands/database/index.html) describes the wetland as:

"An aggregation of three shallow lakes on the inland side of coastal dunes. Butchers Lake is the largest at approximately 25 ha in size, Salt Lake is approximately 10 ha, and an unnamed Lake is around 5 ha. In extreme wet years the area of the lakes expand into the surrounding scrub creating tea-tree and sedge swamps".

Water for the wetland is sourced from Butcher Gap Drain and a freshwater spring in Salt Lake. It is less than a metre deep, is brackish and acts as a refuge for waterbirds in summer or during drought. The area supports Tea-tree scrub, samphire flat, sedgelands and coastal closed scrub and contains some of the last remaining significant stands of coastal vegetation in the area. This Wetland is considered to be a habitat of the nationally endangered Orange-bellied Parrot (Environment Australia 2001).

Hog Lake is approximately 5 km northeast of the eastern edge of the site and covers approximately 54 ha. Although not listed in the Directory of Important Australian Wetlands and thus not classified as a nationally important wetland, Hog Lake does compliment the Butchers & Salt Lakes Wetland. It is fed by a freshwater spring, local catchment and in very wet years from Butchers Gap drain, via over-land flow along the coastal strip. It is described as being groundwater dependant.

The Australian Natural Resources Atlas depicts the Butchers & Salt Lakes Wetland and is shown below in Figure 1. It also shows Hog Lake and an area of periodically inundated land along the coast that extends approximately 13 km from northeast of Wyomi to the eastern extent of the site. The Wetland is also shown on a Department for Environment and Heritage figure that includes Hog Lake and the periodically inundated agricultural land (www.deh.gov.au/cgi-bin/wetlands/wetlandmap.pl?type=wetland;refcode=SA053). This figure has caused some confusion over the extent of the nationally important Butchers & Salt Lakes Wetland as it implies that the Butcher & Salt Lake Wetland extends from Cape Jaffa to beyond Wyomi, over an area of approximately 700 ha, which is clearly in conflict with its extent as defined in "A Directory of Important Australian Wetlands" (Environment Australia 2001).

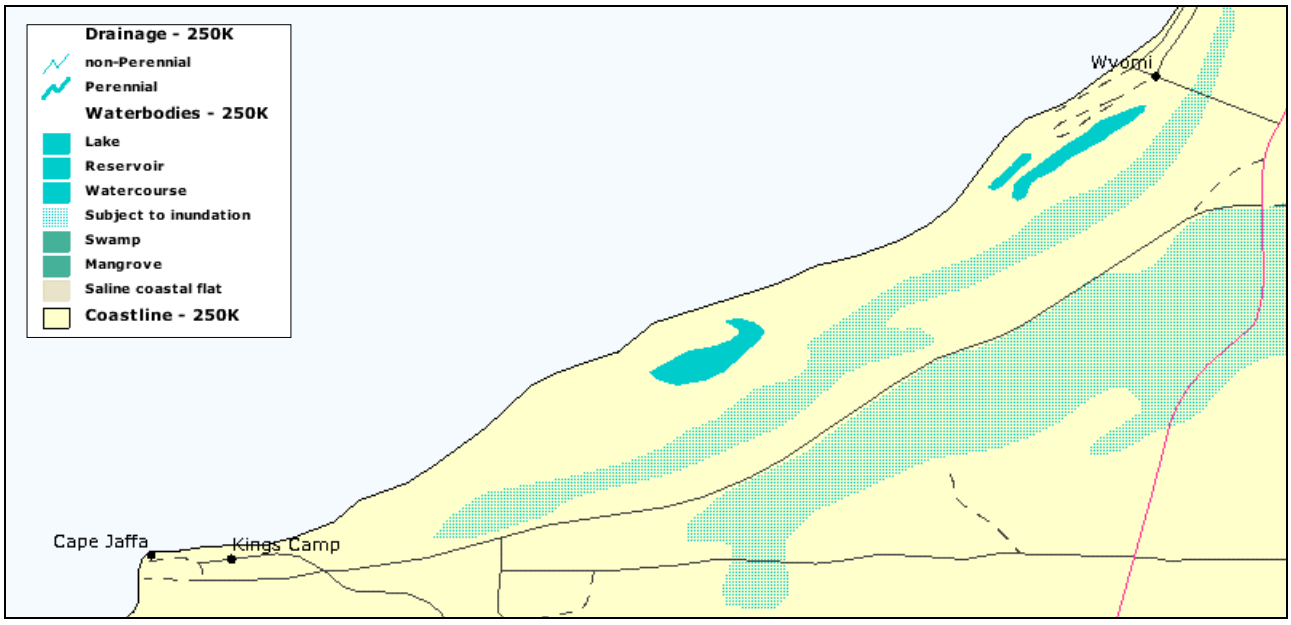

Figure 1 Waterbodies north and east of Cape Jaffa

Source: Australian Natural Resources Atlas - http://audit.ea.gov.au/mapping/

The Wetland Strategy for South Australia (DEH & DWLBC 2003) describes the Butchers and Salt Lakes Wetland as a seasonally saline or brackish marsh. The SA Atlas (www.atlas.sa.gov.au) maps the Wetland and provides more detailed information, as shown in Figure 2 and 3. It depicts the wetland as a complex of 6 lakes: Butchers Lake is shown as 2 lakes covering 44 ha and Salt Lake as a group of 4 lakes covering an area of 26 ha. It also shows Hog Lake, which covers 54 ha. Table 1 below summarises the data available for these areas.

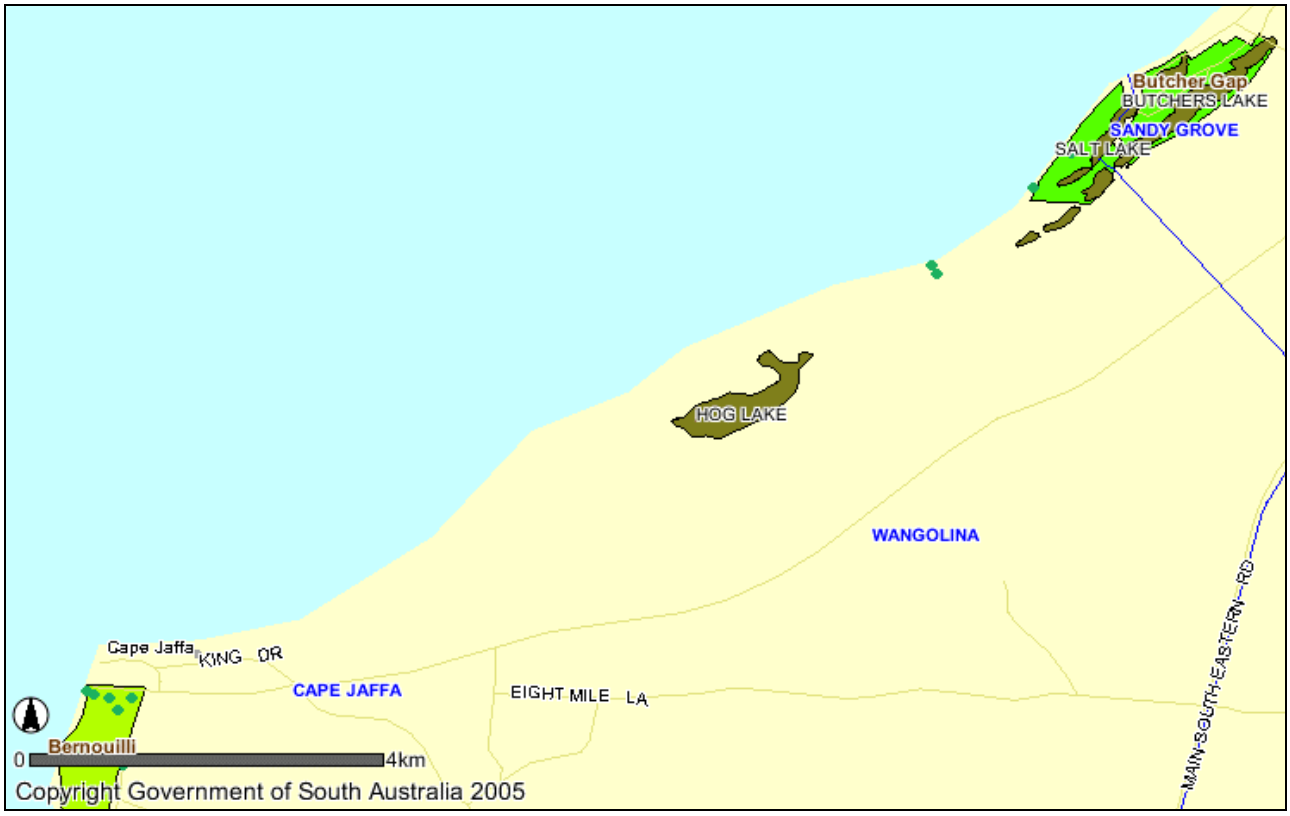

Figure 2 Butchers and Salt Lakes Wetland Hog, Lake and Bernouilli Conservation Reserve

Source: www.atlas.sa.gov.au

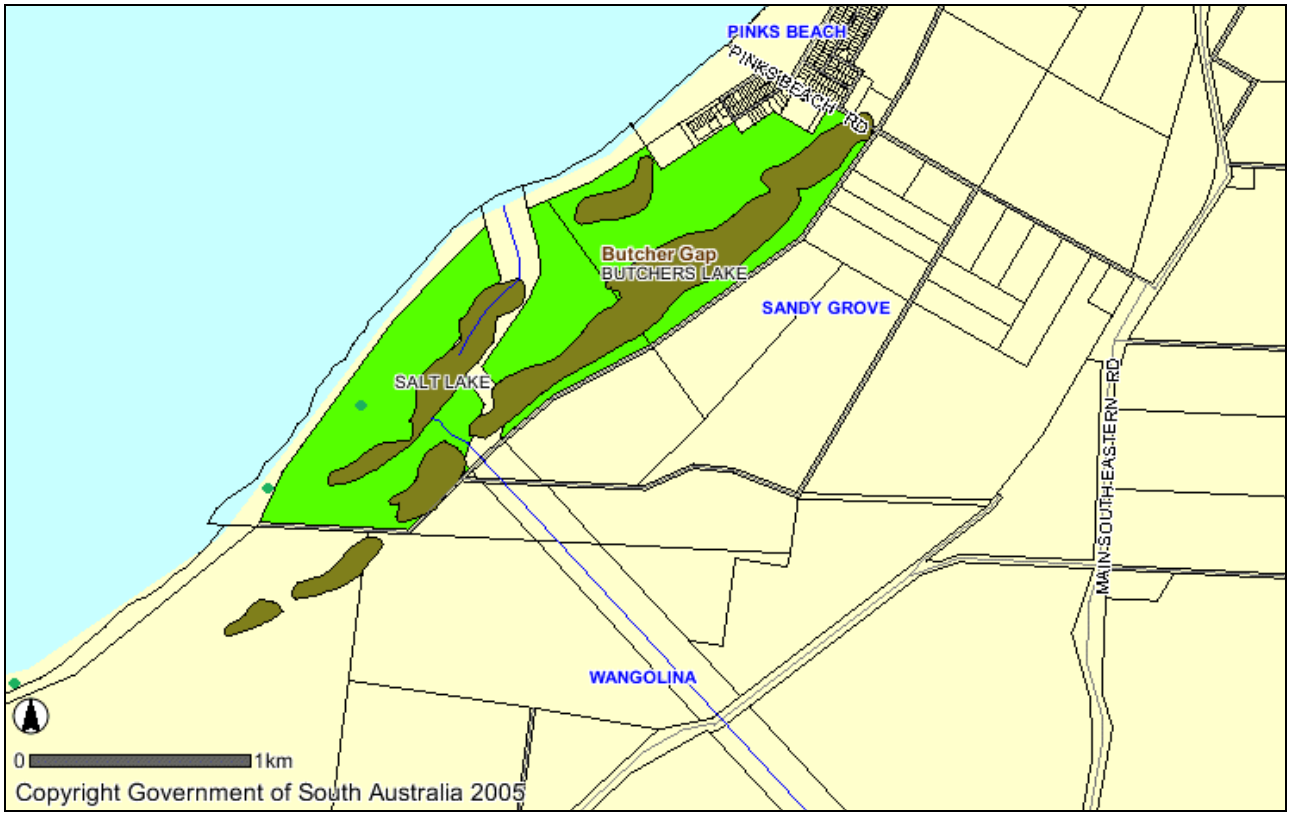

Figure 3 Butchers and Salt Lakes Wetland and Butcher Gap Conservation Park

Source: www.atlas.sa.gov.au

Table 1 Summary Data for Butchers and Salt Lakes Wetland and Hog Lake

Source: www.atlas.sa.gov.au

Name	BUTCHERS LAKE	BUTCHERS LAKE	SALT LAKE	SALT LAKE	SALT LAKE	SALT LAKE	HOG LAKE
Complex	BUTCHER/ SALT LAKE	BUTCHER/ SALT LAKE	BUTCHER/ SALT LAKE	BUTCHER/ SALT LAKE	BUTCHER/ SALT LAKE	BUTCHER/ SALT LAKE	
Easting	394000	393820	393100	393050	392680	392300	389185
Northing (GDA94 UTM Zone 54S)	5917500	5917800	5917000	5916500	5916100	5915850	5913760
Area (hectares)	39.0	5.0	13.8	6.2	4.1	2.0	54.0
As2482 ( )	44010	44010	44010	44010	44010	44010	44010
Ausdirno_96 ( )	NCP002SA	NCP002SA	NCP002SA	NCP002SA	NCP002SA	NCP002SA	
Ausdir_no (wetland reference)	SA053	SA053	SA053	SA053	SA053	SA053	
Aus_wetnr (former wetland reference)	S1098	S1098	S1099	S1099	S1099	S1099	S1100
International	No	No	No	No	No	No	No
National	Yes	Yes	Yes	Yes	Yes	Yes	No
Source	1997 WETLAND MAPPING	1997 WETLAND MAPPING	1997 WETLAND MAPPING	1997 WETLAND MAPPING	1997 WETLAND MAPPING	1997 WETLAND MAPPING	1997 WETLAND MAPPING
Standard	4401	4401	4401	4401	4401	4401	4401
Water_regime	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Temporary

The Butcher Gap Conservation Park Information Sheet (www.parks.sa.gov.au) is attached. It depicts the Wetland and Park area as shown in Figure 4 and describes the Park as:

"This small park is one of the last remaining significant stands of coastal scrub between the Coorong and Robe. The foredune and low-lying areas (swales) contain dense coastal scrub which, if you look closely, you will notice have been shaped by persistent strong onshore winds. A 40 ha wetland area, including Salt Lake and Butcher Lake, is divided by the Butcher Gap Drain. This drain brings large amounts of fresh water each winter from the farmlands, through the Park and out to sea."

"A 40 ha wetland area, including Salt Lake and Butcher Lake, is divided by the Butcher Gap Drain. This drain brings large amounts of fresh water each winter from the farmlands, through the Park and out to sea."

"Salt Lake usually holds water between June and January and during this time waterbirds such as Chestnut Teal, Black Duck and Mountain Duck will be seen. Japanese Snipe and other wading birds use the area in spring and summer and the sedge covered swales hold numbers of Brown Quail, a species far less common than the grassland loving Stubble Quail."

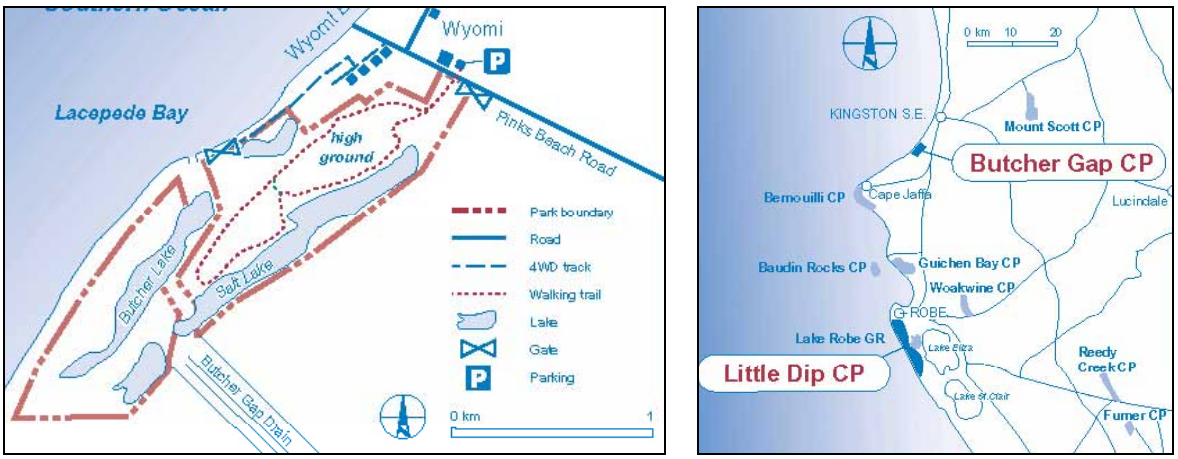

Figure 4 Butcher Gap Conservation Park

Source: Butcher Gap Conservation Park Information Sheet, Department for Environment and Heritage

Like many areas in the Southeast of South Australia, the low-lying coastal land nearby the Butchers & Salt Lakes Wetland and Hog Lake is periodically inundated with freshwater. The water is sourced from overland flow from Butcher Gap drain in very wet periods and from local catchment. The western-most part of these areas of inundation is adjacent to the development site and an associated stand of paperbark is described as the "paperbark swamp" in the **EIS** (**Section 4.6** and **Appendix 11**). These areas are visible in the aerial photography of the coastal strip from Butcher Gap to Cape Jaffa shown in Figure 5 below (DEH 2002).

Figure 5 Aerial Photograph of Butcher Gap to Cape Jaffa

Source: Department for Environment and Heritage, 2002

Groundwater Effects on the Wetland, Lakes and Periodically Inundated Land in the Region

Butchers and Salt Lake Wetland

The modelling of changes to groundwater levels as a result of establishing the waterways is presented in the EIS (**Section 5.2.2, 5.2.3** and **Appendix 14**). It shows that the extent of groundwater level changes is limited to the Cape Jaffa area immediately surrounding the waterways (**Figure 5.13** of EIS). As the wetland is approximately 10 km from the development site there is expected to be no noticeable effects on the wetland.

Hog Lake

Hog Lake is also significantly further from the site than the expected extent of groundwater changes and again there is expected to be no noticeable effect at this location.

Periodically Inundated Land Adjacent to the Development

A periodically inundated area adjacent to the site is the only area within the expected extent of changes to the groundwater as a result of establishing the waterways. Some investigations into this area and its relationship with the groundwater system have been conducted. This area covers approximately 30 hectares, east of the site and is within about 2 km of the proposed waterways. It is generally flat ground with an elevation of 1.3 mAHD near its centre, rising to about 1.7 mAHD near the edge. Information from the landowner and survey of the area indicates inundation occurs to a level of up to about 2.1 mAHD. Survey shows that in 2004, the water level reached a high of approximately 1.95 mAHD in late August / early September, a water depth of up to 0.65 metres. If it is assumed that the average water depth over the 30 hectares was 0.5 metres, a total water volume in 2004 of approximately 150,000 cubic metres is indicated.

In seasons when the area is inundated, it drains over the spring and is typically dry by November. Although, in very wet years it may take until early January to dry. In 2004, it was essentially dry by the beginning of December. Water is lost mainly by evaporation and infiltration to the groundwater. Although limited data are available to make an assessment of the infiltration rate into the groundwater, estimates can be made using the initial investigations of the area discussed above and the groundwater modelling presented in the **EIS** (**Sections 5.2.2, 5.2.3** and **Appendix 14**).

In 2004, approximately 150,000 cubic metres of water, corresponding to approximately 0.5 metres of water depth over 30 hectares, was lost to evaporation and groundwater infiltration over approximately 9 weeks from October to the beginning of December. Average evaporation over that period (indicated by the average of Padthaway and Konetta pan evaporation data, Table 2) was about 285 mm, which indicates that more than half of water loss is by evaporation. Thus, over the 9 weeks about 215 mm was lost to the soil profile, some of which was recharge to the groundwater system. Although some of this water would be lost by evapotranspiration and not reach the aquifer, conservative assessment can be made by assuming that all of the 215 mm became recharge to the aquifer. This equates to about 65,000 cubic metres over the 30 hectares and indicates an average infiltration rate of about 3.4 mm/day or about 1,030 cubic metres per day.

Groundwater levels in the vicinity of this periodically inundated land have been monitored since July 2003 (monitoring bores CJ16 and CJ24). A total of eight groundwater levelling surveys have been conducted in that time, which show groundwater levels have ranged from about 0.55 to 1.73 mAHD. In 2004, the groundwater levels peaked in late September / early October and on the 10th October 2004 were recorded as 1.58 and 1.73 mAHD (CJ24 and CJ16). This supports the understanding that infiltration to the groundwater from this area is occurring, as the water level in the inundated area was approximately 200mm higher (1.95 mAHD) than the highest recorded groundwater levels, as would be expected whilst water is infiltrating into the aquifer.

The groundwater modelling presented in **Sections 5.2.3** of the **EIS** includes assessment of the change in groundwater levels in the vicinity of the waterways and **Section 5.2.6** presents an assessment of the expected rate of groundwater inflow to the marina waterways. The modelling indicates an average lowering of the groundwater levels over the adjacent inundated area of 300 mm to 500 mm, with 300 mm furthest from the waterways and 500 mm nearest to the waterways. In addition, the modelling shows an inflow to the waterways from the groundwater beneath the inundated area east of the site of about 290 cubic metres per day.

Although the groundwater inflow to the waterways from the east will clearly not all be from the inundated area, a conservative assessment of the effect of the waterways can be made by assuming that the inflow to the waterways directly increases the groundwater infiltration from the inundated area by the same amount. This is equivalent to assuming that the surface water of the inundated area supplies all of the inflow to the waterways from the east, via the groundwater system. If this assumption is made, it indicates that in 2004 the infiltration rate would have been increased from about 1,030 cubic metres per day to about 1,320 cubic metres per day, which equates to an increase from 3.4 mm per day to 4.4 mm per day. The spreadsheet setting out these calculations is attached as Table 3. This change would result in drying occurring approximately 1 week sooner, in about 8.1 weeks verses approximately 9 weeks.

On the basis of this assessment it is evident that the groundwater inflow to the waterways is small in the context of the volume of water in the adjacent periodically inundated area and only minor change to the period of drying is expected. The potential effects of these changes on vegetation were discussed in **Section 5.2.5** of the **EIS** (and **Appendix 11**), which concludes:

"The critical factor for the survival and regeneration of the M. halmaturorum is the period of seasonal inundation. Over recent years, depending on the amount of winter rainfall, the area east of the project site has standing water from about May to November. This is not expected to change significantly. It is possible that after completion of the final stage of the development (10 to 15 years), the draining of this area through the aquifer into the marina basin may bring drying on more quickly. This possible change may be offset through stormwater management involving a system of retention basins that will allow infiltration of stormwater into the groundwater and its redirection towards the swamp area.

Taking all these factors into account, it is not expected that the survival of the M. halmaturorum will be threatened. The removal of stock will aid regeneration. If any changes in vegetation structure do occur, it will be over an extended period and if seasonal drying of the swamp happens slightly more quickly than currently, conditions may favour the Gahnia filum (chaffy saw sedge). This successional shift is expected to have minimal effect on the habitat value of the swamp area."

In summary, it is expected that the area will continue to be inundated in wet periods from a combination of local catchment and inflow of water from further east. Increased infiltration to the groundwater system as a result of establishing the waterways may result in marginally quicker drying and this is unlikely to have any adverse effects on the flora and fauna.

Table 2 Padthaway and Konetta Pan Evaporation Data

	Monthly Evaporation Data for Padthaway and Konetta												
	Jul	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Total**
Padthaway	47	60	81	135	178	230	260	235	175	105	60	40	**1606**
Konetta	50	65	84	112	141	205	233	209	167	102	59	42	**1469**
Average	49	63	83	124	160	218	247	222	171	104	60	41	**1538**

Table 3 Calculations of Infiltration Rate and Drying Time

Spreadsheet for Assessment of Increased Infiltration and Faster Drying of the Periodically Inundated Area East of the Site			
	2004, without effect of waterways	**2004, with extra 290m3/day inflitration**	
Area	300000	300000	m2
Average water depth at beginning of drying period	0.5	0.5	m
drying time (from beginning of October)	9.0	8.1	weeks
Padthaway evaporation over drying period	313	277	mm
Konetta evaporation over drying period	253	224	mm
Average evaportation over drying period	283	250	mm
" "	0.283	0.250	m
Infiltration/recharge	0.217	0.250	m
Infiltration/recharge per day	0.00344	0.00441	m/day
Infiltration volume	65100	74864	m3
Infiltration volume per day	1033	1323	m3/day

Other miscellaneous images

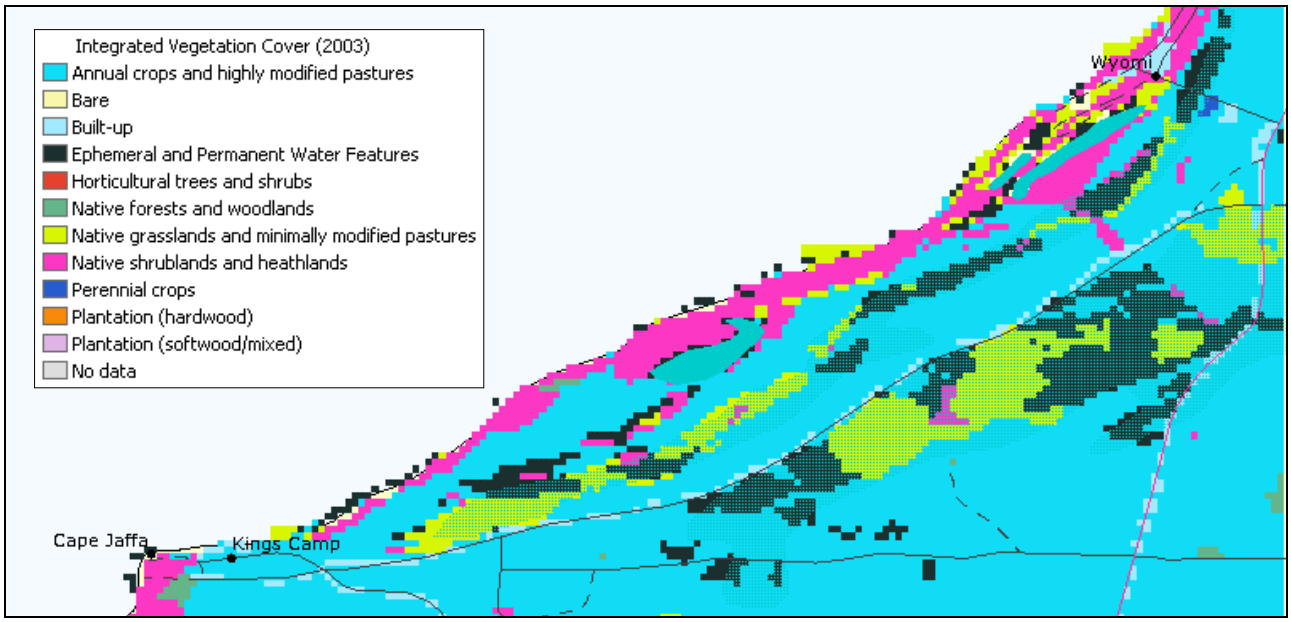

Figure 6 Australian Natural Resources Atlas Vegetation Types and Waterbodies, based on 1:250k mapping

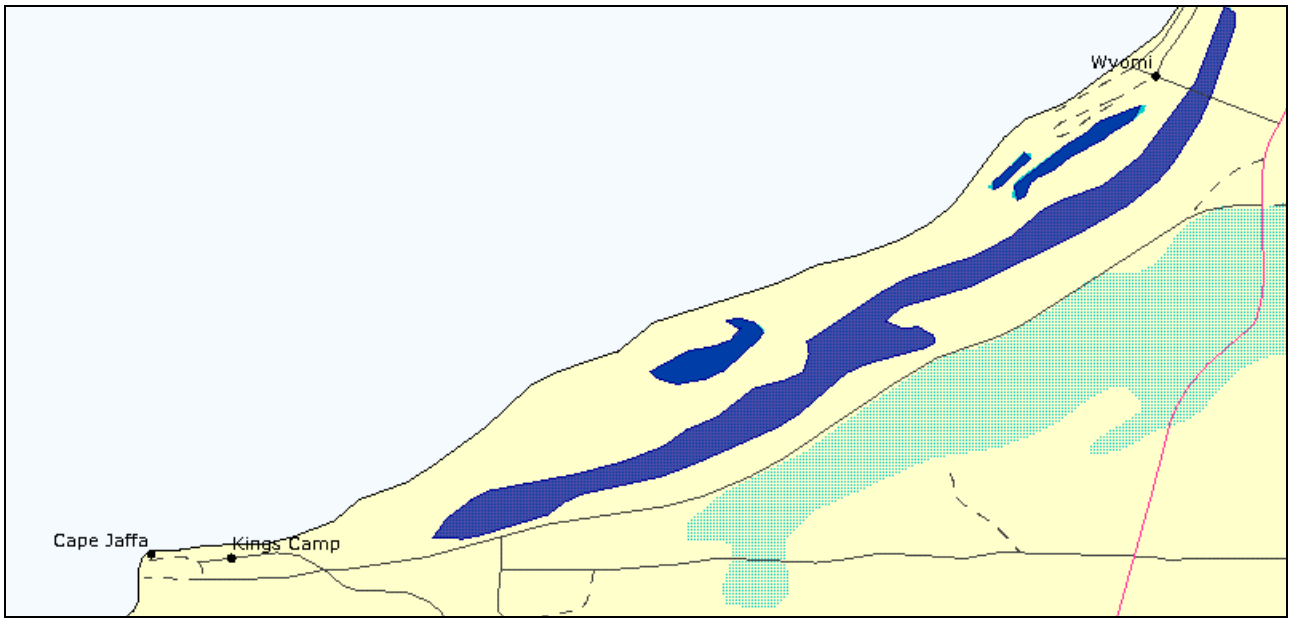

Figure 7 Australian Natural Resources Atlas Vegetation Types and Waterbodies , based on 1:250k mapping

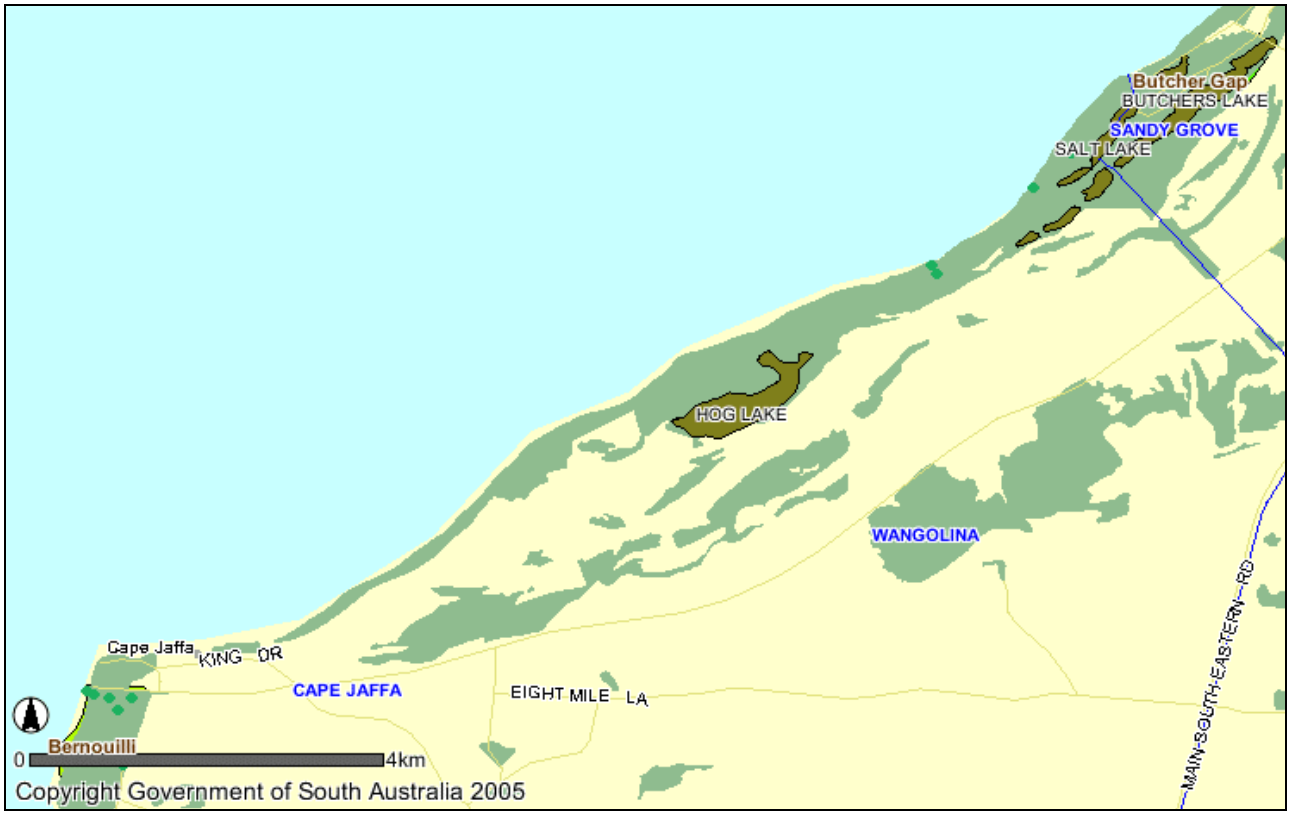

Figure 8 SA Atlas Wetlands, Conservation Parks/ Reserves and Native Vegetation

Source: www.atlas.sa.gov.au

Directory of Important Wetlands in Australia

Butchers & Salt Lakes - SA053

Level of importance: National - Directory

Location: 36 degrees 53' S, 139 degrees 48' E; South East region, 7 km south west of Kingston township.

IBRA region: Naracoorte Coastal Plain. **Area:** 40 ha. **Elevation:** 0-10 m ASL.

Other listed wetlands in same aggregation: SA057, SA063.

Wetland type: A5, B8, B12 **Criteria for inclusion:** 1, 3, 5,

Site description: An aggregation of three shallow lakes on the inland side of coastal dunes. Butchers Lake is the largest at approximately 25 ha in size, Salt Lake is approximately 10 ha, and an unnamed Lake is around 5 ha. In extreme wet years the area of the lakes expand into the surrounding scrub creating tea-tree and sedge swamps.

Physical features:

Landform: The wetlands occur on the coastal flat behind a low, well-vegetated coastal dune ridge with areas of old stable scrub, tea-tree and samphire surrounding the lakes.
Geology: Unconsolidated calcareous sands from the Pleistocene unconformably lay over Tertiary formed calcrete.
Soils: Yellow calcareous sands, sometimes with a grey-brown upper horizon.
Climate: Average annual rainfall is 625 mm; average annual evaporation is 1,400 mm.

Hydrological features:

Water supply: Water flows into the wetlands via the Butcher Gap Drain which receives water from agricultural land to the south east. A freshwater spring also feeds Salt Lake.
Inundation: Water lasts up to 11 months per year (South Australian Ornithological Association 1981; South Eastern Wetlands Committee 1984).
Water depth: Shallow < 1 m. Water salinity: > 3000 mg/L TDS, brackish.

Ecological features:

Ecological role: A freshwater coastal wetland that acts as a refuge for waterbirds in summer or during drought.
Plant structural formations: Tea-tree scrub, samphire flat, sedgelands and coastal closed scrub.
Significance: Contains some of the last remaining significant stands of coastal scrub between the Coorong Lagoon and the township of Robe. It is also one of the areas visited by the nationally endangered Orange-bellied Parrot *Neophema chrysogaster.*

Notable flora:

Threatened species: None identified.
Composition: Tall shrubland with Melaleuca halmaturorum and patches of Leptospermum lanigerum on the edges of the lakes; closed scrub on the dune supports Leucopogon parviflorus with isolated emergents of Acacia longifolia var. sophorae and Allocasuarina verticillata; Cakile maritima occurs on open areas on dunes; samphire dominates exposed flats around the lakes (South Eastern Wetlands Committee 1984).

Notable fauna:

Threatened species: Orange-bellied Parrot (Ne, Se).
Composition: 16 waterbird species recorded; three listed under treaties. Waterbirds include, Australian White Ibis *Threskiornis molucca*, Black Swan *Cygnus atratus*, Australian Shelduck *Tadorna tadornoides*, Grey Teal *Anas gracilis*, Chestnut Teal *A. castanea*, Masked Lapwing *Vanellus miles*, Red-capped Plover *Charadrius ruficapillus* and Whiskered Tern *Chlidonias hybridus*. The Glossy Ibis *Plegadis falcinellus* is listed under a treaty.
Migration stop-over: Migrant shorebirds include Red-necked Stint *Calidris ruficollis* and Curlew Sandpiper *C. ferruginea*.
Numbers: Records of 95 Straw-necked Ibis *Threskiornis spinicollis* and 80 Banded Stilt *Cladorhynchus leucocephalus* (South Eastern Wetlands Committee 1984; Jaensch & Auricht 1989).
Other Fauna:

Social and Cultural values:

Land tenure: The Lakes are on Crown land and Butchers Gap is a Conservation Park. Freehold residential and miscellaneous lease or freehold agricultural land.

Current land use: Nature conservation and recreation. Agriculture and low density residential areas.

Disturbance or threat:

Past/present: Rabbit grazing and soil erosion of dunes.
Potential: Increased uncontrolled visitor access.

Conservation measures taken: No information.

Management authority and jurisdiction: The Park is managed by DEH. District office at Naracoorte.

References: See SA Reference List

Compiler & date: M.C. de Jong, S.A. Department of Environment and Natural Resources, 1995.

Department of the Environment and Heritage
GPO Box 787 Canberra ACT 2601 Australia
Telephone: (02) 6274 1111

Butcher Gap Conservation Park Information Sheet

Butcher Gap
Conservation Park

About the Park

This small park is one of the last remaining significant stands of coastal scrub between the Coorong and Robe. The foredune and low-lying areas (swales) contain dense coastal scrub which, if you look closely, you will notice have been shaped by persistent strong onshore winds.

A 40 ha wetland area, including Salt Lake and Butcher Lake, is divided by the Butcher Gap Drain. This drain brings large amounts of fresh water each winter from the farmlands, through the Park and out to sea.

See map

Visiting the Park

Access to the Park - Vehicle access for visitors is restricted to the carpark at the northern end of the park.

A nice place to walk - Stout footwear and a good hat are advised as the trail has been left as natural as possible.

A scenic walking trail marked with small brown posts was established by the Friends of Butcher Gap and commences near the carpark.

Salt Lake usually holds water between June and January and during this time waterbirds such as Chestnut Teal, Black Duck and Mountain Duck will be seen. Japanese Snipe and other wading birds use the area in spring and summer and the sedge covered swales hold numbers of Brown Quail, a species far less common than the grassland loving Stubble Quail. Binoculars are useful!

Natural Attractions

Migratory birds - Butcher Gap Conservation Park is an important winter refuge for bird species such as the endangered Orange-bellied Parrot which feeds on Two-horned Sea rocket *Cakile maritima* near the beach and in the extensive samphire habitat around Salt Lake.

The wetlands are also noted for a variety of waterfowl, including migratory waders.

Further Information

For further information, please contact the Department for Environment and Heritage's office at Mount Gambier:

11 Helen Street
PO Box 1046
Mount Gambier SA 5290
Australia

Phone: (61 8) 8735 1177
Fax: (61 8) 8735 1110

Map

References

Environment Australia (2001) A Directory of Important Wetlands in Australia, Third Edition.

DEH & DWLBC (2003) Wetlands Strategy for South Australia, Department for Environment and Heritage & Department of Water, Land and Biodiversity Conservation South Australia.
www.environment.sa.gov.au/biodiversity/pdfs/wetlands/wetlands_strategy.pdf

DEH (undated) Butcher Gap Conservation Park Information Sheet Department for Environment and Heritage

Appendix F

Underwater Seagrass Observations

Underwater Observations Relating to the Potential Impacts of Sea Cage Finfish Farming on Seagrass Meadows at Cape Jaffa, Lacepede Bay

Simon Bryars

Final Report
Prepared for PIRSA Aquaculture by the
PIRSA Fish Habitat Program

2003

Government of South Australia

PRIMARY INDUSTRIES AND RESOURCES SA

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ADELAIDE SA 5001

Telephone: 08 8226 2311
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Cover photographs:
Background
Sea cage finfish farming at Cape Jaffa.
Insets (left to right)
Underwater shots taken around finfish cages on 21st November 2002 (see text for further details),

- *Amphibolis* growing around stingray anchor at Cage 2.
- First mooring chain dragging across bottom and scouring leaves off *Amphibolis* plants at Cage 2.
- *Amphibolis* seedlings and clumps of old *Posidonia* root mat adjacent to first mooring block at Cage 1.

Introduction

Lacepede Bay is a large, relatively protected marine embayment in the South East region of South Australia. Sea cage farming of finfish (Atlantic salmon and rainbow trout) has been occurring near Cape Jaffa in southern Lacepede Bay since 1996. There are currently two lease sites for this form of aquaculture (SEAS, and JR Drabsch), both located over extensive seagrass meadows. Seagrass meadows in Lacepede Bay consist of *Posidonia australis*, *P. angustifolia*, *P. coriacea*, *Amphibolis antarctica*, and *Heterozostera tasmanica* (Edyvane 1999). Marsh *et al.* (2003) stated in a recent literature review that seacage finfish farming can have a detrimental impact on seagrass meadows. While concern has been expressed over the potential impacts of sea cage finfish farming on the seagrass meadows at Cape Jaffa, there has been little independent information collected to determine if in fact this is the case.

The mooring system used by the two lease owners at Cape Jaffa is based on a single point swinging system (O'Brien 2002). The system consists of a 316 litre springer buoy with a rope (approx. 6m length) attached to a swivel which is then attached to a mooring chain (approx. 5m length) (Figure 1). This first mooring chain is attached to a mooring block (two train wheels of 300kg each) on the seabed which is then attached to a second mooring block (another two train wheels of 300kg each) on the seabed by a second mooring chain (approx. 15m length). This second mooring block is then ultimately attached by a rope (approx. 20m length) to a 150kg 'stingray' anchor embedded in the substrate. The finfish cage is attached to the swivel below the buoy by a series of four bridle ropes (each approx. 50m length). The bridle ropes allow the cage to swing in a roughly 100m diameter circle around the first mooring block. Cages are approximately 20m in diameter (circumference of 55 or 65m). Therefore the zone of influence directly under a cage is a 'donut' shape between 50m and 70m from the first mooring block.

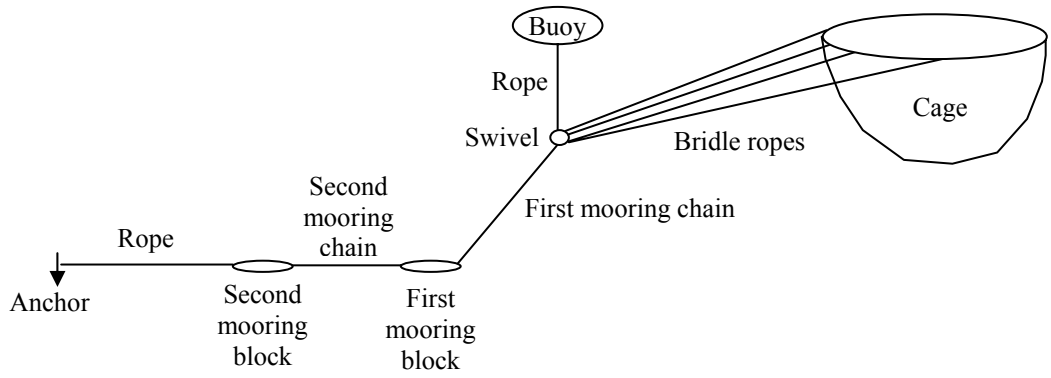

Figure 1. Mooring set-up used at Cape Jaffa.

Due to the nature of the finfish farming activities and the mooring system used at Cape Jaffa, it is apparent that seagrass damage/degradation could occur and be detected visually in a number of ways (Table 1). Based upon this information, an underwater field investigation using visual observations was conducted on 21st November 2002, to determine (at a broad level) if any impact could be detected as a result of sea cage finfish farming at Cape Jaffa, and also if seagrass recovery could be detected at a previously impacted site.

Table 1. Potential causes of seagrass damage/degradation from sea cage finfish farming at Cape Jaffa and methods of detection.

Cause	**Method of detection**
Eutrophication due to increased nutrient inputs from uneaten feed and faecal wastes	High epiphyte load on seagrass under/near cages compared to seagrass in pristine (control) areas. Seagrass dieback/loss and/or lower standing crop and leaf density under/near cages compared to seagrass in pristine (control) areas.
Sedimentation due to uneaten feed and faecal wastes	High levels of sediment on seagrass and/or seagrass dieback/loss under/near cages (particularly at 50-70m from first mooring block) compared to seagrass in pristine (control) areas.
Shading due to the location of sea cages	Seagrass dieback/loss and/or lower standing crop and leaf density in a circular pattern corresponding to the position of cages away from the first mooring block, i.e. 50-70m from the first mooring block
Scouring due to moorings	Seagrass damage/loss in a pattern corresponding to the location of moorings.

Methods

Five sites were inspected by SCUBA divers at Cape Jaffa on 21st November 2002: two cage sites (Cage 1, Cage 2); two 'control' sites (Control 1, Control 2); and an impacted site (Disused boat mooring) (Figure 2).

Cage sites

There are currently 12 cages operational in the Cape Jaffa area. Two cages were assessed within the SEAS lease area. Due to the present practice of regularly checking and re-setting the moorings on cages it was not possible to assess any cages that had been in exactly the same location for longer than nine months. However, the bottom moorings on Cages 1 and 2 were positioned in February 2002, and the cages have been fully stocked with Atlantic salmon since that time (D. Peel, personal communication). Prior to February, the cages (which were initially stocked with Atlantic salmon in August 2001) had been positioned relatively close by (<20m away) such that any broad scale cumulative effects of eutrophication during the period from August 2001 to the time of the investigation might still be detectable.

The assessment of each cage site consisted of three main parts:
- a survey around the first mooring block,
- a survey along the bottom moorings (i.e. second mooring chain, second mooring block, bottom rope, and stingray anchor) and
- a survey in the general area of the sea cage operation.

The survey at the first mooring block and along the bottom moorings included searching for evidence of scouring (bare sand, defoliated plants, remnant root mat) and the spatial extent of any damage. The survey of the general area around the sea cage was based around an 80m straight transect line that was laid out from the first mooring block using a tape measure. The direction of the transect line was different for the two cage sites. However, it is apparent that due to wind and tide variations, the cages do not lie in any one direction noticeably more than another (D. Peel, personal communication) so that any direction away from the first mooring block might reasonably be expected to be representative of the general area in the vicinity of a cage. Nonetheless an attempt was made to lay the transect under the cage at the time of the dive. Observations along and to the sides of the transect included:
- an estimate of percentage seagrass cover directly under the tape measure,
- the presence of bare areas,
- seagrass species composition,
- evidence of sedimentation, and
- a visual assessment of seagrass standing crop, leaf density, and epiphyte load.

Control sites

Two control sites were assessed within the Cape Jaffa region. Control 1 was located about 1.6km to the northeast of Cage 2, outside the SEAS lease area (Figure 2). Control 2 was located about 0.5km to the southwest of Cage 1, also outside the SEAS lease area (Figure 2). Control sites were located in a similar depth to the Cage sites and at a distance from the sea cages that was deemed to be far enough away from any immediate impacts. The survey of the general area at the control sites was based around an 80m straight transect line that was laid out using a tape measure. The direction of the transect was random. Observations along and to the sides of the transect included:

- an estimate of percentage seagrass cover directly under the tape measure,
- the presence of bare areas,
- seagrass species composition and
- a visual assessment of seagrass standing crop, leaf density, and epiphyte load.

Disused boat mooring site

A disused boat mooring was selected adjacent to the Cape Jaffa jetty to assess possible seagrass recolonisation. This mooring was previously used by a commercial rock lobster boat but has not been used since early May 2002 when the boat was moved away. The mooring consists of a float attached to a rope which is then attached to a heavy chain. The type of anchor block used is unknown. A survey of the site included searching for evidence of scouring (bare sand, defoliated plants, remnant root mat), and evidence of seagrass recolonisation (seedlings, rhizome regrowth).

Underwater photographic and videographic records were made on the cage, control, and mooring site surveys.

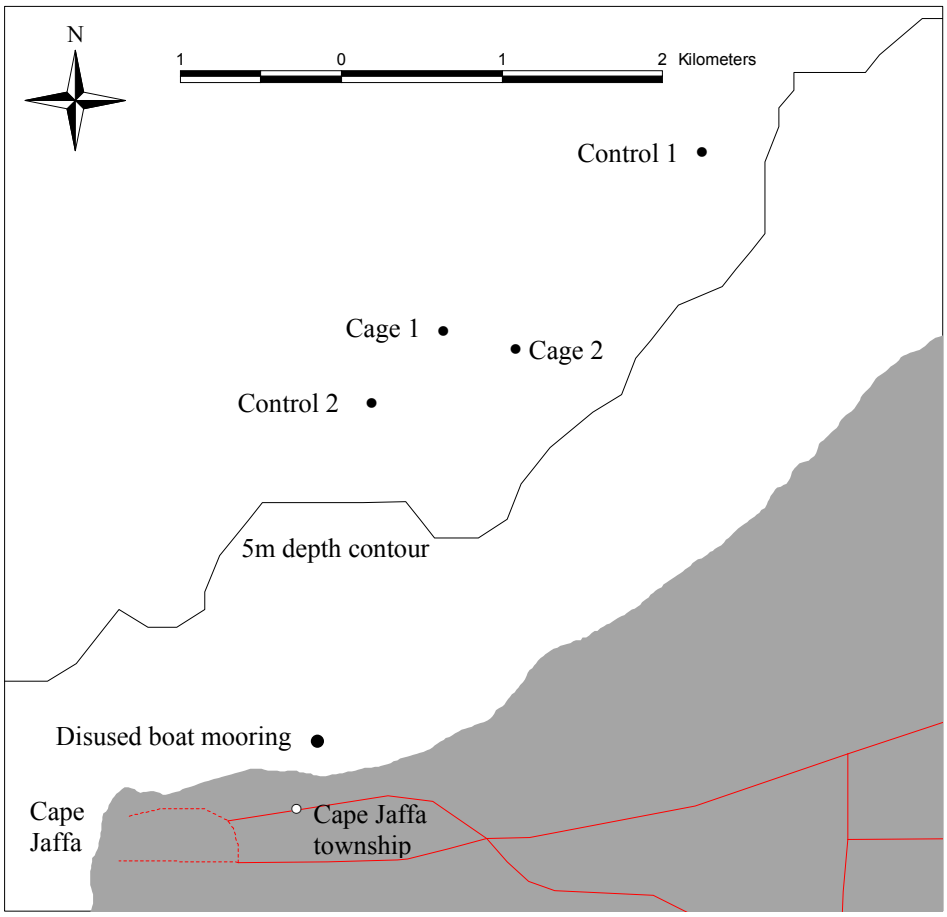

Figure 2. Location of sites adjacent to Cape Jaffa township in southern Lacepede Bay.

Results

Site: **Cage 1**
Cage circumference: 55m
Location of first mooring block: 36º 55.022' S, 139º 41.893' E
Date: 21-November-2002
Time: 10 am
Conditions: Calm seas. Light south-east to easterly wind.
Tide: Low tide. Beginning of flood.
Depth: 8.9m maximum recorded.
Dive time: 46 minutes
Underwater conditions: Approximately 5-8m visibility. Swell movement evident. Some tidal movement evident.
Divers: Simon Bryars, Kane Williams

Underwater observations:
First mooring block: At the time of the dive the first mooring chain was tight and clear of the bottom. An almost bare oval-shaped area of 10-20m width occurred around the first mooring block. When the sand in this area was fanned away a *Posidonia*[1] root mat was revealed (Plate 1a), providing evidence that at least some of the bare area was due to seagrass loss and was not entirely a naturally bare area. Seedlings of *Amphibolis*[2] were also observed in the 'bare' area (Plate 1a). If it is assumed that the entire bare area around the first mooring block is due to scouring, then a rough estimate of the zone of scouring impact is $160m^2$.
Bottom moorings: The mooring blocks and stingray anchor were lying in a westerly direction. Between the second mooring block and the stingray anchor there was a dense cover of *Posidonia* with no evidence of loss due to the block, anchor, or rope (Plate 1b).
Transect: At the time of the dive the cage was sitting in a westerly direction from the first mooring block and the 80m transect was laid in this direction such that it passed directly underneath the cage. An almost 100% cover of *Posidonia* was observed directly under the tape measure between 10 and 80m along the transect (Plate 1c). *Posidonia* meadows in the vicinity of the entire transect (apart from the area of scouring) appeared 'healthy' with respect to standing crop, leaf density, and epiphyte load. These meadows would normally be described as dense with low epiphyte loads. There was no discernible zone of influence from sedimentation, shading, or eutrophication under the cage between 50 and 70m distance from the first mooring block (Plate 1c). Several deeper bare areas that appeared to be 'blowouts' were observed either side of the transect between the first block and about 50m (Plate 1d). These blowouts sometimes had *Amphibolis* plants growing in them. No sedimentation was apparent in the vicinity of the entire transect.

Summary: It was apparent that a small amount of scouring had occurred in the vicinity of the first mooring block. The precise area of this scouring could not be accurately determined as it is evident that some bare areas occur naturally in this region (see Controls 1 & 2 also) and it is possible that the first mooring was originally placed on an area with some natural bare sand. The seagrass meadows observed along an 80m transect in a westerly direction away from the first mooring block (apart from the area of scouring) appeared 'healthy' in all respects. There was no evidence of scouring between the second mooring block and the stingray anchor.

[1]Unless stated otherwise, all *Posidonia* observed in this study was either *P. angustifolia* or *P. sinuosa* (formal identifications were not made to discriminate these two similar looking species).

[2]All *Amphibolis* observed in this study was *A. antarctica*.

Site: **Cage 2**
Cage circumference: 65m
Location of first mooring block: 36º 55.095' S, 139º 42.158' E
Date: 21-November-2002
Time: 11.30 am
Conditions: Calm seas. Very light south-east to easterly wind.
Tide: Low tide. Flooding.
Depth: 7.9m maximum recorded.
Dive time: 35 minutes
Underwater conditions: Approximately 5-8m visibility. Swell movement evident. Some tidal movement evident.
Divers: Simon Bryars, Kane Williams

Underwater observations:
First mooring block: At the time of the dive the cage was undergoing a directional change from a westerly to an easterly position due to a change in tides and wind. However, the cage did not swing around tight on its mooring during this time but rather it moved past the southern side of the mooring float such that the first mooring chain became slack and sat on the seabed (Plate 2a). Due to this fortuitous event it became immediately apparent how the mooring chain could scour the seabed. Indeed, observations around the first mooring block revealed that seagrass had been damaged by scouring. Unlike Cage 1, the seagrass around the first mooring block at Cage 2 was predominantly *Amphibolis* rather than *Posidonia*. Badly damaged *Amphibolis* occurred in the first few metres around the block and was characterised by completely defoliated stems (Plate 2a). Partially damaged *Amphibolis* occurred beyond the first few metres up to 10m (to the south) away from the first mooring block and was characterised by partially defoliated stems. The zone of scouring impact extended about 5m to the west, east and north of the block. A rough estimate of the area of scouring impact is $100m^2$. Beyond the zone of impact were dense meadows of *Amphibolis*.
Bottom moorings: The mooring blocks and stingray anchor were lying in a northwesterly direction. Between the second mooring block and the stingray anchor there was a dense cover of *Amphibolis* with no evidence of loss due to the block, anchor, or rope (Plate 2b).
Transect: At the time of the dive the cage was undergoing a directional change and in an attempt to pass underneath the cage the 80m transect was laid in a southeasterly direction away from the first mooring block. An almost 100% cover of *Posidonia* and *Amphibolis* was observed directly under the tape measure between 10 and 80m along the transect (Plate 2c,d). *Posidonia* and *Amphibolis* meadows in the vicinity of the entire transect (apart from the area of scouring) appeared 'healthy' with respect to standing crop, leaf density, and epiphyte load. These meadows would normally be described as dense with low epiphyte loads. There was no discernible zone of influence from sedimentation, shading, or eutrophication between about 50 and 70m distance from the first mooring block where the cage would sit when tight on its moorings. There was a patch of *Posidonia* around the 80m mark that had a more noticeable epiphyte load than other areas along the transect (Plate 2d), however, it would still not be deemed as 'heavy' or indicative of eutrophic conditions. No sedimentation was apparent in the vicinity of the entire transect.

Summary: It was apparent that a small amount of scouring had occurred in the vicinity of the first mooring block. The seagrass meadows observed along an 80m transect in a southeasterly direction away from the first mooring block (apart from the area of scouring) appeared 'healthy' in all respects. There was no evidence of scouring between the second mooring block and the stingray anchor.

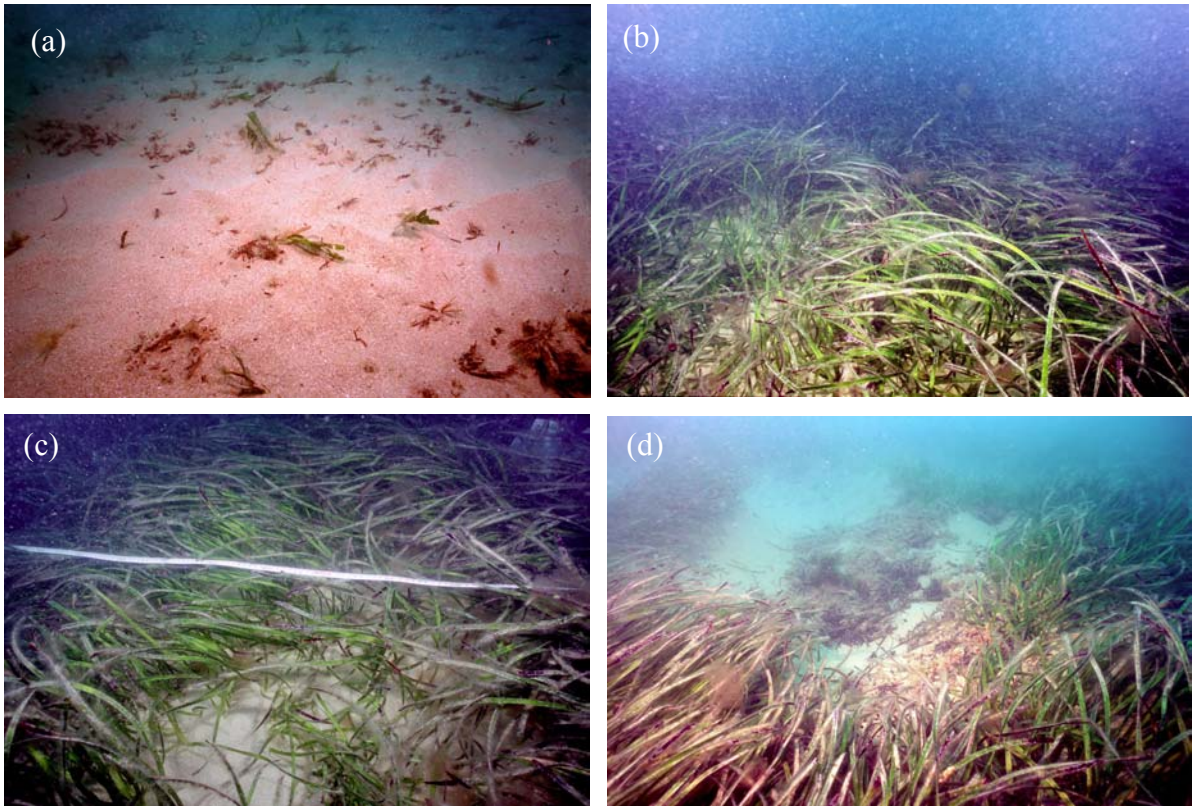

Plate 1. Cage 1 site. (a) *Amphibolis* seedlings and clumps of old *Posidonia* root mat adjacent to first mooring block; (b) *Posidonia* around mooring rope between second mooring block and stingray anchor; (c) *Posidonia* at 60m along transect; (d) 'Blowout' at 52m along transect.

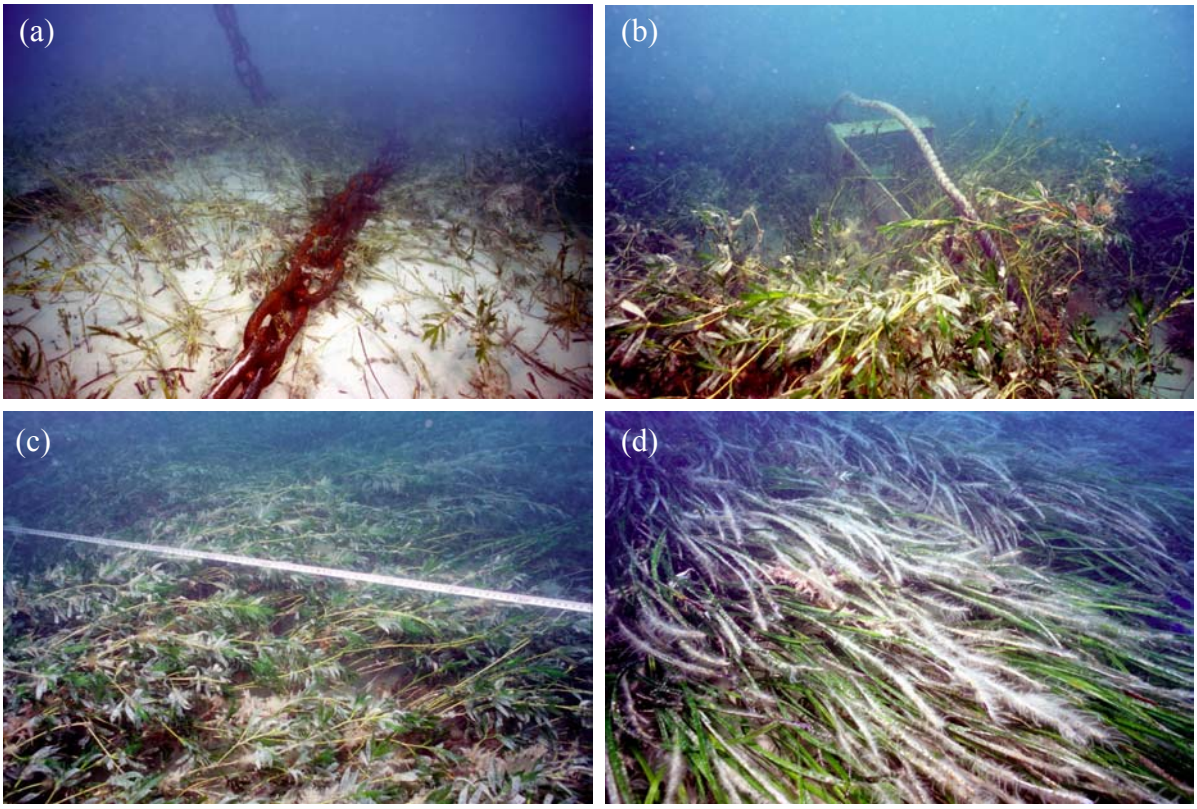

Plate 2. Cage 2 site. (a) First mooring chain dragging across bottom and scouring leaves off *Amphibolis* plants; (b) *Amphibolis* growing around stingray anchor; (c) *Amphibolis* at 21m along transect; (d) *Posidonia* with epiphytic growth at end of 80m transect.

Site: **Control 1**
Location of start of transect: 36º 54.408' S, 139º 42.961' E
Date: 21-November-2002
Time: 12.30 pm
Conditions: Slightly choppy seas. Light south-westerly wind.
Tide: Flooding.
Depth: 8.8m maximum recorded.
Dive time: 19 minutes
Underwater conditions: Approximately 5-8m visibility. Swell movement very noticeable. Some tidal movement evident.
Divers: Simon Bryars, Kane Williams

Underwater observations:
Transect: The 80m transect was laid in a southerly direction from the starting point. Approximately 70-80% cover of *Posidonia* and *Amphibolis* was observed directly under the tape measure between 0 and 80m along the transect (Plate 3a,b). There were numerous blowouts under and to the sides of the transect. The edges of these blowouts often had *Amphibolis* seedlings growing on them (Plate 3c,d). *Posidonia* and *Amphibolis* meadows in the vicinity of the entire transect appeared 'healthy' with respect to standing crop, leaf density, and epiphyte load. These meadows would normally be described as dense with low epiphyte loads. Individual clumps of *P. coriacea* were also noted near the transect.

Summary: The area appears to be quite dynamic with regard to natural blowouts and recolonisation of bare areas. Seagrass meadows were a mixture of *Posidonia* and *Amphibolis* and appeared quite 'healthy'.

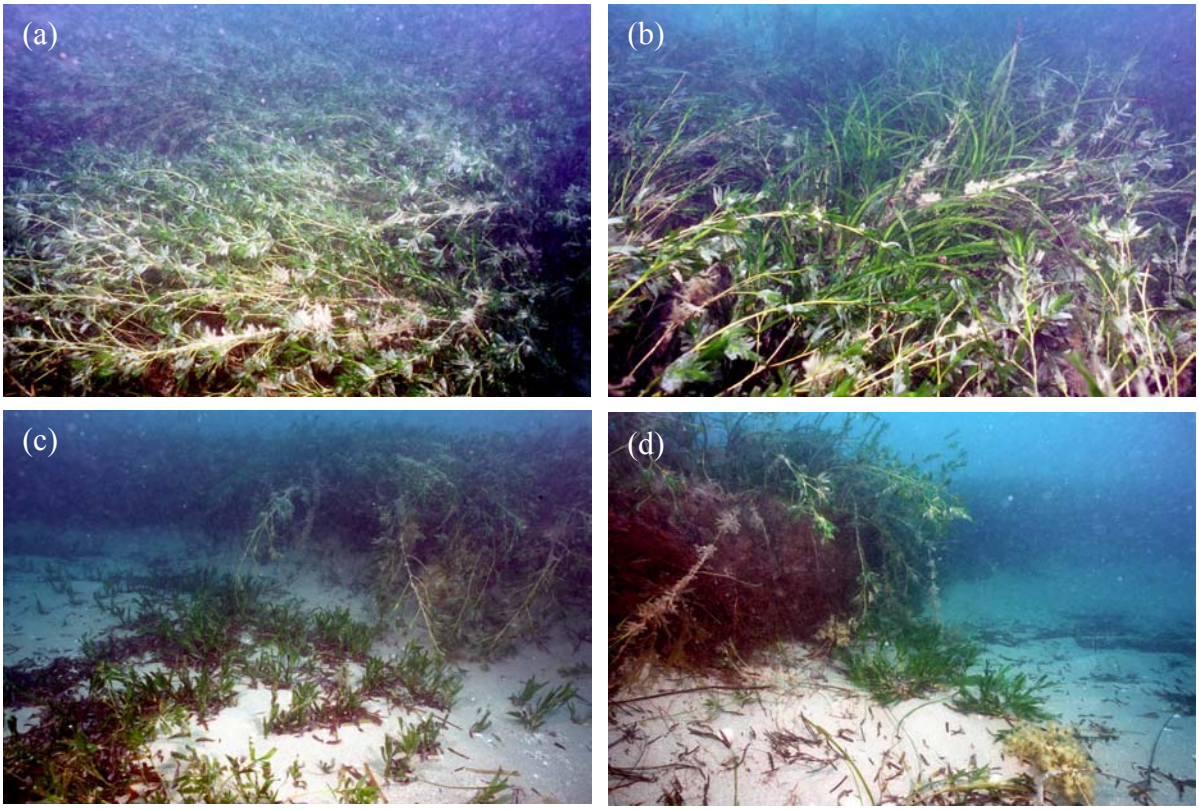

Plate 3. Control 1 site. (a) *Amphibolis* at start of transect; (b) Mixed community of *Amphibolis* and *Posidonia*; (c) *Amphibolis* seedlings at edge of a 'blowout'; (d) *Amphibolis* seedlings at edge of a 'blowout'.

Site: **Control 2**
Location of start of transect: 36º 55.260' S, 139º 41.599' E
Date: 21-November-2002
Time: 2.30 pm
Conditions: Slightly choppy seas. Light south-westerly wind.
Tide: Flooding.
Depth: 8.6m maximum recorded.
Dive time: 20 minutes
Underwater conditions: Approximately 5m visibility. Swell movement very noticeable. Some tidal movement evident.
Divers: Simon Bryars, Kane Williams

Underwater observations:
Transect: The 80m transect was laid in a southerly direction from the starting point. Approximately 80-90% cover of *Posidonia* and *Amphibolis* was observed directly under the tape measure between 0 and 80m along the transect (Plate 4a,b). There were several blowouts under and to the sides of the transect (Plate 4c). *Posidonia* and *Amphibolis* meadows in the vicinity of the entire transect appeared 'healthy' with respect to standing crop, leaf density, and epiphyte load. These meadows would normally be described as dense with low epiphyte loads. However, the epiphyte load on the *Posidonia* at this site was more visually noticeable (Plate 2b) than at the Cage 1, Cage 2, and Control 1 sites. Individual clumps of *P. coriacea* were also noted near the transect (Plate 4d).

Summary: The area appears to be quite dynamic with regard to natural blowouts. Seagrass meadows were a mixture of *Posidonia* and *Amphibolis* and appeared quite 'healthy'.

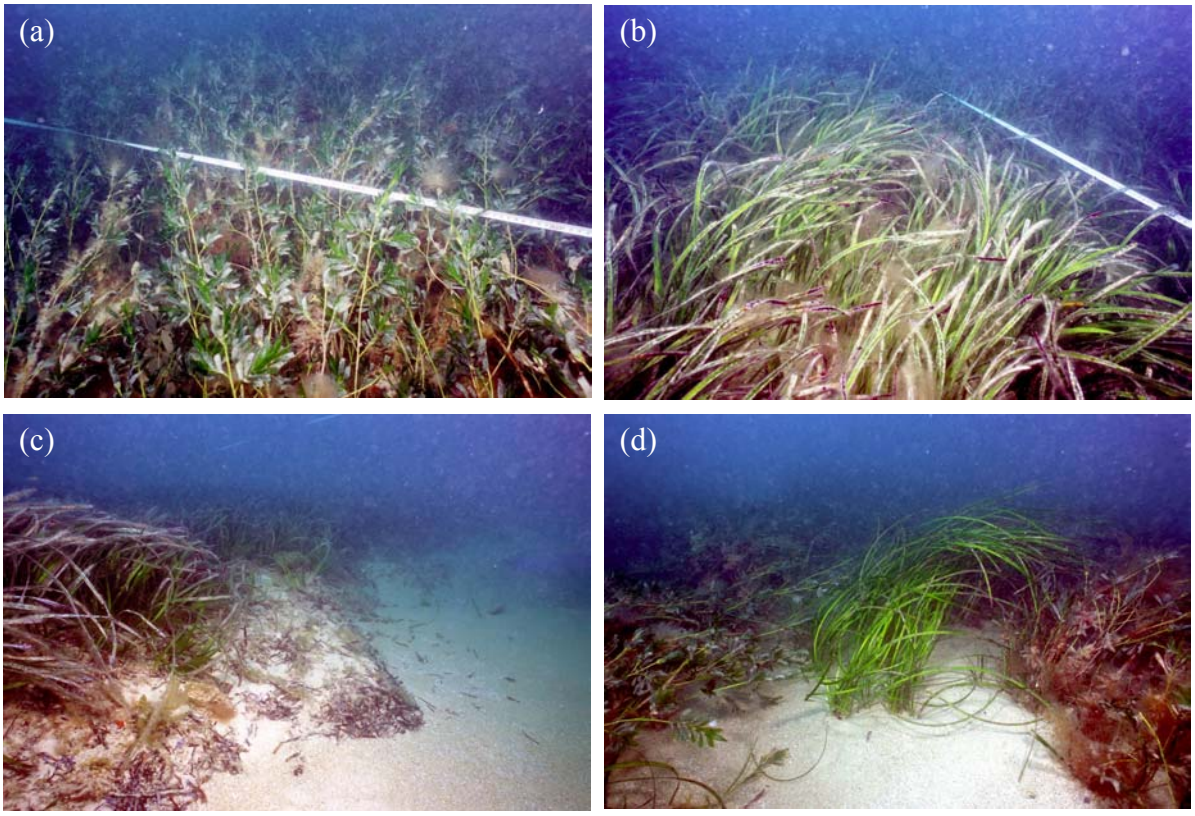

Plate 4. Control 2 site. (a) *Amphibolis* at 40m along transect; (b) *Posidonia* with epiphytic growth; (c) Edge of a 'blowout'; (d) *Posidonia coriacea*.

Site: **Disused boat mooring**
Location: Adjacent to Cape Jaffa jetty (Latitude and Longitude not recorded)
Date: 21-November-2002
Time: 3.30pm
Conditions: Slightly choppy seas. Light south-westerly wind.
Depth: 2.6m maximum recorded.
Dive time: 12 minutes
Underwater conditions: Approximately 8m visibility. Calm.
Divers: Simon Bryars, Kane Williams

Underwater observations:

Three distinct zones were observed around this mooring: an area of bare sand closest to the point where the mooring chain left the bottom; an area adjacent to the bare area that was apparently being recolonised; and an area outside of these two areas that consisted of dense *Posidonia* meadows. When the sand in the bare area was fanned away a *Posidonia* root mat was revealed, providing evidence that at least some of the bare area was due to seagrass loss and was not entirely a naturally bare area. There was some evidence of *Posidonia* rhizome spreading and growth at the easterly edge of the bare zone. The zone of apparent recolonisation was characterised by *Amphibolis* seedlings and several algal species including the green alga, *Caulerpa cactoides* (Plate 5a,b). There was also some evidence of regrowth of *Posidonia* from old root mat in the recolonisation zone (Plate 5c). The length of mooring chain that lay on the seabed was surrounded by *Posidonia* (Plate 5d). However, during the dive it was observed that the disused mooring chain was beginning to move and scour this seagrass due to the weight of the vessel tied to it for this diving operation.

Summary: There was evidence that the site had been impacted by scouring in the past. There was some evidence of seagrass recolonisation and recolonisation by algal species in what was believed to be a previously impacted area. It was apparent when cruising around the nearshore Cape Jaffa region that most boat moorings had an area of bare sand adjacent to them; probably as a result of seagrass scouring.

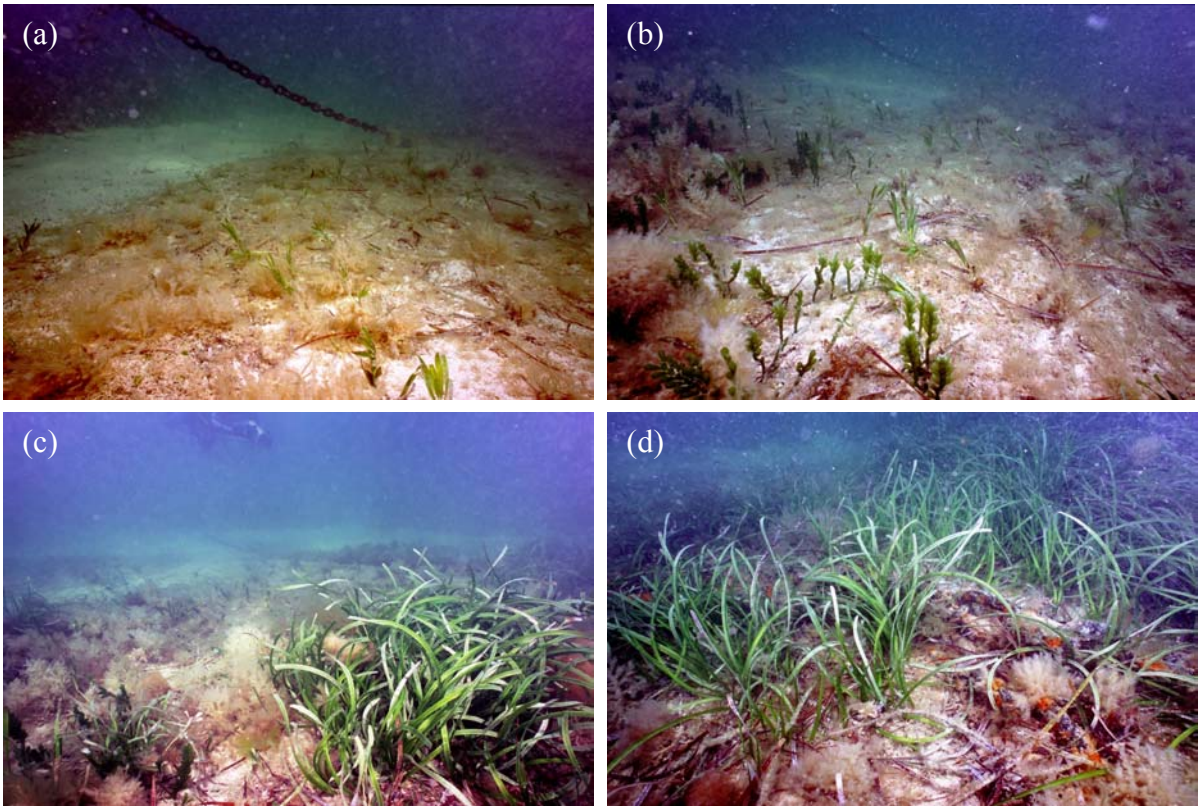

Plate 5. Disused boat mooring site. (a) 'Recolonisation Zone' with *Amphibolis* seedlings and algae (note mooring chain in background); (b) 'Recolonisation Zone' with *Amphibolis* seedlings and *Caulerpa cactoides* (note mooring chain in background); (c) Edge of 'recolonisation zone' showing possible regrowth of *Posidonia*; (d) *Posidonia* growing around mooring chain on seabed.

Discussion and Conclusions

Scouring

Localised small areas of scouring were observed around the first mooring blocks at the two cage sites inspected. This was most likely due to the first mooring chain dragging on the bottom during times when cages change direction suddenly or the water is slack. It is likely that similar areas of scouring have also occurred at the other 10 cages. However, these areas of impact need to be put into perspective when compared to the number of vessels with mooring chains adjacent to the Cape Jaffa jetty that are also probably causing damage to seagrass. There are at least 15 moorings in this area and it is evident that seagrass scouring has occurred around most of these. Nonetheless, there is still potential to decrease the amount of seagrass scouring at the sea cage moorings through improved engineering. One possible technique might be the attachment of floats to the first mooring chain so that it is raised off the seabed during times of slack water movement.

A current practise at Cape Jaffa is to periodically lift, inspect, and re-deploy moorings. During this procedure the vessel may drift and the moorings may not necessarily land in the same location (D. Peel, personal communication). This means that the impacts of scouring by the first mooring chain are not limited to one permanent area per cage, but there may in fact be several areas of impact that have occurred over the years. From cruising around in a boat between the Cape Jaffa jetty and the aquaculture lease sites during calm and clear conditions on the field trip (and from diver observations), it is apparent that the seabed in this region is not 100% seagrass, but rather it is a mixture of seagrass and sand patches. Due to the patchy nature of seagrass in the Cape Jaffa region and without any data before finfish farming commenced, it would be difficult to determine any broadscale impacts of scouring by finfish farming in the lease areas versus outside of the lease areas. Nonetheless, it may be preferable to install permanent mooring blocks so that the impacts of any future scouring are limited to one area.

Based upon the limited observations of the present study it appears that the Cape Jaffa area is quite dynamic with regard to seagrass loss (presence of natural blowouts) and seagrass recolonisation (*Amphibolis* seedlings were noted at most sites in impacted areas and in natural blowouts). Blowouts are usually found in areas with swell action on the seabed; conditions that are apparent at Cape Jaffa based on observations while diving and the presence of *P. coriacea* which prefers areas of relatively high wave energy (Kuo and Cambridge 1984). A scenario of *Posidonia* loss and *Amphibolis* recruitment into blowouts has also been documented on the Adelaide metropolitan coastline (Shepherd and Sprigg 1976). Therefore, based upon the apparent recolonising potential of *Amphibolis* into disturbed areas, it is quite possible that seagrass will recolonise areas at Cape Jaffa that have been scoured by mooring chains. Indeed, *Amphibolis* seedlings were noted in the scoured area at the Cage 1 site. It is also possible that *Posidonia* will regenerate from the intact root mat remaining in areas where scouring has occurred. It is unknown, however, if scoured areas will progress into deep blowouts.

Eutrophication and Sedimentation

Based upon a visual assessment of seagrass standing crop, leaf density, and epiphyte load, and the presence of sediments on seagrass, there was no evidence to suggest that any eutrophication or sedimentation was occurring at the two cage sites when compared to the two control sites or to what would be expected in a normal healthy seagrass meadow. Several factors are probably contributing to this apparently benign impact of finfish farming at Cape Jaffa:

- Fish are being fed a pellet diet which results in little wastage and they are being fed efficiently which also results in little wastage; pellet feed is expensive and it is obviously in the farmers best interests to use feed efficiently.
- The area adjacent to Cape Jaffa experiences strong wind-driven currents, moderate tidal currents (Sinclair Knight Merz 2001), and apparently swell movements also (diver observations from present study). All of these factors would help to quickly dissipate any feed or faecal wastes from the cages.

Shading

There was no evidence of the impacts of shading in the area between 50 and 70m from the first mooring block along the two transects. While this investigation was limited to a distance of 10m either side of the transect in the potential zone of impact, if shading was causing seagrass dieback it would be immediately apparent in a distinct band. The single swinging mooring set-up that is used at Cape Jaffa is probably very effective in minimising the potential impacts of shading on seagrass.

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Acknowledgments

Thanks go to Doug and Jason Peel from 'South East Atlantic Salmon' (SEAS) for background information, field assistance and boat use. Thanks also go to Kane Williams and Louisa Halliday from PIRSA for field assistance. Vic Neverauskas and Les Gray from the PIRSA Fish Habitat Program made useful comments on a draft version of this report.

Appendix G

Liquefaction Assessment

A4222/1-AE BJH
8 June 2005

Tonkin Consulting
5 Cooke Terrace
WAYVILLE SA 5034

Attention: Jeff Tyler

Dear Sir

RE: CAPE JAFFA MARINA

PRELIMINARY LIQUEFACTION ASSESSMENT

1. INTRODUCTION

A preliminary liquefaction assessment has been performed for the proposed Cape Jaffa Marina.

The assessment was commissioned by Mr Jeff Tyler from Tonkin Consulting in an email dated 17 May 2005.

This assessment is of a general nature and does not include detailed calculations. It is only suitable for preliminary planning purposes.

2. BACKGROUND

2.1 Geotechnical Conditions

Coffey Geosciences Pty Ltd (Coffey) has not performed any geotechnical investigations at the site. From the documents provided by Tonkin Consulting in a communication document dated 11 May 2005, it is understood that the geotechnical conditions at the site typically comprise:

- Semaphore Sand and St Kilda Formation soils near the coastal strip, overlying;
- Glanville and Bridgewater Formations.

Groundwater monitoring wells drilled by Tonkin Consulting within the Marina site (wells denoted CJ01 to CJ23) indicate that the soil profile comprises a thin topsoil layer overlying a mixture of SAND and CLAYEY SAND. Some layers of medium and high plasticity CLAY and SANDY CLAY are also present in places, generally below the groundwater level.

A layer of limestone was encountered at most groundwater monitoring well locations. The level of the top of the limestone appears to vary from about +0.6 m AHD (CJ10) to about –3 m AHD (CJ18). The top of the limestone generally appears to be within the range of –0.5 m AHD to about –2 m AHD.

Groundwater monitoring wells drilled outside the proposed Marina, in the surrounding area (denoted CJ24 to CJ31), indicate that the variation in the level of the top of the limestone ranges from about +7 m AHD to about –7.6 m AHD.

14B Henley Beach Road
Mile End SA 5031 Australia
Telephone +61 8 **8352 1744**
Facsimile +61 8 8234 0932
Email adelaide@coffey.com.au

Based on the information supplied and Coffey's previous experience, the limestone is inferred to be associated with the top of the Bridgewater or Glanville Formations. The overlying sand (and clay) layers are probably associated with the Semaphore Sand and St Kilda Formations.

No indication of the insitu relative density of the sand layers or consistency of the clay layers is indicated on the logs provided.

Particle size distribution testing performed by Adelaide Geotechnics Pty Ltd on two samples of sand from the site indicate that the sand sampled was relatively clean, with 1% or less passing the 0.075 mm sieve. The maximum particle size of the samples was 1.18 mm, indicating that the sand was predominantly fine and medium grained. Although the location and depth of the samples is not provided, it is envisaged that the samples were collected from the Semaphore Sand or St Kilda Formation.

2.2 Proposed Development

The proposed marina development appears to comprise:

- construction of a new breakwater out from the existing beach;
- excavation of a series of waterways behind the existing beach;
- construction of fixed moorings and wharf areas within the waterways;
- formation of a number of residential allotments; and
- construction of a reclaimed water winter storage dam.

Based on sketches provided, the excavated level of the new waterways is proposed to be –3.5 m AHD. The typical edge treatment for the waterways comprises:

- an excavated batter of about 1V:2.8H below RL –1.35 m AHD;
- a rip-rap revetment at an angle of about 1:1 between –0.35 m and –1.35 m AHD; and
- a near-vertical limestone block wall above –0.35 m AHD (up to +1.65 m AHD)

At wharf areas a near vertical limestone block wall would extend from –3.5 m to +2.05 m AHD.

The base of the new breakwater would be founded at –2.5 m AHD and would comprise rock armour (up to nominal 4 tonne rock) at a batter of 1V:1.5H. The central core of the breakwater would comprise material up to 0.5 tonne.

The reclaimed water winter storage dam is understood to be located directly to the east of the development boundary. The base of the dam is likely to be above the level of the top of the limestone. We understand that the dam is likely to be lined with either compacted clay or a geosynethic product.

2.3 Existing Seismicity Information

Advice provided by Tonkin Consulting from PIRSA indicates that a magnitude 6.5 earthquake was experienced in the Kingston/Beachport area in 1897. This earthquake is reported to have caused liquefaction in the area.

A magnitude 5.6 earthquake was recorded near Robe in 1948. No liquefaction is reported to have occurred as a result of this earthquake.

Liquefaction events have only twice been confirmed in Australia. The first was the 1897 earthquake mentioned above, and the other was in 1903 near Warnambool, Victoria (magnitude 5.3). No cases of liquefaction were confirmed from the 1989 Newcastle earthquake (magnitude 5.6) although there were some suggestions that liquefaction may have occurred in places.

During the 1897 earthquake in the Kingston/Beachport area spectacular sand volcanoes were reported from a number of places, and there were numerous reports of ground failure from Kingston to Robe (over a distance of 40 km) and possibly further.

Photographs of some of the ground failures indicate that the slopes that failed were probably non-engineered and were in some places immediately adjacent to water bodies.

Although information in Australia is sparse, it appears that magnitude 5.5 is about the lowest level at which liquefaction may occur, but then only at close range to the epicentre. Based on the previous experience at Beachport, widespread liquefaction can be expected around the 6.5 magnitude level.

3. PRELIMINARY LIQUEFACTION ASSESSMENT

3.1 General

Coffey has been asked to specifically comment on the potential impacts of an earthquake of similar magnitude to those described in Section 2.3 on the proposed development, including impacts on:

- waterway slopes;
- building foundation areas;
- foundations for the breakwater; and
- base of the reclaimed water winter storage dam.

3.2 Soil Susceptibility

Liquefaction is defined as the temporary loss of shear strength due to an increase in pore pressure during strong ground motion. Soils particularly vulnerable to liquefaction include very loose and loose sands, non-engineered sandy fill and silty sands below the groundwater table. Clean sands are generally more vulnerable to liquefaction than sands with a significant proportion of silty or clayey fines. Cohesive soils and soils above the watertable are less prone to liquefaction, although some settlement may occur during seismic events (particularly in loose sandy fill).

Whilst no data regarding the insitu relative density of the various layers of sand has been provided to date, from previous experience, it is expected that sands of the Semaphore Sand and St Kilda Formations may be in a very loose to medium dense condition. These soils, where they are loose and below the groundwater level, may be prone to liquefaction during strong ground motion.

The older sand layers of the Glanville or Bridgewater Formation (ie the sand layers below the upper-most calcrete or limestone cap) are often cemented and therefore are considered to be less likely to be susceptible to liquefaction.

The clay layers of the St Kilda Formation are not expected to be vulnerable to liquefaction, although significant softening and settlements could occur during strong ground motion.

3.3 Impacts on the Proposed Development

3.3.1 Breakwater Structure

Where the breakwater structure is founded on or below the uppermost layer of calcrete or limestone, the foundation soils are not expected to be susceptible to liquefaction for an earthquake with a recurrence interval of 1 in 500 years.

Due to the flexible nature and the overburden pressure provided by the breakwater, a relatively thin layer of potentially liquefiable sand below the structure is unlikely to significantly affect the overall stability of the breakwater, although some differential settlement would be expected during an earthquake.

3.3.2 Wharf Edge Treatment

Based on the information provided, the base of the limestone block wall would be below the level of the top of the limestone. As such, the foundation materials beneath the wharf walls would not be expected to be susceptible to liquefaction.

Provided the soils retained behind the wall were suitably engineered and/or reinforced, liquefaction would be expected to have relatively minor detrimental effects on the wharf walls.

3.3.3 Waterway Edge Treatment

Whilst the base of the waterway (-3.5 m AHD) will probably be below the top of the limestone, and hence below the likely zone of liquefaction, loose sandy soils may be exposed in the submerged batters and beneath the limestone block wall shown in the typical waterway edge treatment. Submerged loose sandy soils may be prone to liquefaction (as discussed in Section 3.2).

Where loose sandy soils are encountered beneath the limestone block wall, ground improvement works are expected to be required. Such works could include over-excavation and replacement with select granular fill (possibly reinforced), insitu densification or the adoption of flatter slopes.

Geotechnical investigations and a further assessment would be required during detailed design to assess the risk of liquefaction and the need for any ground improvement works.

3.3.4 Building Foundation Areas

Liquefaction of sandy soils below the groundwater level under the building allotments may occur depending on the geotechnical characteristics of the sand. A detailed geotechnical assessment of the proposed residential area will be required to assess the extent of potentially liquefiable soils.

Liquefaction of a zone of soil which is expected to be about 3 m below the founding level of a residential structure may not necessarily present a significant risk to the structure, especially if the structure is flexible and supported by a stiffened raft footing system. This would also need further assessment during detailed design.

The subsurface conditions for the building areas at the marina are expected to be similar to the conditions along large parts of the South East coastline where building development has previously occurred without measures to mitigate the effects of liquefaction.

3.3.5 Reclaimed Water Winter Storage Dam

It is understood that the founding levels for the reclaimed water winter storage dam will be above the limestone layer.

If loose sands below the groundwater level are present beneath or in the sides of the dam, engineering treatment of the foundation soils may be required to prevent liquefaction beneath the dam.

Further assessment would be required during detailed design.

4. SUMMARY

Based on the available geotechnical and seismic information, it would be reasonable to expect that a liquefaction hazard could exist in the loose, saturated near surface sands (Semaphore Sand or St Kilda Formation). The extent of potentially liquefiable soils would need to be assessed as part of the detailed geotechnical investigation.

None-the-less if such a hazard exists it is expected that mitigation measures could be reasonably included in the development. Such measures would be assessed as part of the detailed design and include:

- insitu ground improvement techniques;
- the use of a stiffened raft footing system (rather than isolated strips and pads) for buildings;
- the use of a piled footing system, with lateral connections to reduce differential lateral displacement, for heavily loaded or settlement sensitive structures;
- incorporating flexibility and ductility in to underground services, particularly at joints and connections;
- improving the edge zones of fill or cut batters by providing set-backs for structures, insitu ground improvement of soils to reduce the risk of lateral spreading, excavation of unsuitable materials or the provision of geogrid reinforced slopes;
- the provision of a stiff, well compacted engineered fill mat on top of any potentially liquefiable soils.

Should you require clarification of any aspect of this preliminary assessment, please contact either Brenton Harris or the undersigned.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

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CONTRIBUTORS

- Cobb, Michael – B.Sc.(Hons) Principal Hydrogeologist, Water Search Pty Ltd.
- Dimos, Alexandra – BEng. (Hons) Geological, Hydrogeologist, Soil & Groundwater Pty Ltd.
- Fey, A – Word Processing/Production, MasterPlan SA Pty Ltd.
- Gabb, R - Engineer/Project Manager, B.Eng. Mech. (Hons), Lucas Earthmovers Pty Ltd.
- Hudson, P –B.Ec, Grad Dip Accounting, Economist, Director, Hudson Howells
- Jacobi, Drew – BEng. (Civil/Environmental) (Hons), Senior Engineer, Tonkin Consulting.
- Kirkman. H – B.AgSc. M.Ag.Sc. Ph.D.,Marine Ecologist
- Lightbody, Paul - BEng, MEngSc, MIEAust CPEng, Director,Tonkin Consulting.
- Lucas, B – Design/Construction Engineering, Principal Lucas Earthmovers Pty Ltd.
- Lucas, D – Design/Construction Engineering, Principal Lucas Earthmovers Pty Ltd.
- Maxted, H – Graphic Design/Mapping/Production/IT.
- Minervini, L – Word Processing/Production, MasterPlan SA Pty Ltd.
- Passfield, Glenn – Beng. (Civil/Environmental) (Hons), MIEAust CPEng, Senior Engineer, Tonkin Consulting.
- Patterson, Dean – Beng. BSc DipHE (DELFT) MEngSc MIEAust, Director, WBM Oceanics Australia.
- Playfair, Roger – Bachelor of Applied Science in Natural Resources, Graduate Diploma of Natural Resources, Principal, RMP Environmental Pty Ltd.
- Polley, Niki – Beng. (Environmental) (Hons), BSc (Chemical), MIEAust, Project Engineer, Tonkin Consulting.
- Purton, Chris - FRMIT, DipMet, MEnvSt, Senior Scientist, Meteorology/Hydrology, Tonkin Consulting.
- Salt, Melissa - BScAgr (Hons) Soil Science, CPSS, Project Scientist.

- Schinkfield, K - Production/Editorial, Lucas Earthmovers Pty Ltd.
- Stone, H – Production/Editorial.
- Tanner, Dr Jason - PhD PGDipSci BSc(Hons), Program Leader Environment and Ecology, SARDI.
- Tonkin, S – Planner, Fellow PIA, BA Planning Director MasterPlan SA Pty Ltd.
- Tyler, Jeff - BEng Civil (Hons), MIEAust CPEng, Senior Engineer, Tonkin Consulting.