Spencer Gulf Port Link

SPENCER GULF PORT LINK

Port Bonython Bulk Commodities Export Facility

RESPONSE TO SUBMISSIONS

FINAL

JANUARY 2014

Contents

Appendix B

WBM Report

Appendix C

Oil Spill Contingency Plan

1 Introduction

An Environmental Impact Statement (EIS) was released in October 2013 for the proposed Bulk Commodities Export Facility (BCEF) to assess the environmental, social and economic impacts associated with its construction and operation. The BCEF will export up to 50 million tonnes of iron ore per annum with an estimated capital value $663 million.

The Project consists of:

- A 17.5km railway spur from the existing Whyalla to Port Augusta rail line
- A 6.1km rail loop at the facility end of the rail spur
- An onshore bulk ore handling and storage facility
- A 3km long jetty with deep water access.

The proposal was declared a Major Development under the provisions of Section 46 of the Development Act 1993 in March 2012, and it was determined that an appropriate form of assessment was required by the Development Assessment Commission (DAC). The EIS was prepared in response to Development Assessment Guidelines issued by DAC in August 2012.

The EIS was released for public comment in October 2013, and was made available for a period of six weeks.

A total of 34 submissions were received. Submitters included government agencies (state and local government), community groups and private individuals.

1.1 Report Purpose

The proponent (Spencer Gulf Port Link) was directed to prepare a Response to Submissions Report (RSR) to address the submissions received on the EIS. Whilst the main purpose of the RSR is to formally respond to issues raised in these submissions, it also provides:

- An update on any project changes since the release of the EIS
- Documentation of any relevant legislative and policy changes since the release of the EIS.

1.2 Response to Submissions Process

Under Section 46B of the *Development Act 1993*, the proponent is required to provide a written response to all submissions provided to the proponent and provide a response to the Planning Minister. The Minister must then prepare an Assessment Report that sets out the Minister’s assessment of the Project and their comments on the EIS, any submissions made, comments provided by government authorities and the proponents response.

The Assessment Report will be made available to the public for inspection, however there is no further opportunity to comment accommodated within the Development Act.

1.3 Consultation and Public Exhibition

The *Development Act 1993* requires an EIS to be publically exhibited for a period of at least 30 business days, and for a public meeting to be held during this period.

The EIS was made available from the 3rd October to the 18th November 2013, a period of six business weeks. This is a longer period than the 30 days minimum required under the Act. It was available for viewing for the duration of the submission period at the following locations:

- Online at spencergulfportlink.com.au and www.sa.gov.au
- On CD by contacting the Department of Planning, Transport and Infrastructure (DPTI)
- In hard copy at:
  - DPTI, level 5, 136 North Terrace, Adelaide
  - South Australian State Library, Kintore Avenue, Adelaide
  - Whyalla City Council, Civic Building, Darling Terrace, Whyalla
  - Whyalla Library, Elkhorn Street, Whyalla.

Hard copies were also made available for purchase by DPTI. Other libraries (Barr Smith (University of Adelaide) library, the Flinders University library, the State library and the Mortlock Library) also received copies of the EIS for catalogueing, although these were not publically displayed.

A public meeting was held by DAC on the 29th October 2013 at the Westlands Hotel/Motel, 100 McDouall Stuart Avenue, Whyalla Norrie. At the meeting, DPTI provided an overview of the EIS assessment process, whilst the proponent (SGPL) gave a presentation on the major EIS findings. The meeting concluded with time for questions and answers from the floor, facilitated by DAC.

1.4 Approach to Submission Response

From the 3rd October, submissions regarding the BCEF EIS were accepted by DPTI, and provided to the proponent in a consolidated set following completion of the public consultation period. These submissions are included in Appendix A of this report.

Each submission received on the EIS was reviewed individually and any comments, requests for further information or concerns were documented and any common issues were collated. Many of the submissions contained similar issues and were therefore grouped collectively for response.

Each separate topic or issue raised has been responded to in Section 2.0, with the issue raised, submitter that raised the issues and a response provided. In summary, the RSR is structured as follows:

- **Section 1** provides an overview of the EIS exhibition process and submissions received
- **Section 2** provides responses to each of the key issues raised in the individual submissions received.

1.5 Submissions Received

A total of 34 submissions were received comprising ten submissions from government, one submission from the City of Whyalla and the remainder from the community and stakeholders. Table 1 summarises the responses received and the key issues raised. The table assigns an issue to a key topic (with similar topic breakdowns as those presented in the EIS); some issues may cross over several topics and are dealt with in more detail in Section 2.0 of this report where this is the case.

Table 1: Submissions received and the key issues raised

Submitter Number	Organisation/Name	Project Description	Land use and Planning	Water Resources	Noise and Vibration	Air Quality	Terrestrial Ecology	Transport	Visual Amenity	Socio-Economic	Cultural heritage	Climate change &	Coastal Processes and	Marine Ecology	Sustainability	Hazard and Risk	Environmental Management	Cumulative Impacts
1	Department of Planning, Transport and Infrastructure (transport division)							✓					✓					
2	Department of Planning, Transport and Infrastructure (Marine Services)												✓					
3	Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE), Strategic Policy Division											✓						
4	South Australian Tourism Commission													✓				

Submitter Number	Organisation/Name	Project Description	Land use and Planning	Water Resources	Noise and Vibration	Air Quality	Terrestrial Ecology	Transport	Visual Amenity	Socio-Economic	Cultural heritage	Climate change &	Coastal Processes and	Marine Ecology	Sustainability	Hazard and Risk	Environmental Management	Cumulative Impacts
5	South Australian Water Corporation			✓														
6	City of Whyalla		✓		✓				✓	✓			✓	✓				
7	Department of Primary Industries and Regions SA (Fisheries and Aquaculture)												✓	✓				
8	South Australian Environmental Protection Agency	✓	✓	✓	✓	✓							✓					
9	Minister for Sustainability, Environment and Conservation		✓										✓					
10	Department of Environment, Water and			✓			✓							✓			✓	

Submitter Number	Organisation/Name	Project Description	Land use and Planning	Water Resources	Noise and Vibration	Air Quality	Terrestrial Ecology	Transport	Visual Amenity	Socio-Economic	Cultural heritage	Climate change &	Coastal Processes and	Marine Ecology	Sustainability	Hazard and Risk	Environmental Management	Cumulative Impacts
	Natural Resources																	
11	Department of Further Education, Employment, Science and Technology									✓								
12	[redacted]		✓									✓	✓	✓	✓			✓
13			✓										✓	✓				
14						✓												
15										✓								
16				✓	✓	✓								✓		✓		
17			✓					✓										

Submitter Number	Organisation/Name	Project Description	Land use and Planning	Water Resources	Noise and Vibration	Air Quality	Terrestrial Ecology	Transport	Visual Amenity	Socio-Economic	Cultural heritage	Climate change &	Coastal Processes and	Marine Ecology	Sustainability	Hazard and Risk	Environmental Management	Cumulative Impacts
18	[redacted]									✓				✓				
19			✓							✓								✓
20													✓					
21		✓	✓					✓	✓									
22			✓		✓			✓	✓				✓					✓
23			✓										✓					
24			✓										✓	✓				
25			✓										✓	✓				
26			✓										✓	✓				
27		✓	✓										✓	✓				

Submitter Number	Organisation/Name	Project Description	Land use and Planning	Water Resources	Noise and Vibration	Air Quality	Terrestrial Ecology	Transport	Visual Amenity	Socio-Economic	Cultural heritage	Climate change &	Coastal Processes and	Marine Ecology	Sustainability	Hazard and Risk	Environmental Management	Cumulative Impacts
28	[redacted]										✓		✓	✓				
29		✓					✓						✓	✓				✓
30			✓				✓		✓		✓							✓
31			✓									✓	✓					
32			✓										✓	✓				
33			✓										✓	✓				✓
34			✓				✓						✓	✓				✓

1.5.1 Summary of Key Issues

The most commonly raised issues are summarised in Table 2. This report addresses all submissions received, with Table 2 simply highlighting the main issues raised by quantity to provide perspective on key issues to be addressed.

Table 2: Most Commonly Raised Issues

Number of Submissions that raised issue	Issue	Detail	Location in the Response to Submission Report
20	Alternate project location	A majority of public submitters were concerned about the impact of the project on water quality, the Giant Australian Cuttlefish and the impact of the project on the recreational and tourism values of the Point Lowly Peninsula. Alternative locations were suggested, with most favouring an alternative site south of Whyalla.	1.6
18	Water quality and turbidity	Submitters were concerned about the potential for the project to generate excessive sediment (from construction piling and vessel propeller wash), and the subsequent impact this may have on the marine environment.	2.11, 2.12
15	Government decision making processes	Insufficient time was allowed for review of the EIS and the allowance of only one public meeting was not satisfactory. Submitters also expressed concern that there is no opportunity for comment on the Response to Submission Report or the Assessment Report.	1.6
15	Impacts to the Giant Australian Cuttlefish	Many submitters were concerned about potential impacts on the Giant Australian Cuttlefish and its habitat as a result of the Project. In particular, concerns were related to underwater noise, introduction of pest species, potential oil spills, increased turbidity and vessel movement.	2.12
6	Oil Spills	Despite the control measures outlined in the EIS, submitters were still concerned about the potential for the Project to	2.11

		increase the risk of oil spill, and the impacts this may have should it occur on the marine environment. Further information was also requested on management measures and plans to be put in place and whether these reflected learnings from historical oil spills in the Spencer Gulf.	
6	Shipping congestion and navigation in tidally-constrained waters	Submitters have noted that navigation is constrained in shallower areas of the Gulf, with vessel movement being tidally dependent in some areas. Their concern is that could cause congestion in some areas and increase the risk of collision or grounding of vessels as well as increasing turbidity.	2.11
5	Visual impact of storage sheds and conveyors	Submitters were concerned at the size and visual impact of the proposed iron ore storage sheds and conveyors. They expressed concern about how this would contribute to the perception of Point Lowly as an industrialised area and the impacts on recreational/tourist usage.	2.8
5	Cummulative Impact	Submitters raised concerns that the environmental planning reports for the Port Bonython Fuels and Arrium (Whyalla port) projects were not made available to the proponent. They questioned the validity of the cumulative impact assessment without this information.	2.16
5	Impacts on the Upper Spencer Gulf Marine Park	Concerns were raised about the Project being located within the Upper Spencer Gulf Marine Park and how this impacted the Management Plan.	2.2
4	Marine Monitoring	Further information was sought on the marine ecology and water quality monitoring proposed.	2.11
4	Marine pests	Further information was sought on the management of marine pests and measures for limiting their introduction to the Project area	2.11, 2.12

4	Ship Strike	Submitters were concerned about the increased risk of ship strike on Whales and other marine fauna	2.12

1.6 Matters not Addressed in this Report

A number of sumbissions were made on matters that are not within the jurisdiction of the proponent as they were either subject to government regulation or policy that is outside the Proponents control or not required to be addressed in the EIS Guidelines. These are summarised below, and are not addressed further in this RSR.

Alternative Project Location

The proposed development is for a location named the Port Bonython Bulk Commodities Export Facility adjacent the existing Pt Bonython facility, Eyre Peninsula. The purpose of the EIS, as outlined in the Guidelines is ‘an assessment of environmental (biological and physical), social and economic effects associated with the development and the means by which those effects can be managed’. Therefore, whilst the EIS does provide some consideration of project alternatives, it is not the purpose of the document to assess the advantages or disadvantages of other possible locations for an iron ore export facility in the Spencer Gulf.

A number of submitters have requested that a strategic assessment be undertaken that examines a preferred location for an iron ore export facility within the Spencer Gulf, looking at all possible options. Such a study is not the role of the SGPL (but rather the South Australian Government) and therefore submissions that comment on the benefits of an alternative location have not been further addressed. Any further communications about the site selection process should be directed to DPTI or an elected representative. Proponents of alternative locations will be required to prepare their own environmental assessment, in line with the requirements of the Development Act.

Government Process

A number of submitters questioned the adequacy of the EIS decision making process, in particular, the time given to review the EIS and the inability of the public to comment on this report and the Assessment Report provided by the Planning Minister.

The *Development Act 1993* establishes the planning and development system framework for the assessment of major projects in South Australia. The EIS process is governed by the legal requirements set out by Act which establishes requirements for consultation, decision making timeframes and roles of the Planning Minister and Development Assessment Commission in assessing applications.

The DAC and the Minister must abide by these legal requirements. The decision-making process for the Port Bonython BCEF has been compliant with the requirements of the Act.

Industrialisation of the Point Lowly Peninsula

A number of submitters have expressed concern about the use of the Point Lowly Peninsula for industrial purposes, and advocate it being set aside for recreation and tourism purposes for the residents of Whyalla and visitors.

The Point Lowly Peninsula where the development is proposed is currently zoned for industrial purposes. The BCEF is consistent with the objectives of this zoning. Any proposed changes to other purposes (e.g. recreation or tourism purposes) is a decision for the State and local Governments and is not within the jurisdiction of the proponent.

Whilst the proponent is conscious of these concerns, it does have confidence that industrial and recreational activites can coexist at Point Lowly and the proposed development does not restrict its use for non-industrial purposes. The BCEF does not restrict access to coastal and marine areas currently utilised by the public (with the exception of a small exclusion area around the jetty (refer to Figure 1)). Public access to the Cuttlefish breeding zone for divers will also be retained, with relocation of the Cuttlefish viewing platform to a new location in consultation with Council and stakeholders. It is acknowledged that there will be some level of impact on visual amenity, as discussed further in Section 2.8. Extensive mitigation measures have been proposed to minimise disturbance to coastal processes and fauna and flora habitats.

1.7 Additional Assessment Work

In response to feedback received during consultation with project stakeholders and the Public Meeting, further modelling work has been undertaken to clarify the potential impact of propeller wash on marine water quality and the surrounding sensitive receivers. This work is summarised in Section 2.11.6 and the full report is contained in Appendix B.

1.8 Design Amendments

It has not been necessary to make any changes to the concept design and drawings provided in Appendix E1 of the EIS, based on the submissions received. Comments received on the Concept Design will be taken into account during the detailed design phase, as outlined in Section 2.0 of this report.

2 Submission Responses

The following section provides a detailed response to all issues raised by submitters.

2.1 Project Description

2.1.1 Design of the Proposed Grade Separation at Port Bonython

Issue: Further information on the proposed location and design of the grade separation on Port Bonython Road is required.

Submitter: 1

Response: A grade separated crossing has been provided for at the intersection of the rail line with Port Bonython Road between False Bay Road and Cuttlefish Drive. The concept design drawings for this structure are included in Appendix E1 of the EIS. A nominal three passively protected level crossings will be installed between the existing ARTC network and the balloon loop to permit local access over the railway to adjacent properties. The exact location and design of these crossings will be developed during the detailed design phase in consultation with relevant property owners and DPTI and will meet all relevant standards.

2.1.2 Location of the On-shore Support Facility at Whyalla

Issue: The submitter has requested that the location of the on-shore support facility at Whyalla be clarified.

Submitter: 8

Response: The support facility will be located at the Arrium Wharf should approval be granted, and commercial arrangements with Arrium be agreed, for use of their facilities.

2.1.3 Port Users

Issue: The EIS is unclear as to which mines are considered to be potential customers for the proposed BCEF.

Submitter: 17

Response: The Port is intended to be a multi-user facility, available to all miners who wish to use it. Upon approval of the Project (should approval be granted), negotiations with potential port users can commence, but are presently not finalised. Figure 1.7b of the EIS provides a map of potential iron ore mines that could potentially export from the BCEF. Each potential port user would need to obtain their own environmental approvals, which would include addressing transportation of iron ore material to the facility and any associated impacts.

2.1.4 Long Term Use of the Port

Issue: Clarify whether the BCEF be used for purposes other than the export of iron ore, and also its capacity.

Submitter: 21, 29, 30

Response: The current application relates to the export of iron ore only; the export of any other goods (e.g. copper, grain) is not included, nor has the proposed infrastructure been designed for any other purpose. There is no long-term plan for the facility to be utilised for any another purpose. Should SPGL wish to use the facility for the export of any other goods in the future however, approval from appropriate authorities would need to be sought in accordance with legislative requirements at that time.

The BCEF has been designed to cater for up to 50mtpa of iron ore to be exported and approval is sought for this volume only; it is likely to take some years before this capacity is reached. Should further capacity be required in the future, then the appropriate environmental approvals would be sought and any further works or additional export volumes would not proceed until expanded approval was granted.

2.1.5 Access to the Jetty for Researchers, Divers and Recreational Fishermen

Issue: Will the exclusion zone limit access for researchers and divers who wish to view Cuttlefish aggregation or conduct other scientific studies?

Submitter: 10, 21, 29

Response: Figure 1 shows the existing and proposed exclusion areas for the Santos and BCEF jetties. The *Harbours and Navigation Regulations 2009* outline that a person may not enter a 400m zone around the existing Santos jetty (or 1100m while loading/unloading is occurring).

The exclusion zone for the BCEF will be 50m either side of the jetty only. Whilst there is a small strip between the two exclusion zones, this will only be accessible to recreational fishing while there is no loading or unloading at the Santos jetty.

SGPL is working with maritme safety to enable access to researchers who wish to study Cuttlefish or other marine issues within the BCEF exclusion zone, subject to ensuring safety measures are met. Recreational divers will be able to dive beyond the 50m exclusion zone, which will enable full access to the Cuttlefish Habitat Protection Zone under the Upper Spencer Gulf Marine Park Management Pan.

2.1.6 Access to the Point Lowly Coastal Road

Issue: Access to the Point Lowly Coastal Road will be restricted

Submitter: 25, 27

Response: Full access for the public to the existing coastal road will be provided once the facility is operational; there will be minimal change to existing access along Cuttlefish Drive with the road realigned to allow vehicular transit under the proposed transfer conveyor.

There may be some temporary disruption to access during construction for safety reasons, and the contractor will manage this through appropriate signage and traffic management solutions throughout the construction stage, with public access to the foreshore along Cuttlefish Drive being restricted to the Western access point off Port Bonython Road up to the boundary of the construction site.

2.1.7 Concept Drawings

Issue: The Concept drawings provided in the EIS only show the infrastructure for the 25mtpa capacity. Are drawings for the full 50mtpa capacity available?

Submitter: 21

Response: Generally, the expansion from 25mtpa (Stage One) to 50mtpa (Stage Two) will be predominately provided by an increase in utilisation of the rail infrastructure and storage sheds.

The increased ultilsiation of this shore based infrastructure will enable the expansion to occur in a gradual approach however the increase in volumes above 25mtpa would eventually include construction of the following elements:

- Additional shipping berth
- Additional shipping wharf
- Second jetty conveyor
- An additional storage shed

Construction for the expansion to 50mtpa would occur while the facility is in operation.

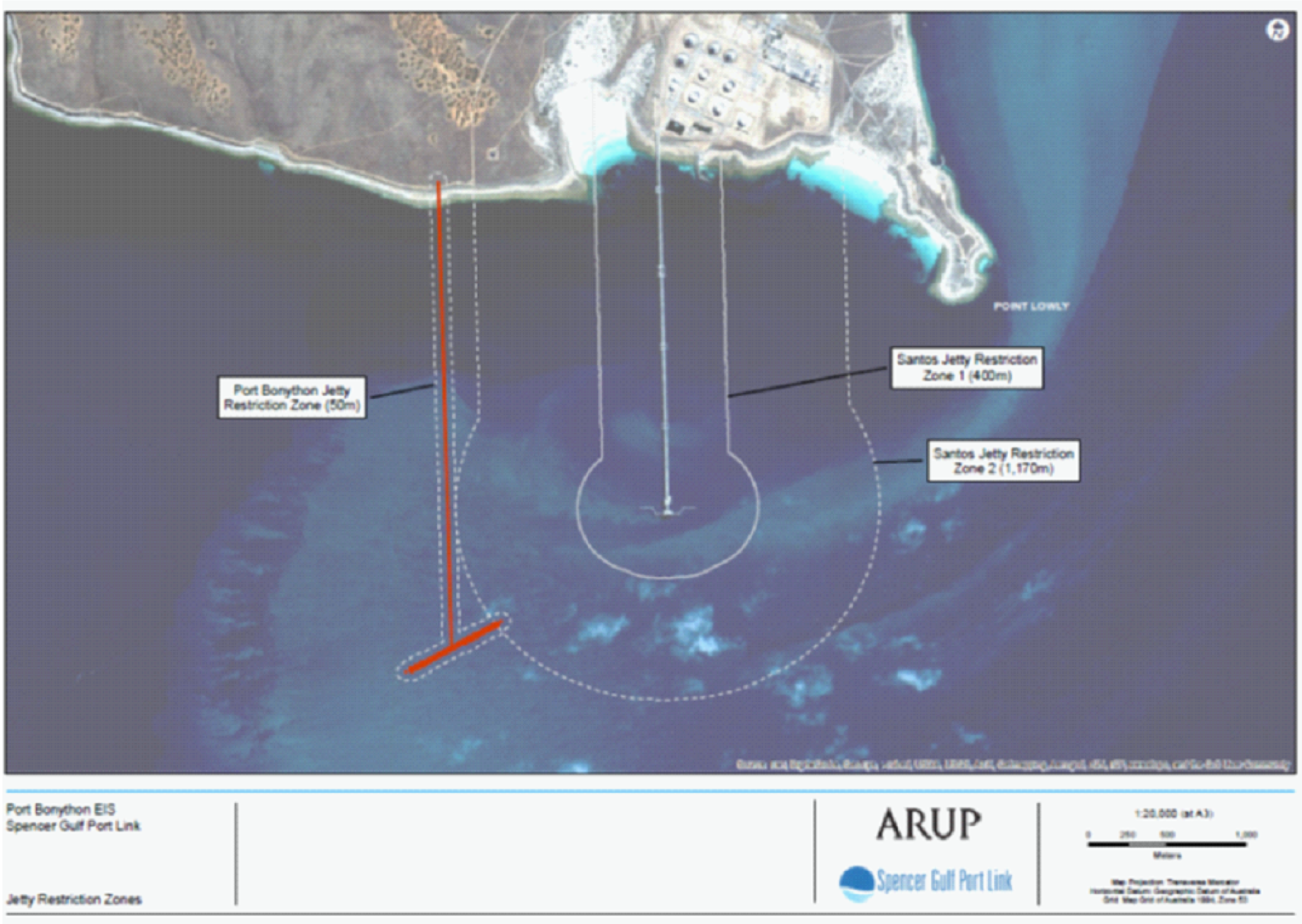


Figure 1: Jetty exclusion zones. Acess to the Zone 2 area will be available to the public when no vessel is docked at the Santos jetty.

2.2 Legislation and Planning

2.2.1 Whyalla Development Plan

Issue: Whilst the majority of the Project is located within industrial-zoned land, portions of the conveyor and port facility occur within the Coastal Conservation Zone and Land Not Within a Council Area (Coastal Waters) Development Plan of the Whyalla Development Plan. Natural elements should remain dominant to any introduced elements to conserve natural features of the coast.

Submitter: 6,22

Response: The Project has been carefully designed to avoid to the maximum extent possible areas that contain significant vegetation species or communities, cultural heritage values or interference with coastal processes. Major infrastructure (with the exception of the conveyor belt and jetty that must traverse the Coastal Zone) has been sited within industrial areas, and not within the coastal conservation zone. Whilst there is some visual impact when the Project is viewed from Cuttlefish Drive the Project has been positioned such that the main physicial elements blend in with the existing environment and are not visually prominent from heavily visited or occupied areas of Point Lowly. In addition, access to the coastline and the marine environment will be maintained. Cuttlefish Drive will remain open to the public and there is only a small area of exclusion around the jetty structure (50m either side of the jetty). This will not impact significantly on recreational use of the marine environment by the public and tourists. The existing Cuttlefish Dive platform will be moved to a nearby location in consultation with Council and stakeholders, so that visitors will still have access.

These measures will assist in protecting significant environmental and amenity outcomes sought for the coastal conservation zone.

2.2.2 Allowable Activities within the Upper Spencer Gulf Marine Park

Issue: It is unclear whether the proposed port is to be excluded from the Marine Park Boundary and subsequent implications for the USG Marine Park and Management Plan.

Submitter: 6, 9, 21, 26, 31

Response: The BCEF jetty, wharf and approach/departure channel lie within the Upper Spencer Gulf Marine Park, within Special Purpose Area (SPA) 3 (Harbour Activities), as illustrated in Figure 2. This SPA allows for the ‘activities undertaken by or on behalf of the Minister responsible for the administration of the *Harbours and Navigation Act 1993*, or a port operator, for the purposes of maintaining or improving a harbour or port’ (DEWNR, 2012).

The BCEF is therefore an allowable activity under the USG Marine Park Management Plan, and there is no requirement for an exclusion from the Marine Park Boundary. Shipping activities have been considered in the formulation of the Management Plan.

A submission by the Minister for Sustainability, Environment and Conservation (Submitter 9) confirms that the existing SPA fully supports the proposed BCEF, and no further amendments to zoning or the Management Plan are required.

2.2.3 Decommissioning Phase of the BCEF

Issue: Tenure arrangements and conditions should be put in place to ensure the site is effectively rehabilitated after the facility is no longer in use.

Submitter: 6

Response: Should the Project be approved, a lease arrangement will be agreed with the land owners (South Australian Government). It is envisaged that any lease arrangement will incorporate responsibilities for decommissioning and rehabilitation of the Project site similar to that contained within existing tenure arrangemnts for the existing infrastructure at the current privately owned port facilities in South Australia.

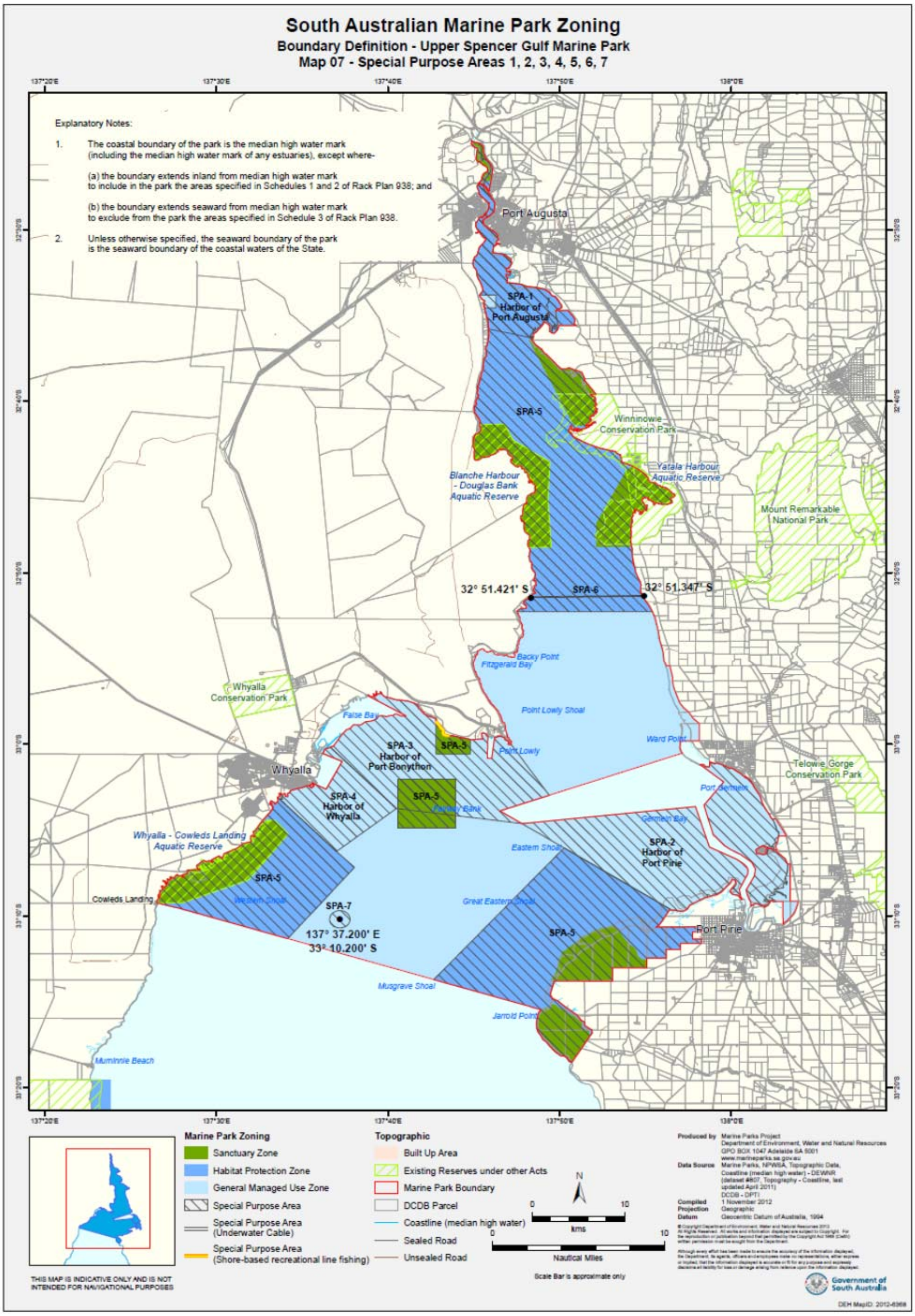


Figure 2: Map 7, Special Purpose Areas (Harbour Activities) of the Upper Spencer Gulf Marine Park Management Plan 2012 (DEWNR, 2012)

2.2.4 Licensable Activities

Issue: The EIS does not fully identify all environmental authorisations that would require a licence under the *South Australian Environment Protection Act 1993*.

Submitter: 8

Response: Chapter 3.0 (Legislation and Planning) of the EIS identifies potential planning and environmental approvals that may be required for the Project. Should the Project receive approval from the South Australian Government, such approvals will be sought prior to the construction phase commencing.

The summary of likely approvals and permit requirements provided in the EIS (Table 3.7a in Section 3.7, p99) has been updated in Table 3 to reflect comments received by the EPA on potential environmental authorisations required, as well as recent changes to Federal Government department names.

Table 3: Updated Legislative Approvals Requirements

Relevant Legislation	**Approvals and Legislative Requirements**	**Administering/Regulatory Agency**
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Permission will be required to access, search or excavate land of aboriginal significance including damaging, disturbing or interfering with an aboriginal object or remains. The Project will also require the approval of a heritage management plan, established through negotiations and agreement with all relevant aboriginal parties and regulatory agencies. The construction and operational phase of the Project will need to comply with the general duty of care provision outlined in the Act.	Department of Environment
Native Title Act 1993	The Project area lies within the Barngarla native title claim application area (NNTT No SC96/4, Federal Court No SG6011/98) however a detailed assessment of the Projects impact on Native Title Claimants is yet to occur. BCEF will use the mechanisms in the Native Title Act to address the extent, if any to which native title rights are affected by the Project. Developing a dialogue and consultation with Barngarla is a priority for SGPL, but until such consultation occurs, assessment of any impact on Native Title will be incomplete.	Commonwealth Attorney-General National Native Title Tribunal
Navigation Act 1912	Authority approval will be required for transporting bulk materials through Australian waters by shipping vessels.	Department of Infrastructure and Transport
Aboriginal Heritage Act 1988	Permission will be required to access, search or excavate land of aboriginal significance including damaging, disturbing or	Aboriginal Affairs and Reconciliation Division of the South Australian

	interfering with an aboriginal object or remains. The Project will also require the preparation and approval of a heritage management plan, established through negotiations and agreement with all relevant aboriginal parties and regulatory agencies. An application will need to be made to the Minister under Section 12 and Section 23 of the *Aboriginal Cultural heritage Act 1988.* The construction and operational phase of the Project will also be required to comply with the general duty of care provision outlined in the Act.	Department of Premier and Cabinet
Climate Change and Greenhouse Emissions Reduction Act 2007	The proponent may enter into an agreement with the State or be conditioned to meet specified thresholds/targets relating to greenhouse emissions.	Department of Environment and Natural Resources
Coastal Protection Act 1972	The Project requires referral to the Coastal Protection Board for assessment for undertaking works on the coastline	Department of Environment and Natural Resources
Environment Protection Act 1993	The Project will require an environmental authorisation in the form of a licence under the EP Act. The licence will likely be granted subject to particular construction and operational conditions aimed at minimising environmental impacts. Authorisation for and ongoing licensing of these activities may be required from the EPA under Schedule 1 of the EP Act depending on the final design and construction methodology; these include: - Activity 7 (1) – Bulk Shipping Facilities (exceeding 100 tonnes per day) - Activity 2 (5) - concrete batching exceeding 0.5cubic metres per production cycle - Activity 1 (1) – chemical storage and warehousing facilities - Activity 1 (5) – Petroleum Production, storage or processing works or facility	Environmental Protection Authority (South Australia)

	- Activity 8 (2) – Fuel Burning - Activity 7 (2) – Railway Operations	
National Parks and Wildlife Act 1972	A permit may be required to remove or damage native plants or interfere with protected animals.	Department of Environment, Water and Natural Resources
Native Title (South Australia) Act 1994	The Project area lies within the Barngarla native title claim application area (NNTT No SC96/4, Federal Court No SG6011/98) however a detailed assessment of the Projects impact on Native Title Claimants is yet to occur. BCEF will use the mechanisms in the Native Title Act to address the extent, if any to which native title rights are affected by the Project. Developing a dialogue and consultation with Barngarla is a priority for SGPL, but until such consultation occurs, assessment of any impact on Native Title will be incomplete.	Attorney-General, linked through National Native Title Tribunal
Native Vegetation Act 1991	Approval from the Native Vegetation Council is not required for the clearance of native vegetation, as the clearance is proposed under Regulation 5(1)(c) - Development subject to Section 48 – Development Act 1993 (as the proposed Project has been declared to be of such social, economic or environmental importance requiring an EIS) Instead, the Council is provided the opportunity to make comment on the proposed development, which is then taken into account by the Minister administering the Development Act.	Department of Environment, Water and Natural Resources
Natural Resources Management Act 2004	A licence or permit may be required if the Project interferes with natural resources including surface water, ground water, terrestrial ecology or marine environment. For example, if the Project interferes with particular plant or animal species or requires extraction of groundwater.	Department of Environment, Water and Natural Resources
Railways (Operations and Access) Act 1997	Written consent is required to construct and operate the railway spur associated with the Project.	Department for Transport, Energy and Infrastructure

2.3 Water Resources

2.3.1 Water Supply Infrastructure

Issue: The EIS indicates that water for the proposal will likely be sourced through connection to the existing 200mm main that extends to Port Bonython from the Morgan Whyalla No. 2 pipeline, or via a new pipeline that connects to the No. 2 pipeline. The proponent should liaise with SA Water in regards to water requirements and connection.

Submitter: 5

Response: The proponent will liaise with SA Water during the detailed design phase to determine water infrastructure requirements and connection details for the Project.

2.3.2 Natural Resources Management Act 2004

Issue: Section 4.2 of the EIS should also reference the *Natural Resources Act 2004.*

Submitter: 8, 10

Response: The *Natural Resources Act 2004* and its applicability to the Project is summarised as follows:

Natural Resources Management Act 2004

The *Natural Resources Management Act 2004* promotes sustainable and integrated management of the State's natural resources and makes provision for their protection. This is achieved primarily through the development of regional Natural Resource Management Plans.

The objective of this Act is to assist in the achievement of ecologically sustainable development in the State by establishing an integrated scheme to promote the use and management of natural resources.

The Act lists soil, water, native flora and fauna, geological features and ecosystems as natural resources that require protection and, where necessary, rehabilitation to restore ecological function. The Act requires that these natural resources are managed within the principles of ecologically sustainable development.

Relevance and/or Project Consistency

The Project site area is contained within the Eyre Peninsula Natural Resource Management Region. The Eyre Peninsula region covers a significant area of South Australia (80,000km^2 / 8 million Ha) and includes part of the Upper Spencer Gulf, the City of Whyalla, stretches across the southern boundaries of the Gawler Ranges, past Ceduna to the edge of the Nullarbor Plain and south to the fishing hub of Port Lincoln. In accordance with this Act, a licence or permit may be required if the Project interferes with natural resources including surface water, ground water, terrestrial ecology or marine environment. Depending on the chosen method for supplying construction water to the site, licences will be sought from DEWNR for erecting a dam, drilling a well or conducting an activity in a watercourse.

2.3.3 Groundwater Baseline Investigations

Issue: The EPA have suggested that a conceptual hydrogeological model should be prepared to improve understanding of the existing groundwater and surface water characteristics of the site and wider region.

The EPA has also suggested that information from studies undertaken at the neighbouring Santos facility could be utilised to characterise the baseline environment.

Submitter: 8, 10

Response: During the EIS drafting period, requests for information were made to Santos in relation to a number of matters including groundwater studies on or in the vicinity of the Santos Port Bonython operations. Access to this information was denied by Santos. During the Draft EIS comment period the EPA made a submission including commentary on the groundwater related sections. At a meeting on 11th December 2013 with officers of the EPA, they indicated that recent groundwater information in relation to the Santos site at Port Bonython was held by the EPA and was available to the public on request. A request for this information was made and it was received on 17th December 2013. The most recent report discovered was a URS Australia Pty Ltd report to Santos Ltd titled Santos Port Bonython Groundwater Remediation and Monitoring Plan, dated 18th April 2013 (URS 2013). This information has been used to respond to the EPA's issue noted above. It is also noted that during the meeting with officers of the EPA on 11th December 2013, it was agreed that a descriptive conceptual model would be provided from available information.

Geology
The Geological Survey of South Australia mapping series and in particular that of the Port Augusta region published in 1968 (Department of Mines 1968) indicates the surface geology of the Port Bonython peninsula to be almost totally dense white Simmens Quartzite with a small area of red sand inland and areas of modern white sand and gravels in the embayments. The Simmens Quartzite is part of the Tent Hill Formation, the southern-most unit of the Stuart Shelf on Eyre Peninsula. The Stuart Shelf is a platform sequence of flat lying sedimentary rocks overlying the Gawler Craton. URS 2013 which was focused on the Santos site reports that the observed geology at this site includes pink sand, calcrete, sandstone, conglomerates and gravels with traces of shell fragments consistent with shallow marine and delta environments. The Santos site is 2000 metres east and topographically down-gradient of the proposed SGPL bulk commodities storage facility. The proposed storage site ground elevation is at approximately 40 metres AHD whereas the Santos site grades from about 19 metres AHD at its northern boundary down to 3 metres AHD or less in the south. In addition, there is a significant embayment between the two sites.

Hydrogeology

In terms of local hydrogeology, the URS 2013 work refers to earlier work done by URS in 2010. This work indicates that:

- At the Santos Port Bonython site, groundwater is present in the fractured rock at depths of less than one metre near the coast to up to eight metres toward the north of the site with the hydraulic gradient being towards the coast
- The fractured rock aquifer is unconfined on a broad scale
- Groundwater flow is expected to be entirely through rock fractures and joints
- Fracture infill with clays and silts suggests considerable heterogeneity in the interconnectedness of fractures.

More generally URS 2013:

- Indicates the likelihood of a groundwater divide not far north of the Santos site extending inland and to the north-west
- Concludes that the groundwater catchment up-gradient of the site is likely to be small
- Expects a shallow near-surface zone where groundwater flow occurs, being recharged from the surface and flowing towards the coast to discharge.

The specific observations and facts relating to the Santos site and its environs and relevant to the proposed SGPL bulk commodities storage facility support the conclusions that:

- The Santos site, 2000 metres east of the proposed storage facility, is hydraulically down-gradient of it and that any contamination being managed at the Santos site will not encroach back into the SGPL site
- The near surface geology of the SGPL site is more likely dominated by the Simmens Quartzite than the shallow marine and delta sediments and sedimentary rocks that exist at the Santos site
- The groundwater catchment relating to the SGPL site is small and the near surface fractured rock aquifer is likely to be saline and very low yielding
- The groundwater transmissivity is very low with flow under the SGPL site eventually discharging into the near-shore coastal or marine environment.

Environmental Management

The proponent re-asserts that the proposed activity is relatively benign with respect to any groundwater impacts. The iron ore receival and enclosed storage areas will be founded on levelled, natural material. As indicated in the EIS, none of these works are anticipated to approach the local groundwater table. The hazardous goods storage area will be founded on a reinforced concrete industrial base underlain by a membrane moisture barrier. In the operations phase there will be little water use as ore handling is a dry process. Fuels, oils, greases and any other potentially contaminating substances will be subject to hygiene and environmental controls as comprehensively described at Chapter 19 of the EIS. The enclosure of the iron ore in storage sheds is a major mitigant of any risk of contaminant leakage into the groundwater environment. The iron ore will be delivered dry and kept dry within the storage sheds. Whilst the likely groundwater catchment relating to the site is concluded to be small at a regional scale, the area of industrial shedding represents a much smaller fraction of the likely catchment. Interference to natural groundwater recharge will therefore be negligible, and as local run-off will be collected and treated before use for local irrigation or other beneficial uses, the net interference to local recharge will be even further reduced. As also detailed in Chapter 19 of the EIS, hygiene and environmental controls during the construction phase will be managed by way of a detailed Construction EMP with the aim being to eliminate any risk of groundwater contamination. This will include measures to respond to potential specific events, e.g. a fuel tanker roll-over, in order that rapid and appropriate responses are pre-planned and capable of being activated to contain, control and quickly remove any contamination that may occur as a result of an accident or incident. Consequenly any risks of contamination of local groundwater or of the receiving inshore marine waters in the immediate vicinity or beyond are considered negligible.

2.3.4 Use of Groundwater for Construction Water Supply Purposes

Issue: The EPA have requested confirmation that groundwater will be utilised for construction water supply. If this water is to be utilised, it is suggested that a more rigorous study of groundwater conditions is required.

Submitter: 8

Response: At this stage of the Project the proponent is unable to confirm whether groundwater will be used to supplement the construction water supply requirements or not. The EIS has stated that such use is unlikely because of the expected poor quality of groundwater. For example, good quality concrete requires good quality water for its production and the durability of project works will not be compromised by using sub-standard inputs. However, it has been noted that it is desired to keep open the option to explore for suitable quality and quantity groundwater within an economic radius of the proposed works, and to and utilise that water if found. As the prospectivity for suitable groundwater has not yet been researched and as the economic radius may be 50 kilometres or more, rigorous studies are not yet possible or prudent. The proponent understands that any such activity must be in accordance with the *Natural Resources Management Act 2004.*

2.3.5 Water Quality Controls

Issue: The EPA have requested that further information be provided on erosion and sediment controls that will be utilised during construction to prevent sediment from travelling via waterways to the marine environment during a rain event. The submitter also provides advice on sediment basin and wash-down facility design requirements, the separation of runoff from roof and hardstand areas and bunding and spill management.

DEWNR has recommended that a Water Management and Monitoring Plan should be developed, consisting of:

- An understanding of the various site water balances
- Identification of all monitoring wells, including permit/unit numbers
- Identification of all surface water monitoring points
- Locality plan showing location of all well and surface water monitoring points and infrastructure
- A comprehensive discussion regarding the risk assessment undertaken and the required actions associated with those potential risks and incorporation into the Monitoring and Management Plan, including adaptive management strategies
- List of all parameters monitored and frequency, including water levels and volumes, for all monitoring points
- Established trigger levels for all monitored parameters, including water levels and actions to be taken
- An outline of reporting and adaptive management for both the construction phase and operational phase.

Submitter: 8, 10

Response: As outlined in Section 19.5.1.1 of the EIS, the objective for construction will be that no surface water generated by construction activities is released from site that does not meet the relevant water quality criteria (as per the *Environmental Protection (Water Quality) Policy 2003)*. Following detailed design and formulation of the construction methodology, a very detailed Erosion and Sediment Control Plan will be prepared by the on-site Contractor prior to construction commencing, in accordance with the requirements of the *Code of practice for the Building and Construction Industry*. This Plan will detail all measures to be implemented to control erosion and runoff from site during rain events. These measures are expected to include:

- Minimising erosion potential through staging of works and covering exposed surfaces
- Installing sediment control and capture measures to avoid any eroded material entering waterways which may include:
  - Rock check dams
  - Sandbags
  - Sediment fences
  - Concrete-lined channels
  - Sediment basins.

Any sediment basins constructed will be designed in accordance with the Wastewater and Evaporation Lagoon Construction Guidelines, as recommended by the EPA. This will include consideration of its location (i.e. away from drainage lines and coastal areas) and appropriate sizing to sufficiently capture runoff. They will also be regularly maintained and desilted so they operate to design standards. Any wastewater from concrete batching or machinery washdown bays (during both construction and operation) will be designed in accordance with the EPA Guidelines for *Stormwater Management for Wash Bays* to mitigate the risk of contaminants from these activities entering the stormwater system.

In stream controls will also be installed downstream of culvert works such as silt fences or rock check dams to prevent any sediment-laden water being transported to the marine environment in rain events. Weather reports will be regularly checked by the Site Construction Manager, so that any debris in culverts will be tidied up prior to a predicted event and the area stabilised to minimise erosion.

Operational stormwater controls will also be detailed in a Stormwater Management Plan prepared for the site.

All stormwater runoff generated by the BCEF will be treated including road runoff. This may include road-side swales if required to best practice Engineering standards, mainly the Best Practice Erosion and Sediment Controls Guidelines (IECA, 2008).

Stormwater from iron ore storage shed roofs (all iron ore storage areas will be contained within these sheds) will be treated as clean runoff that does not require treatment and will be reused where possible. Any runoff from hardstand areas will require treatment prior to its reuse and will be captured and stored separately to roof runoff to avoid contamination of clean stormwater. Any reuse of stormwater or wastewater from the facility will consider the requirements of the *National Water Quality Management Strategy Guidelines for Water Recycling: Managing Health and Environmental Risks.*

Any fuels, lubricants or herbicides used during either construction or operation of the BCEF will be stored and managed in accordance with the requirements of the *EPA Guidelines for Bunding and Spill Management.*

The Environmental Management Plan for the Project (Section 3.0 of this report) has been updated to reflect the requirements of the EPA Guidelines outlined in this response. Detailed design of both construction and operational stormwater management systems will be undertaken in the next phase of development, pending project approval. The design will address the Guidelines and advice provided by the EPA.

A Water Monitoring and Management Plan will be prepared prior to construction, as per the recommendations of DEWNR, and incorporated into the Construction and Operational Plans for the BCEF.

2.3.6 Changes to Water Flows in Drainage Lines

Issue: Any works undertaken in drainage lines should not permanently alter flow regimes. This may have an indirect impact on vegetation patterns and the spread of weeds.

Submitter: 10

Response: There will be some alteration of drainage lines where they intersect with the iron ore sheds and other operational facilities as well as the rail line. The amended drainage design will ensure that existing flow regimes are maintained. Railway culverts will be aligned and sized to match the existing road culverts, so should not alter existing flow regimes where road and rail are postioned in parallel alignment.

2.3.7 Groundwater Wells Within the Vicinity of the Project Area

Issue: Santos have noted that information taken from the WaterConnect website on groundwater wells at the Santos site may be incorrect. The two wells are reported as being for irrigation purposes, but should be shown as investigation wells.

Submitter: 16

Response: Santos has commented that the groundwater wells on its site and referred to as irrigation wells on the WaterConnect website are in fact investigation wells. A check of the WaterConnect website confirms that these wells are currently described as irrigation wells, but the proponent accepts the correction by Santos.

2.4 Noise and Vibration

2.4.1 Background Noise Investigations

Issue: Additional background monitoring should be considered across a 12 month period to further characterise the existing ambient noise environment.

Submitter: 8

Response: Background noise monitoring was undertaken as a data collection exercise to characterise the existing environment. In accordance with the *Environmental Protection (Noise) Policy 2007* (noise policy), assessment criteria are based on minimum absolute criteria based on zoning.

Nonetheless, site notes indicate a quiet ambient noise environment (occasional car, birds, waves, Santos site occasionally audible) characterised by a mixture of quasi-steady manmade noise (Santos site), and natural noise sources (wind and wave noise). As identified in the EIS, the noise environment throughout the year will vary depending on the occupancy of the shacks; however the time of year during which ambient noise monitoring was undertaken was the last month of Autumn (29th April 2013) and few, if any, of the shacks were occupied, so the noise measurements are considered representative of the colder months, which are likely to be the quietest time of year.

Further, the use of the RBL parameter as opposed to the arithmetic average of the L_{A90} as background noise descriptor derived from noise logging data is more conservative than required by the Noise Policy. The change in noise environment above this background noise level is therefore considered to be worst case.

Attended measurements taken at Point Lowly are deemed sufficient due to the following factors:

- The noise environment of the area is characterised by the near-constant underlying noise level from the Santos facility plus variable wind and wave noise
- Measurements taken during the day to characterise both the near-constant level from Santos (which will be the dominant noise factor at night) and to

gauge how much the daytime noise environment will rise due to wind and wave noise.

Based on this review, it is not considered necessary to undertake further background noise monitoring for the Project.

2.4.2 Operational Noise and Vibration Criteria

Issue: Methodology for derivation of operational noise criteria should be reconsidered to reflect the identified Settlement Zone and industrial criteria.

Submitter: 8

Response: The recommended updated noise criteria for Coastal Settlement Zones are 3 decibels (dB) more stringent (i.e. 3dB lower). Settlement Zone criteria remain the same.

- Point Lowly is identified as a “Settlement Zone” – no change in noise criteria
- False Bay is identified as a “Coastal Settlement Zone” – results in reduced noise criteria.

The update to the criteria does not change the assessment of compliance of the predicted noise levels in the EIS, because the predicted False Bay noise levels are well below the amended criteria and Point Lowly criteria remain the same. (refer Table 5.7d of EIS).

The following is noted in Section 5.8.2 of the EIS:

“*Enclosure of the conveyer(s) on the jetty is required for dust suppression purposes. This also provides an acoustic benefit. No further mitigation will be required to achieve the noise emission targets.”*

Given that the maximum predicted exceedance is 1 dB(A), any mitigation measure that provides a reduction of the noise source level would likely result in compliance with industrial noise criteria. For completeness, the acoustic benefit of enclosing the conveyer belt has been modelled and the industrial noise impacts are predicted to be 4 dB(A) lower than unmitigated noise levels. This results in compliance with the updated industrial noise criteria at all identified nearby sensitive receiver locations under all modelled weather conditions.

The following is also noted:

- A marginal exceedance of 1 dB for the unmitigated scenario is not considered significant as it is subjectively imperceptible
- The measured existing ambient noise environment of the area is already of similar level to the predicted noise levels from operation of BCEF (i.e. 44 dB(A)) and therefore operation of BCEF will not significantly increase the existing noise environment
- The unmitigated exceedance is only predicted to occur at night and although operation of the BCEF can potentially occur over a 24 hour period, the likelihood of a ship loading occurring at the same time as adverse wind conditions at night (<20% of the year based on available weather data) is

considered very unlikely to occur in practice and hence the predicted worst case scenario is unlikely to occur regularly.

2.4.3 Weather Conditions

Issue: Weather conditions for assessing potential noise impacts should use CONCAWE Category 6 weather conditions as a worst case.

Submitter: 8

Response: A review of Bureau of Meteorology meteorological data at Whyalla Airport since 1981 (refer Section 6.4.1.1 of the EIS) shows that wind direction is predominantly off-shore. Less than 20% of over 8500 samples taken at 9am and 3pm have a wind direction to the north, west or east (i.e. the direction of receivers). Further, temperature inversions are not expected to occur due to the coastal location.Nonetheless, additional predictions of Category 6 conditions were undertaken to assess potential increase in noise impacts. This was done for each of the Pasquill Stability Classes relevant to Category 6. In each case (with the exception of Category G), the wind speed was left at 8m/s in the direction of the receiver. For all predictions, the noise impacts remained within 1 dB of the previously predicted impacts under ‘adverse’ weather conditions. This is due to the high wind speed being the governing factor rather than the atmospheric stability class. Noise impacts presented in the EIS are therefore considered to remain appropriate and relevant.

An updated version of Table 5.7d of the EIS is given below with the revised criteria, additional information regarding meteorological conditions and the effect of the enclosure of the conveyer.

Table 5.7d Predicted operational noise levels at nearest noise sensitive receptors

<table>
<tr><th rowspan="3">Location</th><th colspan="2">Noise Impact Criteria</th><th colspan="2">Predicted Sound Pressure Level
No Mitigation
LAeq dB(A) re 20 μPa</th><th colspan="2">Predicted Sound Pressure Level
With Mitigation
LAeq dB(A) re 20 μPa</th><th rowspan="3">Signif-icance of Impact</th><th rowspan="3">Risk Rating</th></tr>
<tr><th rowspan="2">Day</th><th rowspan="2">Night</th><th colspan="4">Meteorological Conditions</th></tr>
<tr><th>Neutral*</th><th>Adverse**</th><th>Neutral*</th><th>Adverse**</th></tr>
<tr><td>False Bay</td><td>48 dB L_{Aeq}</td><td>40 dB L_{Aeq}</td><td>27 dB</td><td>34 dB</td><td>27 dB</td><td>34 dB</td><td>Negligible</td><td>Low</td></tr>
<tr><td>Point Lowly</td><td>51 dB L_{Aeq}</td><td>43 dB L_{Aeq}</td><td>36 dB</td><td>44 dB</td><td>32 dB</td><td>40 dB</td><td>Negligible</td><td>Low</td></tr>
</table>

*CONCAWE Category 4 (0 m/s wind speed, Pasquill Stability Class D)

**CONCAWE Category 6 (8 m/s wind speed towards receiver, Pasquill Class D)

Note that enclosure of the conveyer only provides a significant benefit for Point Lowly receivers because the predicted noise levels at False Bay are dominated by other activities at BCEF.

2.4.4 Road Noise Criteria

Issue: Derivation of road traffic noise criteria should be reconsidered to incorporate façade reflection

Submitter: 8

Response: It is acknowledged by the Submitter that assessment of road traffic noise is not required for assessment as there are no new or redeveloped roads as part of the proposal. It is also acknowledged that the criteria quoted in the EIS are largely the same as those proposed as amendments. Additionally, the relative increase criteria used are in keeping with international best practice and provide further indication of the minority of likely road traffic noise impacts.

2.4.5 Rail Noise Criteria

Issue: Rail criteria referenced have been superseded.

Submitter: 8

Response: At the time of writing the EIS, the *2013 Guideline for Assessment of Noise from Rail Infrastructure* (GANRI) had not yet come into effect. As such, it was appropriate to undertake assessment in accordance with the existing 2010 EPA Guidelines. Notwithstanding, it is acknowledged by the Submitter that assessment criteria remain largely the same between the two documents, therefore the EIS findings have not been amended.

2.4.6 Rail Noise Impacts

Issue: Consideration should be given to mitigation measures for ongoing rail activity.

Submitter: 34

Response: An assessment has been undertaken in accordance with the relevant rail noise guideline applicable in South Australia. Predicted rail noise impacts are below the relevant assessment criteria. Therefore consideration of mitigation measures is not required. Nevertheless the Port operator will investigate any complaints about rail noise received and consider remediation measures should this be necessary.

2.4.7 Construction Noise Impacts

Issue: Further detail on mitigation of construction noise impacts should be considered.

Submitter: 8, 6

Response: It should be noted that the 45dB(A) construction noise level is not a criterion but rather an impact threshold determining whether construction works may occur outside of standard hours.

The contractor is proposing work hours of 6am to 6pm. The 6am to 7am time period falls out of the standard construction hours and would need special approval for activities that exceed the 45dB(A) L_{Aeq} impact threshold. The majority of activities are not predicted to exceed the impact threshold.

Approval from EPA would be required if some short-term construction activities (mainly rail construction) is proposed to start at 6 am, however most activities undertaken at this time of the day would be start-up activities and are unlikely to produce noise that would exceed the criterion. Mitigation measures would likely be required by EPA for works to occur outside of the standard construction hours.

Predicted noise level from offshore piling is only 48dB(A) under worst-case meteorological conditions. This is comparable to existing daytime ambient noise levels at Point Lowly. Further, the worst case conditions would only occur approximately 20% of the year based on prevailing wind conditions. Piling will be limited to summer months as a mitigation measure to reduce impacts on cuttlefish, and therefore the likelihood of worst-case conditions occurring on a day when piling is occurring is low. Therefore no significant impacts are expected from offshore piling.

Nevertheless, as described in Section 2.4.6, further mitigation measures will be investigated and implemented in consultation with sensitive receivers should complaints be received.

2.4.8 Vibration Impacts

Issue: Vibration impacts from construction and operation of the new facility should be considered with regard to ground conditions and stability of infrastructure at the Santos site.

Submitter: 16

Response: The predicted vibration levels presented in the EIS (which are assessed using a conservative procedure) are below the threshold of human perception (0.1 mm/s) at the nearest receivers (approximately 235m from source). Criteria for damage to building structures are an order of magnitude higher than criteria for human comfort (the most stringent criterion generally adopted in Australia is 3mm/s, which is sourced from German Standard DIN4150.3 and is for extremely sensitive/dilapidated structures; criteria for reinforced industrial structures are higher still). The Santos site is significantly further away from potential vibration sources than the closest receivers (>1 km). Therefore vibration impacts at the Santos site will be substantially below the most stringent thresholds for human comfort or building damage and are likely to be undetectable at the Santos site.

2.4.9 Potential Impacts of Vibrations on Ground Conditions or Stability of Infrastructure at the Santos site

Issue: Appropriate controls should be implemented to prevent vibrations from piling or from future train movements affecting ground conditions or the stability of infrastructure at the adjacent Santos site.

Submitter: 16

Response: Vibration levels from construction and operation of BCEF are predicted to be below the threshold of human perception and significantly below the most stringent thresholds for damage to infrastructure at the nearest sensitive receivers (approximately 235m from BCEF).

The Santos site is more than 1km from the nearest piling location and is more than 2km from the nearest section of the railway line. Vibration levels from BCEF at the Santos site will be so low as to likely be undetectable.

As such, no controls to prevent vibration impacts on the Santos site are necessary.

2.4.10 Recreational Areas

Issue: Consideration should be given to recreational areas, particularly along the coast, as well as noise-sensitive receivers when assessing operational noise impacts.

Submitter: 34

Response: There is no requirement to undertake a noise assessment for recreational areas in South Australia. For the purpose of comparison, the maximum recommended noise level in areas specifically reserved for passive recreation in other states is 55 dB(A) (this level is adopted in both the NSW Industrial Noise Policy and the QLD Environmental Protection (Noise) Policy).

A review of the noise contours presented in Section 5.7.2.1 of the EIS clearly depicts the extent of the 55 dBA contour line under different weather conditions for both the mitigated and unmitigated scenario. The most relevant contour for the assessment of recreational areas is considered to be the mitigated scenario under neutral weather conditions (because adverse conditions will only occur under strong wind weather conditions occurring <20% of the year, during which natural ambient noise levels in recreation areas will be increased due to wind and/or wave noise).

The 55 dBA contour line extends to approximately 150 m either side of the conveyor belt along the coastal frontage. Beyond approximately 500m on either side of the conveyer belt, noise from the BCEF operation is approximately the same level as existing daytime ambient noise levels. Accordingly, the amount of coastline potentially experiencing a significantly changed noise environment due to the operation of BCEF is very limited.

2.5 Air Quality

2.5.1 Dust Criteria

Issue: The PM10 ground-level concentration criterion contained within the National Environment Protection (Ambient Air Quality) Measure should be applied to the Project as a total contribution (i.e. including non-operational background dust concentrations) rather than an operational-only contribution as proposed within the EIS.

Submitter: 8

Response: The EIS proposed the criterion be applied as operational-only in order to facilitate and simplify the monitoring and management of dust emissions (which are assessed as negligible) during the operational phase of the Project, as applied at other, similar operations (refer to Table 6.3b of the EIS). The Project acknowledges that due to the low level of predicted dust generation as a result of the proposed mitigation measures, the inclusion of background dust concentrations provides an additional degree of assurance to nearby residents that potential impacts to health as a result of additional dust generation are being monitored and managed appropriately. The air quality criterion applied to the

Project will therefore include the contribution of background dust. The exact nature of the management and monitoring system will be detailed in an Air Quality Management Plan to be developed prior to the commencement of construction activities.

2.5.2 Existing Air Quality

Issue: The impact of existing operations on ambient air quality at the Project location has not been adequately assessed.

Submitter: 8

Response: The EIS identified the Santos Hydrocarbon Processing Facility at Port Bonython as the only local source of dust emissions, based on a review of activities currently undertaken at Port Bonython and the Australian National Pollutant Inventory (NPI). The NPI indicates that the Santos facility emits around 4,700kg of PM10 material per annum, and the EIS suggested that this mass of material was unlikely to significantly impact local air quality. A meeting with the EPA on 12 December 2013 suggested that additional information was required in order to place this emission into context. Table 4 presents a summary of PM10 dust emissions from various significant South Australian industrial operations. The results of this analysis suggest that the Santos emissions are relatively low in comparison to operations that are either already operating or are proposed within South Australia.

Table 4: Existing PM10 emissions from selected South Australian industrial facilities (Source: National Pollution Inventory, 2013)

Facility / Project	Location	PM10 emissions (kg/year)
ACI Operations (Glass)	Adelaide	92,000
Adelaide Brighton Cement	Adelaide	100,000
AGL Torrens Island Power Station	Adelaide	86,000
BHP Billiton Olympic Dam	Olympic Dam	4,700,000
Boral Quarry	Whyalla	20,000
Bradken Foundry	Adelaide	13,000
Dominion Gold Challenger	Tarcoola	220,000

Flinders Container Terminal	Port Adelaide	2,200
Flinders Power Coal	Leigh Creek	1,600,000
Flinders Northern Power Station	Port Augusta	630,000
Flinders Playford Power Station	Port Augusta	65,000
Illuka Jacinth-Ambrosia Mine	Eucla	1,200,000
One Steel Dolomite	Ardrossan	280,000
Nystar Port Pirie	Port Pirie	140,000
One Steel Steelworks	Whyalla	2,500,000
Penrice Soda	Port Adelaide	93,000
OZ Minerals	Prominent Hill	4,600,000
Rex Minerals Hillside	Ardrossan	610,000
Santos	Port Bonython	4,700

Furthermore, the monitoring system proposed to be developed prior to the operation of the Project will have sufficient capability to measure the existing background dust concentrations and distinguish that concentration from the concentrations resulting from operational activities. Coupled with the revised PM10 criterion (refer to Section 2.5.1), this will ensure that existing air quality is factored into the management of dust from the Project during operations.

2.5.3 Modelling

Issue: Insufficient data has been presented within the EIS to suggest that air quality modelling of ground level PM10 concentrations is not required in order to assess impacts to nearby receivers.

Submitter: 8

Response: The EIS presented an estimation of the likely dust emissions, given the dust mitigation measures proposed to be maintained by the Project (refer Table 6.6b of the EIS), concluding that this rate of dust generation (totalling around 0.07 g/s of PM10 dust) was virtually negligible and therefore unlikely to result in any change to existing air quality at nearby residences (the nearest of which is located 2.7km from the proposed operations). Furthermore, benchmarking of the performance of existing Australian bulk materials handling port facilities was undertaken, providing evidence that impacts were likely to be negligible, based on the mitigation measures proposed for the facility.

A meeting between the proponent and the EPA on 12 December 2013 indicated that further information was required to provide additional context if air quality modelling was not to be undertaken. To this end, the results of air quality modelling of other, similar facilities was benchmarked to provide an indication of the likely extent of dust impacts associated with the Project. Table 5 summarises the distance between the proposed port facility and the PM10 criterion for a number of similar bulk handling port Projects relative to the predicted dust generation rate under worst case meteorological conditions (i.e. the maximum 24-hour average ground level concentrations).

This data demonstrates that, at the proposed BCEF Project dust generation rate, the PM10 criterion is likely to be met within the order of around one hundred metres of the proposed operations under worst case conditions. Maximum and minimum distances are detailed to provide an indication of the influence of the prevailing wind direction on dust dispersion.

Table 5:Approximate distance to the modelled ground-level PM10 concentration criterion relative to predicted emission rate

Operation / Project1	Materials handling rate (Mtpa)	Ship-loading rate (tph)	Predicted PM10 emission rate (g/s)	Minimum distance to the PM10 criterion (m)	Maximum distance to the PM10 criterion (m)
Anketell Port	115	20,000	21.42	1,600	3,100
FMG Port Hedland	45	7,500	11.28	300	1,300
Dudgeon Point Coal Terminal	60	8,000	1.80	300	500
Dudgeon Point Coal Terminal	120	8,000	3.71	600	1,450
Port of Abbot Point	70	10,000	6.11	Not exceeded at any point	
Bunbury Port Expansion (Berth 14A)	15	8,000	0.085	Not exceeded at any point	
Rex Minerals Hillside	1.5	2,000	0.077	80	120
SGPL Port Bonython	50	4,000	0.07	-	-

Given the data presented in Table 5 which shows that PM10 ground level dust criterion would likely be met within around 100 metres of the proposed operations based on other, similar operations (the nearest residence is at least 2,700m from operations), it is not considered necessary to conduct additional PM10 modelling. As described below in Section 2.5.4, monitoring will be undertaken to ensure that both construction and operations are not exceeding PM criterion, as predicted.

2.5.4 Dust Management and Monitoring

Issue: Consideration should be given to the implementation of real-time meteorological monitoring during the construction phase, as the use of visual triggers may not be sufficient. Discussion is also required regarding contingencies available if installed dust mitigation measures do not work, or are less effective than designed, and what lines of authority exist to inform when and what contingencies are implemented. The monitoring system, when operating, should permit the derivation of operational and background PM10 dust concentrations, and there should be consideration for monitoring of other particulate size fractions, and for maintaining the monitoring system beyond the initial years of operations as proposed in the EIS.

Submitter: 14, 8

Response: Section 6.6.4 of the EIS provided details of the proposed Project contingency measures during both construction and operations, and also provided an overview of the proposed dust monitoring system. These will be detailed in a Dust Management and Monitoring Plan that is to be developed in coordination with the EPA prior to the commencement of construction. The plan will outline roles and responsibilities, training requirements, reporting requirements and the process and triggers for implementing the nominated contingency measures, together with maintenance and system monitoring requirements.

The agreed dust monitoring system will have sufficient capability to determine the contribution of the Project to overall dust concentrations (those from the BCEF and background levels), and will be fitted with devices to allow the collection of wind speed and direction information. This system is to be installed during the construction phase and will be fully commissioned and operational prior to the commencement of operations. The use of visual triggers for the application of dust mitigation during the construction phase is considered standard practice for construction activities and it is not considered that the installation of a local meteorological monitoring and/or forecasting capability would provide a better indication of the generation of construction-related emissions than the use of constant visual monitoring by construction crews as construction activities are undertaken.

The operation and maintenance of a complex, real-time PM10 monitoring system can be an expensive proposition, and it is proposed that, given the low predicted dust generation rate, such a monitoring system may not be required in the longer-term should the initial monitoring results indicate no change in existing ambient air quality as a result of the Project. The discontinuation of monitoring, if pursued, would be subject to agreement from the EPA. Monitoring of particulate size fractions other than PM10 is not proposed as it is considered that the health science associated with PM10 is more advanced and therefore more representative of the potential to impact health. The concentration of non-PM10 size fractions can be inferred from PM10 data if necessary, and the use of different-size inlets on the PM10 monitors can be arranged should monitoring of different size fractions be desired in future.

The Dust Management and Monitoring Plan and the implementation of a dust monitoring system will ensure that dust is sufficiently monitored and controlled during both construction and maintenance, such that EPA criteria are met.

2.5.5 Potential Impacts of Dust on Santos operations and/or Maintenance of Infrastructure

Issue: Appropriate mitigation measures should be implemented so that dust from the proposed BCEF site does not affect the operations and/or maintenance of infrastructure at the adjacent Santos site.

Submitter: 16

Response: Section 6.6.3 of the EIS summarised the predicted impact of dust emissions from the Project, concluding that provided the installed mitigation measures are operated and maintained appropriately, the proposed air quality management system will be sufficient to effectively mitigate fugitive emissions. In addition, Section 2.5.3 of this response presents benchmarking that indicates that the PM10 ground level dust criterion would likely be met within around 100 metres of the proposed operations based on other, similar operations, significantly less than the 1,500m distance from the proposed operations to the Santos facility.

Given this, there is not expected to be any impact on the operations at the Santos facility as a result of dust generated by the proposed BCEF. Monitoring, as proposed in Section 2.5.4 will be undertaken during construction and operations to confirm that dust levels are within acceptable levels.

2.6 Terrestrial Ecology

2.6.1 Long Term Impacts on Native Vegetation from the Introduction of Weeds

Issue: The potential long term impacts on native vegetation from increased traffic (human and vehicular) and the introduction of weeds have been underestimated. In particular, the proponent should provide more information about the potential for weed spread along the rail corridor and how this would be managed and monitored for the life of the Project. Disturbed sites should be rehabilitated immediately, and actively managed to avoid dominance by weed species.

Submitter: 10, 30

Response: The Australian Rail Track Corporation (ARTC) is a member of the SGPL Consortium and will likely be responsible for management of the rail corridor. The ARTC have an Environmental Policy and an Environmental Authorisation to operate under Part 6 of the *Environmental Protection Act 1993* from the South Australia EPA. This authorisation requires compliance with the Act and its policies.

Under the ARTC Environmental Policy and Environmental Management Plan for SA (EMS), they and their contractors are responsible for:

- Undertaking all works in compliance with the EMS and all relevant environmental legislation and standards
- Ensuring that all of their employees, contractors and sub contractors have suitable environmental awareness skills and knowledge of the ARTC EMS
- Preparing an Environmental Management Plan for all major works or as required.

Contractors responsibilities are also clearly set out in the ARTC Engineering Process Procedure (PP-155):

- 5.2.2 Comply with all applicable environmental legislation and standards
- 5.2.3 Be duly diligent in environmental management of all activities
- 5.2.4 "Maintain and adhere to environmental control procedures for workers which may have environmental consequences" including vehicle and equipment cleaning and pest and weed control

- 5.2.5 Ensure that all of their managers, supervisors and employees have appropriate environmental awareness training and training in environmental control procedures relevant to their activities.

Section 19.5.3 of the EIS outlines the general principles of weed control that will be adhered to throughout the life of the Project.

Prior to the construction phase the proponent will develop appropriate weed control strategies for the Eyre Peninsula NRM Region in consultation with the Board. Guidance for this planning will also be obtained from the *Natural Resources Management Act 2004, Australian Weeds Strategy (2007)* and the South Australian Arid Lands Natural Resources Management Region 2013 Weed Risk Assessment Review.

2.6.2 Offsets under the *Native Vegetation Regulations 2003*

Issue: Under the *Native Vegetation Regulations 2003*, a permit is required to clear native vegetation. Where this permit is approved, any clearance of native vegetation is required to be offset by restoration work that provides a Significant Environmental Benefit (SEB). The EIS provides details on the amount of native vegetation that is to be potentially cleared for the Project (refer to Table 7.5a of the EIS), and an estimate of offsets (Table 7.5b of the EIS). Negotiations with the Native Vegetation Council (NVC) are currently being undertaken to finalise the details of the proposed offset.

The submitter (DEWNR) suggests that the SEB offsets should be established prior to any clearance of vegetation on the site. Any offset calculations should also include the clearance of seagrasses.

Submitter: 10

Response: Negotiations with the Native Vegetation Council (NVC) are currently being undertaken to finalise the details of the proposed offset. A clearance application has been prepared and submitted to the NVC for a maximum of 228ha. The total maximum SEB offset is estimated at 1,715.8 hectares to be provided in the Eyre Peninsula NRM Region (refer to Table 7.5b of the EIS). This was a conservative estimate however, and the area disturbed or cleared is likely to be much less. A post construction survey will be undertaken to determine the areas more accurately. In the meantime negotiations will occur on appropriate offsets.

Possible options, in order of preference, for fulfilling the required SEB include:

- Funding and facilitating other negotiated project (s) in the region that will bring about an appropriate level of biodiversity gain. For example, these may be local threatened species research projects, management programs for local threatened species, pest plant or pest animal control programs or similar
- Management of an appropriate area or areas in the region for biodiversity gain
- Revegetation of an appropriate area or areas on Eyre Peninsula
- Payment into the Native Vegetation Fund. This money is then distributed to biodiversity projects in the region through a grants process.

Negotiations will be undertaken with appropriate stakeholders to ensure the SEB is both adequate and meaningful in terms of long-term biodiversity gain in the region and that timing of the offset provision is acceptable should revegetation be the chosen option.

There will be no removal of any seagrass meadows as a result of the Project, therefore no offsets are required. The nearest seagrass meadow is some 2km to the east of the jetty, towards Point Lowly (refer to Figure 14.3e of the EIS). Along the alignment of the jetty seagrass is sparse, with the dominant biota being fauna (including Ascidins, Pinna, Bryozoans etc.) and algae.

2.6.3 Adequacy of Ecological Surveys

Issue: The proponent has relied on the work of previous investigations, and further surveys should be undertaken. Surveys should also be undertaken at various times throughout the year to reflect seasonal conditions.

Submitter: 29

Response: A substantial amount of site surveys have been undertaken within or in close proximity to the study area; these surveys were reviewed for adequacy and methodology to ensure they were suitable for use and met ecological survey guidelines in terms of survey timing and extent. Vegetation types found at site were assessed to determine whether they were likely to provide suitable habitat for fauna species. Relevant records/databases which predict the likelihood of species occurring within an area where also examined. Given this, it was considered appropriate to focus fauna surveys on those significant species that were most likely to occur within proximity to the proposed BCEF given available habitat and the results of previous surveys, rather than repeat studies which did not identify any significant species within the area. This is a standard methodology for undertaking ecological surveys.

Studies and databases that were reviewed include:

- Cultana Training Area Expansion Public Environment Report (AECOM, 2012)
- Olympic Dam Expansion Environmental Impact Statement; Draft Main Report Volume One and Two (BHP Billiton (BHPB), 2009), Supplement (BHPB, 2011a) and Assessment Report (Minister for Mineral Resources Development and Minister for Urban Development, Planning and the City of Adelaide 2011)
- Titanium Dioxide Manufacturing Plant, Whyalla - Draft Environmental Impact Statement (Dames and Moore, Pty. Ltd. 1991)
- Whyalla Investment Park Declaration of Environmental Factors (A.G.Consulting Group Pty Ltd 1989)
- Southern Cross Refinery Environmental Impact Statement; Draft (Maunsell and Partners and Australian Groundwater Consultants 1987a), Supplement (Maunsell and Partners and Australian Groundwater Consultants 1987b) and Assessment Report (Department of Environment and Planning 1987)
- Environmental Impact Statement for Port and Terminal Facilities at Stony Point - South Australia; Draft (Social and Ecological Assessment Pty Ltd. 1981), Supplement (Social and Ecological Assessment Pty Ltd. 1981) and Assessment (Department of Environment and Planning 1981)

- Whyalla Conservation Park Management Plan; North-East Eyre Peninsula South Australia (Department of Environment, Heritage and Aboriginal Affairs 1998)
- Eyre Peninsula Coastal Action Plan and Conservation Priority Study, Volume One and Two (Caton et al, 2011)
- The Status, Distribution and Habitat of the Slender-billed Thornbill Acanthiza iredalei in South Australia' (Matthew, 1994)
- South Australia Wader Surveys, January and February 2000 (Wilson, J.R. 2000)
- Biological Database of South Australia (through the 'NatureMaps' interface and direct requests through DEWNR)
- Protected matters search tool (database of species, habitats and places protected under the EPBC Act)
- Atlas of living Australia (database of biodiversity knowledge aggregated from a range of providers including museums, herbaria, community groups, government departments, universities and individuals).

To supplement these previous studies and current databases, further on-site surveys were conducted as described below.

Two vegetation surveys were undertaken. The first was in October/November, 2011, with a focus on defining broad vegetation associations and habitat types in the area. The second, a more targeted survey was conducted in August 2012, which involved defining individual species abundance at specified survey sites. The timing of the surveys over the spring period gave the best chance of identifying plants down to species level. Additionally, In the 5 months preceding the field survey in late October, 2011 there had been 7 significant rain events (between 6.8mm and 17.0mm), representing a period of high winter rainfall. The subsequent survey period in August, 2012 was preceded by below average early winter rainfall with the exception of one significant rainfall event (35mm) on July 10. Given this, these species counts are considered to represent moderate to high plant species diversity for all plant associations. A review of existing data from previous surveys conducted in the area from 1981-2012 provided an indication of expected species presence and seasonal variation.The methodology for the vegetation survey was based on the survey methods described in the South Australian Government published *Guide to a Vegetation Survey* (Heard and Channon 1997), using a modified Braun-Blanquet system for estimating cover/abundance for each plant species at a survey site. The survey data and assessment had to be detailed enough to satisfy the requirements of the Native Vegetation Management Act for determining offset requirements.

During the August 2012 vegetation survey a bird survey was also carried out targeting threatened species, particularly the Slender-billed Thornbill (Acanthiza iredalei iredalei). Due to the cryptic nature of theThornbill, an area survey was deemed to be the most appropriate survey method, as consistent with the Survey Guidelines for Australia's Threatened Birds (Department of the Environment, Water, Heritage and the Arts 2010). Birds and other fauna recorded outside of the survey periods were recorded as opportunistic sightings. Specific surveys for other groups of fauna, such as mammals and reptiles, were not undertaken as these groups were not represented in searches of threatened species in the study area and it was deemed that sufficient data was available from previous studies in the area (over a 30 year period).

2.6.4 Vegetation Clearance

Issue: Does the total vegetation clearance reported in the EIS include an allowance for site sheds, perimeter fence and internal roads?

Submitter: 30

Response: The total of approximately 228ha (a worst case scenario) does include an allowance for site sheds (including the full 50mtpa capacity), perimeter fence and internal roads. Vegetation to be disturbed will be offset in accordance with requirements of the *Native Vegetation Regulations 2003 (*refer to Section 0).

2.6.5 Fauna Passage

Issue: What provision has been made for the safe passage of fauna through the fenced grounds?

Submitter: 30

Response: During initial vegetation clearing works, any fauna that is nesting within the fenced area will be relocated to another suitable location by trained spotter/catchers to avoid any damage from machinery. This immediate works area will be cleared and minimal fauna habitat will be available within this zone upon operation of the facility. The fencing will be designed to exclude larger fauna (i.e. kangaroos) for their safety and those of site workers.

2.7 Transport

2.7.1 Upgrade of the Lincoln Highway/Port Bonython Road Junction

Issue: The project design currently allows for a CHR(S) (short channelised right turn lane treatment) upgrade at the intersection of Port Bonython Road and Lincoln Highway to accommodate changed traffic conditions. DPTI have requested a CHR (full channelized right-turn treatment) to the intersection to accommodate road trains. The SAFC also suggests that any upgrades to this intersection should consider access by Triple Road Trains that may travel to/from the BCEF.

Submitter: 1,17

Response: The type and dimensions of the intersection required for the Lincoln Highway / Port Bonython Road intersection are established using Part 4a of the Austroads Guidelines. The following factors are determined within these guidelines:

- The type of right-turn treatment, which is dictated by Figure 4.9b as a BAR, CHR(S) or CHR based on forecast traffic volumes. The forecast traffic volumes estimated in the transport assessment require a CHR(S) treatment when assessed used Figure 4.9b
- The taper and deceleration lengths as determined by the design speed (110 km/h)
- The storage length, which is in part determined by the design vehicle. The transport assessment assumed the design vehicle to be a road train, being 36.5m in length, the current maximum vehicle size classification for Port Bonython Road and the Lincoln Highway

- The storage length, which is also determined by queuing probability. The 95th percentile queue length is shown to be one vehicle or less in the Transport Assessment
- The turning length, which is based on the swept path of 36.5m road train.

As described above, it should be noted that the type of treatment is based on traffic volume rather than the types of vehicle using the turn lane. The various dimensions that determine the overall length of the turn lane are shown in Figure 3.

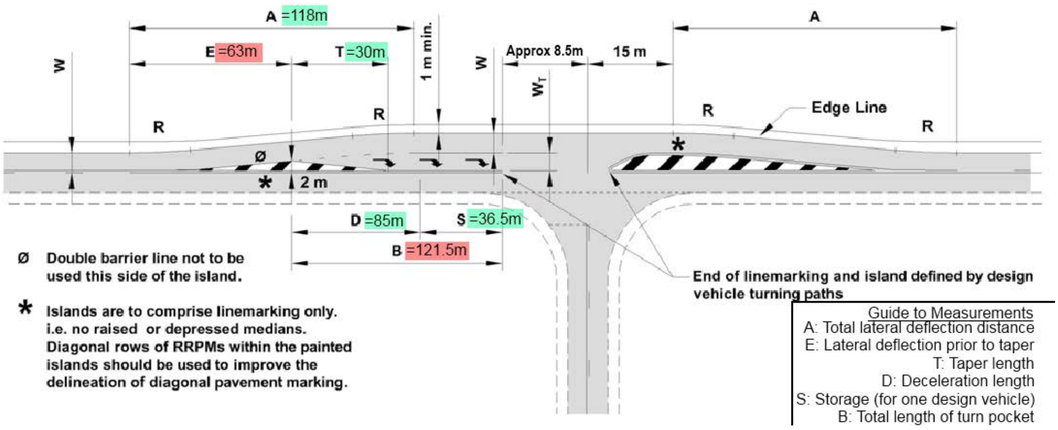


Figure 3: Lincoln Highway/Port Bonython Road turning lane dimensions

The Transport Assessment has not included an increase in size of the Greater Mass Limit (GML) on Port Bonython Road or the Lincoln Highway. This is because the proposal for Port Bonython does not require access for vehicles above 36.5m road trains. Any reliance on an increased GML by other facilities in the area would require a separate application by the relevant project proponent.

2.7.2 Traffic Impacts at the Port Bonython Road Level Crossing

Issue: The proponent should further consider impacts on the level crossing at Port Bonython road (including safety considerations) and the potential impact on the operation of the Lincoln Highway/Port Bonython road junction from increased train movements.

Submitter: 1,6, 17

Response: The proposal does not include an increase in train movements across this level crossing. The new rail spur is connected to the exsitng ARTC network to the north of Port Bonython Road and all currently envisaged rail movements for delivery of export ore are to and from the north. Further, it is not proposed to increase the GML for heavy vehicles using Port Bonython Road, as described in Section 2.7.1 above, for the construction or operational stages of this development. It is therefore unnecessary to upgrade this level crossing.

2.7.3 Rail Traffic

Issue: Submitters have requested that impacts of the Project on the rail network beyond the Port Bonython extension be considered. The SAFC are also concerned that there is insufficient capacity for rail on the wider network.

Submitter: 1, 17, 22, 31

Response: The BCEF project assesses the impact of the new rail connection from the Lincoln Highway to Port Bonython. The ARTC has been consulted, and have confirmed that spare rail paths exist that are able to accommodate the proposed movements to be generated by this development. Because negotiations with potential Port users will not commence until the Project receives approval, it is not known which miners may utilise the facility and what rail paths they will utilise. Each miner who seeks permission to use the BCEF will be required to assess the environmental impact of transportation of material to site and seek appropriate environmental and planning approvals should they require upgrades to the rail system.

2.7.4 Safety of Road Users

Issue: The submitter requests further information on actions to be put in place to ensure the safety of road users on the Lowly Peninsula as a result of increased traffic.

Submitter: 21

Response: Crash analysis was included in the EIS (Chapter 8.0). No particular safety issues were identified, with a low number of crashes and no consistent themes for causes. The current road traffic volumes are low and are not expected to increase to a high level as a result of the development proposal.

The proposal includes a new site access and a new rail crossing of Port Bonython Road via a new grade separated crossing. Both of these features will comply to the latest standards and guidelines. Road safety audits for these items will be conducted in the detailed design stage and upon completion of construction.

The Transport Assessment has therefore concluded that there are no further safety issues to address.

2.7.5 Upgrades for Triple Road Trains

Issue: Given that there is a potentially significant road freight task, including during the construction phase, SAFC suggests that the State Government investigates the necessary upgrades required to bring the Lincoln Highway from Port Augusta to the Port Bonython turnoff, and then from the turnoff to Port Bonython itself, up to a standard that facilitates access by Triple Road Trains.

Submitter: 17

Response: It is not a requirement of the development proposal to provide access for any vehicles above the current GML provided on the Lincoln Highway or Port Bonython Road. Therefore, it is not proposed to upgrade either road to enable a higher GML.

2.7.6 Consideration of Road Freight Alternative to Rail

Issue: An assessment of road impacts that considers freight movements to transport iron ore to site as an alternative to rail has not been undertaken.

Submitter: 22

Response: The BCEF has been designed to accommodate the transportation of iron ore to site by rail, and this is the approval sought; therefore the impacts of transporting iron ore to site by alternative means has not been assessed. Should a mining company propose an alternative method of transportation, they will be responsible for seeking separate approvals, including approval from SGPL to accommodate an alternative delivery method. It is considered more economical for future miners to utilise the existing rail network given the current known locations of proposed and existing mines (refer PwC report included in the EIS as Appendix A).

2.8 Landscape and Visual Amenity

2.8.1 Visual Impact of Storage Sheds and Conveyor

Issue: Several submitters have raised concerns in regards to the visual impact of the storage sheds and overhead conveyor. Further mitigation measures should be considered to reduce this impact.

Submitter: 6, 21, 22, 28, 30

Response: Figures 4 to 7 show the likely visual impact of the facility from a variety of view points. Generally, the BCEF will blend in with the surrounding environment from most viewpoints as it as been designed to fit with site contours and minimise visual intrusion.

The storage sheds follow best practice design standards which optimise their functionality in terms of containing iron ore dust. Whilst it is not desirable to reduce their height or dimensions without compromising functionality, all effort will be made to reduce their visual impact through architectural treatments as appropriate.

Figure 4: The BCEF viewed from Port Bonython Road. The sheds are barely visable above the horizon (right hand side of picture)

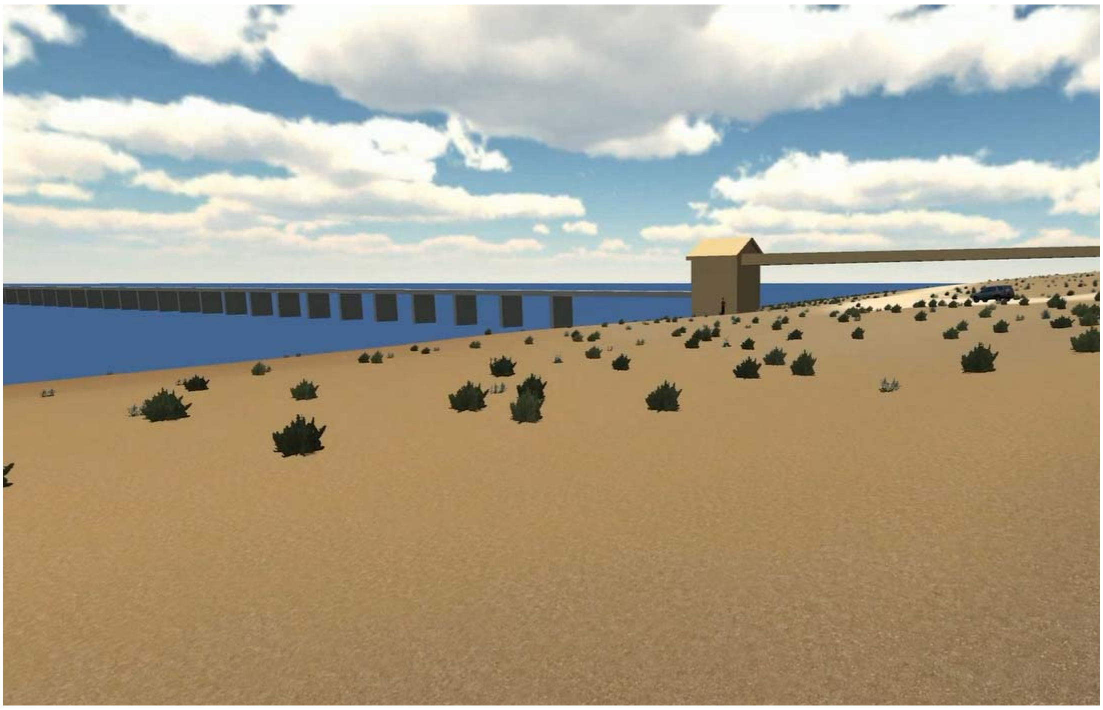


Figure 5 The conveyor and jetty viewed from Cuttlefish Drive.

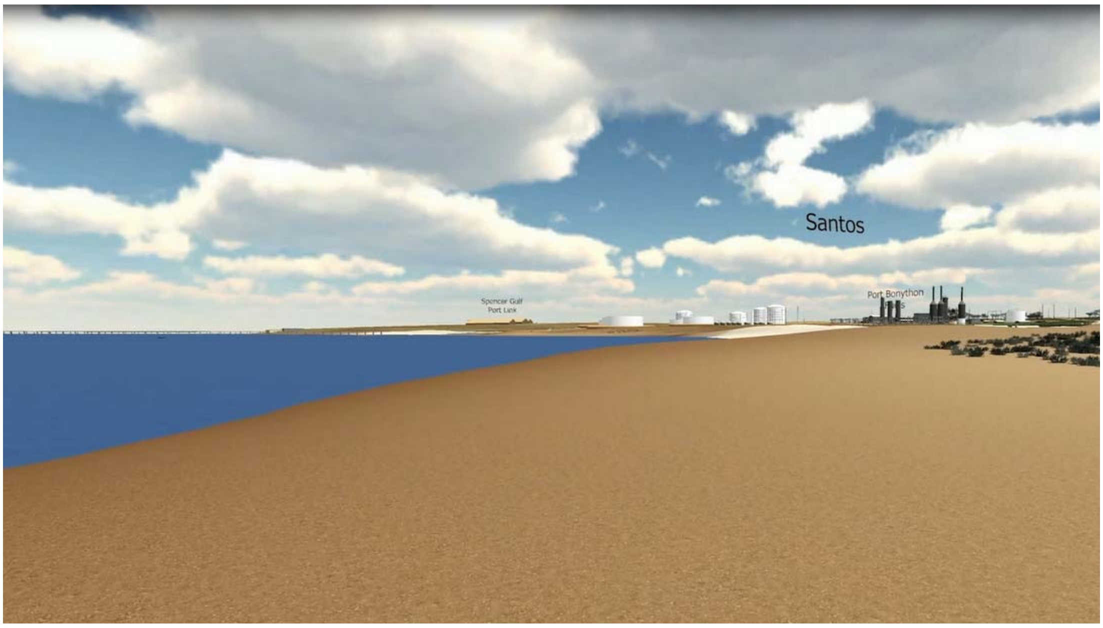


Figure 6: The BCEF viewed from the Point Lowly coastal home community. The sheds and jetty can be discerned on the horizon, but blend into the background

Figure 7 The BCEF storage sheds and conveyor viewed from the water. The jetty and sheds are most evident from this view.

2.8.2 Visual Impact of Additional Shipping

Issue: The increased number of ships will have additional visual impact in the area.

Submitter: 21

Response: Large ships are already a feature of the Whyalla and Port Bonython horizon, as they visit the transhipment points located in the middle of Spencer Gulf, the Arrium facility at Whyalla and the existing Santos jetty.

When viewed from a distance from Whyalla and other vantage points, the vessels blend into the background of the view as they travel across the Gulf. As vessels approach and use the BCEF, they will be more clearly visable from local vantage points at Point Lowly, although will still be at least 3km from the shoreline. Due to the visual context of industrialised landscapes, and the existing vessels that utilise the area, there will be a noticeable, but minor change in the character of these views from local vantage points at Point Lowly.

2.9 Socio-economic Impact

2.9.1 Benefits for Business Activity and Investment

Issue: The EIS should further explore the benefit to business activity and investment locally and regionally

Submitter: 6

Response: The Project is estimated to directly support an additional 270 jobs (full time equivalent (FTE)) during construction and more than 40 direct jobs during operation of the port. In addition to this, the stimulus provided by the capital expenditure, operating expenditure and export revenue associated with the Project could support more than 500 direct and indirect jobs (FTE) for the local and regional economies 2019/20, rising to a peak of 605 additional jobs in 2027/28.

The economic impact assessment for the Project (Appendix D1 of the EIS) models the economic impact of the proposed BCEF on the local economy. This has included the value of production (a sum of the net value of goods and services across all industries in a region or state). Indirect benefits of the Project are identified as income for employees and business that supply goods and services, although the $A value to regional businesses has not been quantified at this time. The spend on local businesses will largely be influenced by the purchasing policy of the proponent and its chosen contractor.

The proponent has committed to developing and implementing a South Australian Industry Participation Plan which will encourage local contractor and business involvement wherever possible. Leightons Contractors, who are part of the SGPL consortium, have offices locally in Whyalla and have a track record of using local businesses for their projects.

The Industry Participation Plan will address the following:

- Major capital items
- Potential supply locations for goods and services
- Tender and contract provisions to encourage the use of local goods and services
- Identified goods and services shortages
- Strategies for working with local businesses at an early phase of the Project to encourage local supply/skills if gaps are identified; this may include training opportunities
- Investment in local businesses to enable them to upskill to potentially supply project.

The proponent is committed to working with the Council, business groups and potential suppliers to maximise the use of local businesses wherever possible and further consultation with these groups will be undertaken as part of development of the Industry Participation Plan upon project approval.

2.9.2 Cuttlefish Viewing Platform Relocation and Design

Issue: The new location of the Cuttlefish Viewing Platform should be provided and the design described further.

Submitter: 6, 21, 30

Response: SGPL will work with the City of Whyalla and other stakeholders to determine the desired design and location of the new viewing platform.

SGPL is also supportive of working with relevant stakeholders to progress the concept for a Cuttlefish Interpretive Centre. A scoping study was previously prepared by the City of Whyalla and other stakeholders to examine the feasibility of a Cuttlefish Interpretive Centre within the Whyalla Region. Various options for an interpretive centre were proposed at both Whyalla and Point Lowly, with a smaller satellite viewing area proposed at the location of the current platform.

For further details on the Scoping Study, please refer to www.whyalla.sa.gov.au.

2.10 Greenhouse Gas Emission Mitigation Measures

2.10.1 Efficient Plant and Equipment

Issue: The proponent should further consider mitigation measures for the use of energy efficient electricity consuming plant and equipment such as motors, pumps, fans and lighting

Submitter: 3

Response: Section 12.3.5 of the EIS outlines a range of Greenhouse Gas reduction measures that have already been incorporated into the planning phase of the Project as well as outlining measures that will be further examined during the detailed design and purchasing phases; this is when decisions will be made about the plant and equipment to be utilised on site. The use of energy efficient plant and equipment (e.g. motors, pumps, fans etc.) does have the potential to reduce Greenhouse Gases produced by the Project and their energy or fuel use will form part of the decision making process.

2.10.2 Energy Efficiency Opportunities Program

Issue: The proponent should consider the Energy Efficiency Opportunities Program.

Submitter: 3

Response: The Energy Efficiency Opportunities program is a Federal government program which encourages large energy using businesses to improve their energy efficiency. Corporations that use more than 0.5 petajoules of energy must undertake energy efficiency assessments, identify opportunities with a four year payback or less, and report publicly on their business response.

The proponent will comply with all reporting and energy efficiency requirements of the *Energy Efficiency Opportunities Act 2006* should energy use from the BCEF exceed the threshold value of 0.5 petajoules per annum. Based on the initial calculations, it is likely the BCEF will be required to report under this Act.

2.10.3 Greenhouse Gas Accounting Methodology

Issue: The EIS addresses Scope 1 and 2 emissions only, when calculating the impact of the proposal on potential greenhouse gas emissions.

Submitter: 12

Response: The separation of emissions into direct and indirect is fundamental to both the GHG Protocol and AS ISO 14064 accounting standards. To help distinguish between direct and indirect emission sources, provide transparency and avoid double counting the proposed SGPL's emissions are categorised as follows:

- Scope 1 – Direct GHG emissions owned or controlled by SGPL which include:

  - Fuel combustion in plant and equipment and site vehicles
- Scope 2 – Indirect GHG emissions associated with electricity supplied from external sources
- Scope 3 –Indirect GHG emissions not owned or in control of SGPL which include:
  - Embodied energy of materials
  - Transport of materials and equipment to and from site
  - Extraction, production and supply of fossil fuels.

SGPL have direct control over Scope 1 and 2 emissions, whereas Scope 3 emissions will be largely the responsibility of mining and freight companies who transport iron ore to and from the facility, and are not within the control of SGPL. Scope 3 emissions, as per the National Greenhouse and Energy Reporting Protocol and AS ISO 14064, are typically not counted in GHG accounting, to avoid double counting (i.e. calculated in both the user and producers accounts). Whilst it is acknowledged that SGPL can have some level of influence over Scope 3 emissions, there are many Scope 3 emissions that are not within their control to manage, and it is for this reason they have not been included in calculations.

SGPL will complete a more detailed carbon footprint during the detailed design phase, which will examine the potential to influence Scope 3 emissions through engagement with Port Users, operating procedures and contractual requirements. SGPL will also maintain a National Greenhouse and Energy Reporting inventory to monitor GHG emissions produced by the Project.

2.10.4 Commitment to Greenhouse Gas Management, Mitigation Measures and Residual Impacts

Issue: The EIS describes mitigation measures that could potentially be applied for the Project. The proponent should make a commitment to which of these measures will be implemented.

Submitter: 12, 31

Response: The proponent will comply with all legislative requirements to record, reduce or offset its GHG footprint; this includes its obligations to reduce emissions under the Federal *Energy Efficiency Opportunities Program* and *Clean Energy Act 2011* (currently under review). Under the current Clean Energy Act, the proponent (or its contractor) is likely to be considered a 'Liable Entity' and would be subject to the carbon pricing mechanism to offset its emissions.

Until detailed design is complete, it is difficult to commit to the specific measures that will be implemented, however they will be chosen from the range of measures proposed in Table 12.3e of the EIS. A detailed carbon footprint will be undertaken during the next phase of works (prior to construction) that provides all GHG reduction strategies to be employed at the BCEF and quantifies the savings that will be gained through the implementation of these measures.

The proponent will prioritise measures that reduce the overall GHG footprint of the construction and operational phases of the BCEF through efficient design and construction methodology. Only once all these measures have been implemented, offsets or renewable energy will be considered for residual impacts, as required under current legislation. A detailed study is required to ensure measures implemented are feasible and cost-effective to provide a material reduction in emissions for the Project e.g. is solar power on site more cost effective and practical than using GreenPower or vice-versa? Should the proponent be a 'liable entity' under the Clean Energy Act (Australia's largest carbon emitters, as calculated on an annual basis), then residual impacts will be offset through the requirements of this Act (e.g. paying a carbon price or trading certificates on the carbon market). It should be noted that repeal of this Act is currently before the Federal Parliament, and different requirements for carbon reduction may be in place prior to commencement of works at the BCEF; the proponent will comply with the relevant legislation in place at that time.

2.11 Coastal Processes and Water Quality

2.11.1 Santos Restricted Zone

Issue: The area around the Santos jetty is currently a restricted zone under the *Harbours and Navigation Regulations 2009 (restricted areas – Schedule 5).* Vessels loading at the BCEF will be required to navigate through a small area of this restricted zone when approaching/departing from the proposed jetty. Either the regulations will need amendment, or Santos must grant an exemption to the proponent. Santos have requested that further consultation occur with them to determine potential hazards and risks associated with additional ship movements to determine appropriate mitigation measures and controls.

Submitter: 1, 2, 16

Response: SGPL will consult in detail with Santos and DPTI regarding appropriate management and operational procedures and processes are established to ensure the Port Bonython operates safely for all users. Flinders Ports currently manages Port Bonython on behalf of DPTI and Santos. The BCEF proposal has prepared by Flinders Ports and includes draft Port Rules for consultation and agreement for the future operaton of Port Bonython as a dual jetty common user port facility.

2.11.2 Oil Spill Containment

Issue: The BCEF should make provision for a Tier One oil spill (up to 1000t) including oil pollution clean-up equipment and training personnel in its use. Other submitters have also asked for clarification of procedures in the event of potential Tier Two or Three spills. Further clarification is also requested in regards to how current oil spill plans will be updated to reflect the new facility, and also take account of lessons learnt from the 'Era' spill. A submitter has questioned why oil spill modelling was not undertaken.

Submitter: 1, 2, 18, 20, 26, 29

Response:

As outlined in Section 13.5.4.4, oil spills are classified according to the volume spilled:

- Tier one, up to 10 tonnes. This is a small spill requiring a local response.. Flinders Ports will provide oil spill equipment appropriate for a Tier One response. Regular training is provided to staff on the use of the equipment, in accordance with the requirements of the Spill Contingency Plan for Port Bonython

- Tier two, 10-1000 tonnes. This requires a state and interstate response. There is a South Australian Marine Spill Contingency Action Plan, which would be activated
- Tier three, above 1000 tonnes, which would require all local state, national resources and possibly international assistance.

The existing Flinders Ports South Australia 2005 *Oil Spill Contingency Plan*, South Australia, which currently covers its other ports will be updated to cover The BCEF facility and Santos. Information is available on the appropriate responses to spill management and clean-up for the various types of coast/habitat, such as cobble beach, sandy intertidal, seagrass, mangroves, rock platforms from studies undertaken for Santos (refer AGC 1988a, b), in order to minimise potential impacts.

In the event of a Tier one event the response will be the responsibility of Flinders Ports Incident Controller (FPIC). Activation of the SAMSCAP will be initiated by the State Marine Pollution Controller (SMPC). The FPIC will inform the SMPC of an incident and regularly provide updates on response progression. Full details are contained in the current Flinders Ports Oil Spill Contingency Plan. (Refer to Appendix C for details)

Tier one equipment will be kept at Port Bonython and with the tugs being stationed at the BCEF, responses to an incident can be relatively rapid. Currently equipment or vessels may have to come from Whyalla or Port Pirie.

The piloting of ships and the strict port rules will mitigate against oil spill risk (Refer to Appendix C for a copy of the draft Port Rules for Port Bonython). Under the rules, the management of shipping within the harbour undertaken by Authorised Persons (AP) appointed under Section 12 of the *Harbours and Navigation Act 1993.* Safety is berthing, loading and departure is paramount.

2.11.3 Relocation of Navigational Aides

Issue: Some navigational aids may have to be relocated and maintained by the proponent.

Submitter: 1, 2

Response: Navigation Beacon No.10 (refer Appendix J2, Figure 19 of the EIS) is to be relocated south to the 18m depth contour to improve navigation. SGPL will liaise with DPTI during the detailed design phase about any further relocation requirements.

2.11.4 Vessel Tracking Services System

Issue: A Vessel Tracking Services System should be put in place prior to the commencement of operations to ensure safe navigation and efficient traffic management.

Submitter: 2

Response: Appendix J2, Section 1.7.1 of the EIS outlines the VTS system that Flinders Ports currently utilises at the Port of Adelaide. A similar system will be implemented at the BCEF.

2.11.5 Port Operating Rules

Issue: A Port Operating Agreement and Port Rules should be developed and regularly audited.

Submitter: 2, 26

Response: Port Rules will be developed for the BCEF, and will address the following issues as a minimum:

- Communication protocols between the BCEF and the Santos facility
- Traffic management
- Rules for tug assistance, which will be provided until a vessel is well clear of the wharf and has turned into the shipping channel
- Controls for loading and unloading of vessels (a risk assessment will be undertaken to determine if pumping at Santos should discontinue whilst a vessel passes the Santos berth).

2.11.6 Propeller Wash

Issue: A large number of submitters were concerned about the potential impact of vessel propeller wash on water quality of the Upper Spencer Gulf and marine fauna and requested further detailed assessment of this issue, including modelling.

Submitter: 6, 7, 8, 10, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33

Response: Based on feedback received during stakeholder consultation during the EIS exhibition phase, SGPL has undertaken some further modelling of this potential impact to supplement the material provided in the EIS. A detailed report of findings is provided in Appendix B, and summarised below.

The assessment of the BCEF ship propeller wash has been extended to determine the fate (direction, distance and concentration) of the sediments suspended from the seabed by ship propeller wash. This was undertaken by means of numerical modelling of the tidal flow and consideration of the tidal flow pattern during the ship departure window (2 hours before high tide).

Three scenarios were simulated, namely Simulated Departure 1, Simulated Departure 2 and Simulated Departure 3, as shown in Figure 8.

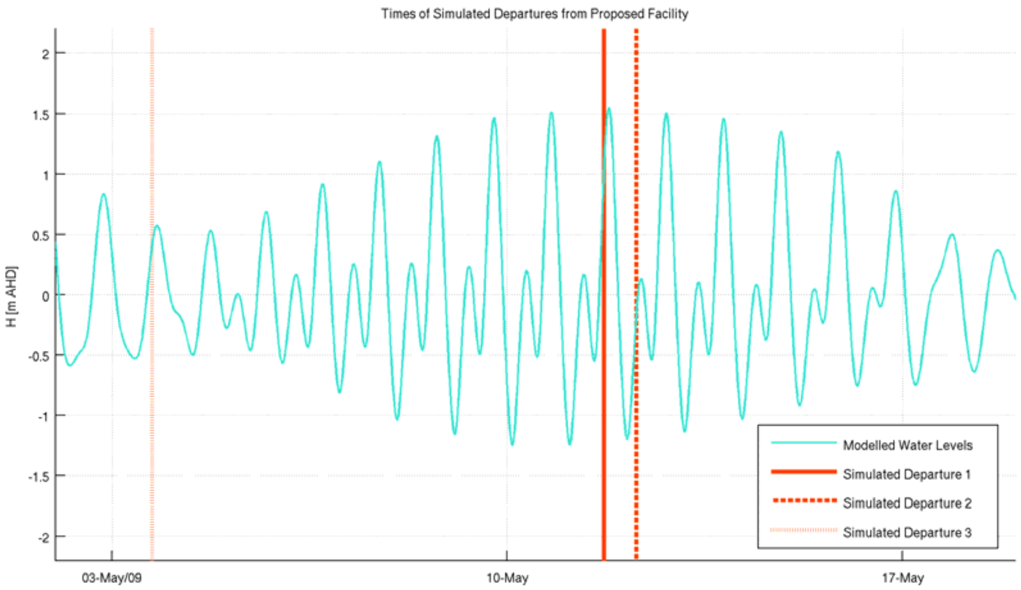


Figure 8:Times of Simulated Ship Departures

Simulated Departure 2 is included to determine the impacts of the ship propeller wash during a relatively small high tide condition as the worst case scenario. It is however noted that for navigation safety reason Flinders Port will not allow ships to depart at this tidal level, as will be documented in the Port Rules for the BCEF.

The results of the numerical modelling works are shown in Figure 9, Figure 10 and Figure 11.

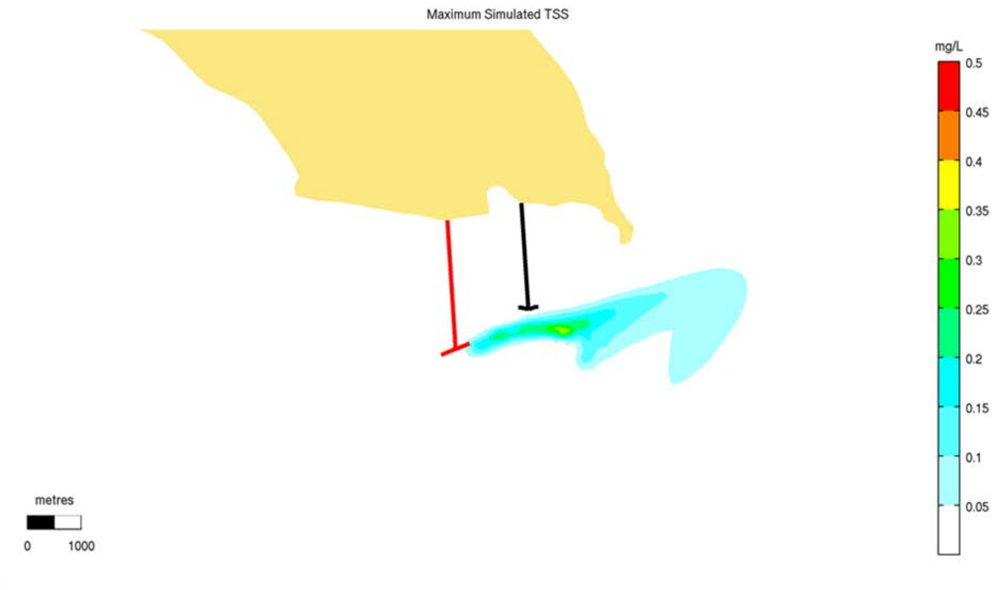


Figure 9: Max Simulated Sediment Concentrations, Scenario 1

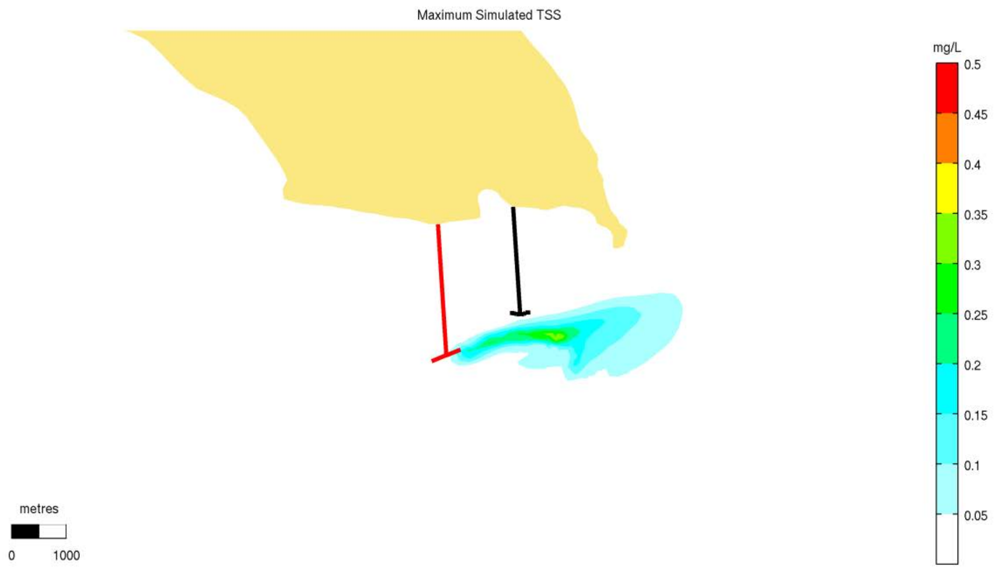


Figure 10: Max Simulated Sediment Concentrations, Scenario 2

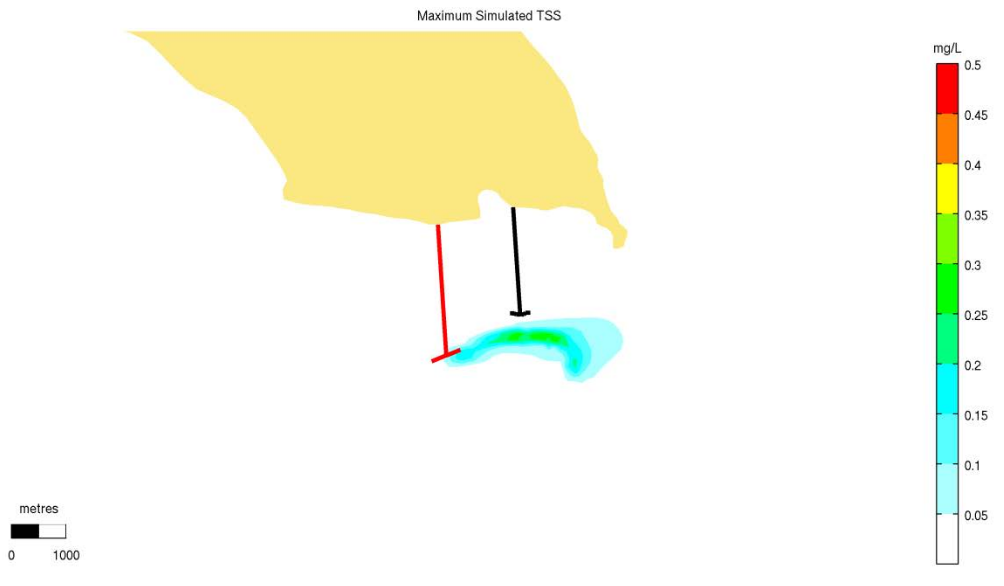


Figure 11: Max Simulated Sediment Concentrations, Scenario 3

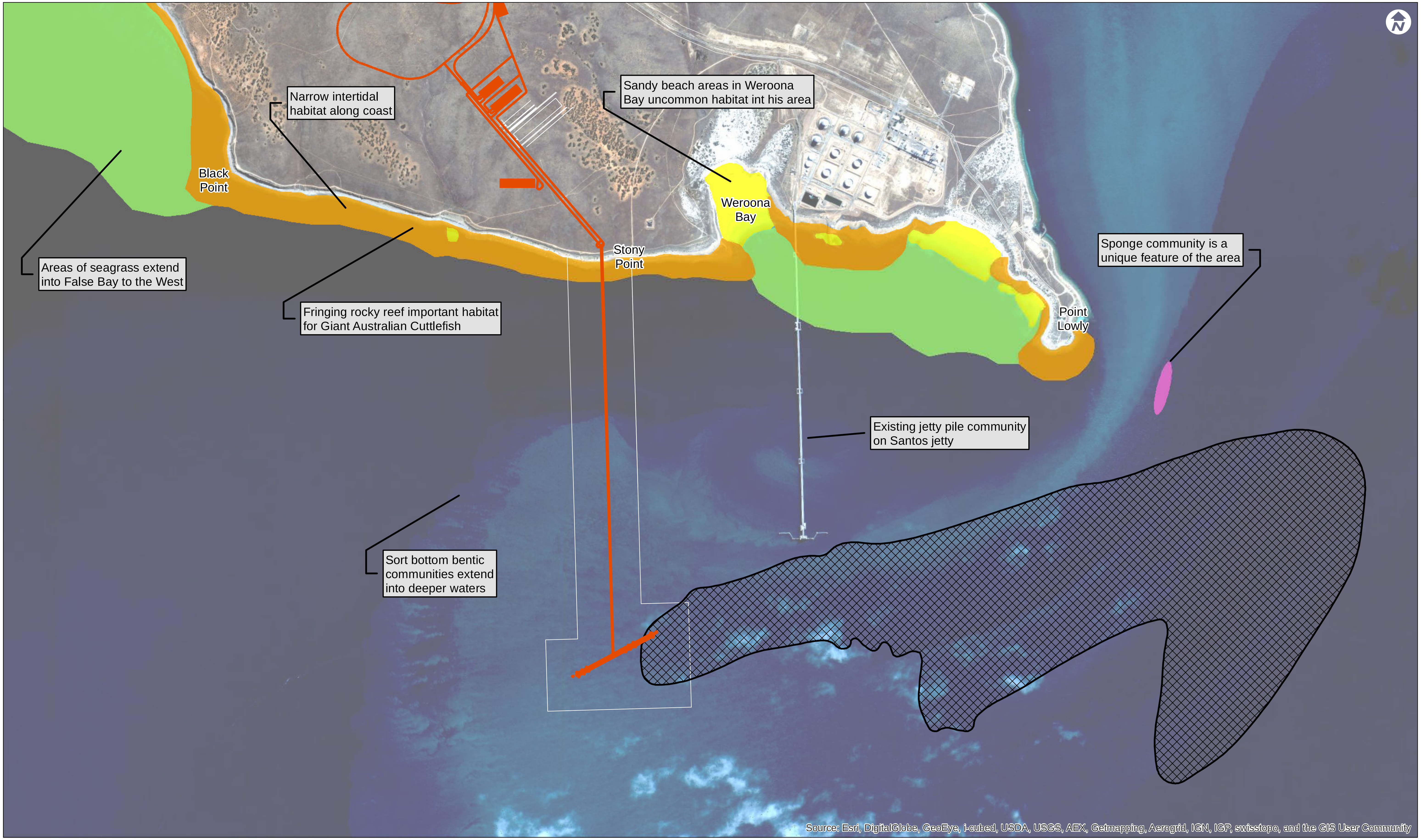
The results show that the plumes of sediments suspended from the bed in the lee of both unladen vessels approaching and laden vessels departing the proposed facility are unlikely to impact on the nearshore water quality for the following reasons:

- There are limited fines (silts and clays) in the natural bed in the vicinity of berths and arrival and departure routes
- Ebb and flood currents are mostly parallel to the shoreline
- Vessels depart during the flooding tide (a Flinders Ports restriction) mean that there is more than five hours before sediments could be transported towards the

coast of Port Bonython by the clockwise circulation which develops in the lee of Point Lowly during low water

- Vessels approaching the proposed facility will abide to all UKC restrictions and will transit under low power as they approach the berth. Therefore any suspended sediments generated will be below water quality thresholds and several kilometres from shore. The modelling demonstrates that these will not be transported towards the shoreline or sensitive ecological habitats.

Concentrations of suspended sediments beyond the immediate shipping route are unlikely to be detectible or visible. Background conentrations of suspended solids near Point Lowly range between 2-22mg/L with a median value of 4.6mg/L (BHBP, 2009). Turbidities range from 2.2-22.4 NTU with a median value of 5.5. These concentrations indicate the range along the coastline from Black Point to Point Lowly. Although there are no statutory water quality objectives for this part of the Australian Coast, draft water quality objectives have been published as part of the Adelaide Coastal Water Quality Improvement Plan (EPA, 2013). This recommends an objective (for nearshore coastal waters) of turbidity <1NTU and suspended solids of <2mg/L. for the 90th percentile. The modelling demonstrates that the concentrations of suspended sediments attributable to the project will be well below this threshold. The maximum level of suspended solids generated will not exceed 0.35mg/L, and will occur at least three kilometres from the shoreline, where sensitive rocky reef habitat that supports the Giant Australian Cuttlefish occurs, as illustrated in Figure 12.



Port Bonython EIS
Spencer Gulf Port Link

Figure 12 -
Maximum Simulated Sediment
(Worst Case Scenario) and
Habitat in Proximity to the Project.

Legend

Habitat Types:

- Rocky reef
- Sand
- Seagrass
- Sponge community

Ship propellor plume extent (worst case scenario)

ARUP

Spencer Gulf Port Link

1:25,000 (at A3)

0 0.25 0.5 1

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

Bed sediments in the vicinity of the proposed facility can be mobilised during spring tides as evident in the spring-neap signal in the turbidity records (BMT WBM 2013). The sediments mobilised by the propeller wash are the same surface sediments which are mobilised during the spring tides. During Spring tides the high currents will inhibit the settling of the sediments originally suspended by the propeller wash and the sediments may remain in suspension for consecutive tides.

Vessels approaching the proposed facility will be within 400-500m of Fairway Bank (a shallow area), and will have greater UKC in an unladden condition than fully loaded vessels departing the facility. As well they will be under low power due to being unladen. The bed sediments on the approach route consist of fine content similar to that at the wharf. Compared to the power required for the vessels and tugs to manoeuvre at the wharf, vessels will transit in much lower power in the approach channel and hence less sediment resuspension is expected. Furthermore these resuspended sediments will be further offshore than the vessel departure sediments and more likely to be captured by the shore parallel currents. It is again likely that concentrations of suspended sediments in the shipping approach route will be below detectable levels within 500m of the approach route. This means that there is negligible risk of sedimentation reducing light availability to seagrass meadows at Fairway Bank or impacting on the coastal environment.

The declared depth at the Yarraville Shoals is -19.6mCD in the declared shipping channel. As described in the EIS, Port Bonython Port Rules will be enforced which ensure all ships departing the port will pass this area during high tides, ensuring that the under keel clearance is maintained at all times within the shipping channel.

2.11.7 Pile Driving Activities and Turbidity

Issue: Further information on potential turbidity as a result of jetty piling activities should be provided.

Submitter: 6, 21

Response: Pile driving does have the potential to generate localised turbid plumes via the mobilisation of in-situ sediments. As stated in the EIS, because of the hollow piling construction methodology chosen, there will be very limited disturbance of the bed and sediment mobilisation is expected to be limited, with plumes localised to the immediate activity area. As nearshore piling will not be conducted during the Cuttlefish breeding season, piling will not cause any sedimentation of Cuttlefish habitat during the season when they would be affected.

Water quality at the Cuttlefish habitat will be monitored during the piling operations. Should the limiting turbidity level at monitoring locations be exceeded due to the piling operations, piling operations will cease and corrective measures to mitigate the turbidity will be sought.

This will be detailed in a Water Quality Management and Monitoring Plan to be developed in consultation with the EPA.

2.11.8 Marine Water Quality Triggers

Issue: The ANZECC Trigger values in Table 13.4f are incorrect. The units should be consistent to allow for meaningful comparison.

Submitter: 8

Response: Table 13.4f of the EIS has been updated, as provided in Table 6 .

Table 6: revised Table 13.4f, Marine Water Quality data for the period Setember 2007-November 2008 (BHPB, 2009)

Parameter	**Santos Jetty Fire Pump**			**A1**			**A10**			**B1**			**B10**			**ANZECC (2000)**
	Min	**Max**	**Ave**	**Min**	**Max**	**Med.**	**Min**	**Max**	**Med.**	**Min**	**Max**	**Med.**	**Min**	**Max**	**Med.**	**trigger values**
Physico-chemical																
pH	8.1	8.1	8.2	7.62	8.36	8.05	7.49	8.36	7.95	7.59	8.31	7.99	7.65	8.33	7.99	8-8.5
Conductivity (mS/cm)	58.6	60.6	59.8	56.3	64.7	61.21	56.4	64.82	62.03	56.7	65.3	62.65	56.8	65.2	62.65	
Turbidity (NTU)	1	8	3	0.0	26.0	2.2	0.0	23.0	2.6	0.0	20.4	2.4	0.0	27.0	2.38	0.5-10
Suspended solids (mg?L) (1.2ug)	5.3	17.0	10.5	2.0	22.0	4.6	2.2	22.5	5.5	2.8	23.5	4.4	2.5	18.0	4.4	
DO (mg/L)	-	-	-	3.81	10.75	8.6	3.62	10.79	8.55	3.86	10.6	8.15	3.82	10.67	8.07	
DO (% sat)	-	-	-	86.5	140.9	120.4	85.3	135.1	124	88.4	135	109.9	87	133	109.4	
Nutrients (mg/L)																
Ammonia as N	0.007	<0.005	0.01	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	0.050
NOX as N	0.006	<0.005	0.008	<0.005	<0.1	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	0.050
TKN as N	<0.05	0.62	0.239	0.08	<1.0	0.14	0.09	<1.0	0.14	0.10	<1.0	0.13	0.1	<1.0	0.15	
Total N as N	<0.06	0.62	0.247	0.10	<1.0	0.15	0.10	<1.0	0.15	<0.10	<1.0	0.13	<0.1	<1.0	0.15	1.00

Parameter	Santos Jetty Fire Pump			A1			A10			B1			B10			ANZECC (2000) trigger values
	Min	Max	Ave	Min	Max	Med.	Min	Max	Med.	Min	Max	Med.	Min	Max	Med.	
PTotal as P	0.011	0.023	0.017	0.007	0.015	0.011	<0.01	0.013	0.012	0.007	0.020	0.014	0.007	0.020	0.012	0.100s
Reactive P as P	<0.005	0.006	0.006	<0.005	0.0	<0.005	<0.005	0.0	<0.005	<0.005	0.0	<0.005	<0.005	0.0	<0.005	0.010s
TOC	0.0	1.3	1.1	0.9	2.5	2.0	0.9	2.0	1.5	0.9	2.0	1.9	0.9	2.0	1.5	
Chl a	0.77	1.5	1.1	0.3	2.0	0.8	0.3	1.1	0.9	0.4	1.4	<1	0.5	1.4	<1	0.001s
Metals (ug/L)																
Iron Total	<5	6	6	<5	80	13	6	57.5	19.5	5.5	31.5	14	<5	28.5	15.5	ND
Iron dissolved	<5			<5	9.5	<5	<5	15.5	<5	<5	9	<5	<5	15	<5	ND
Arsenic	,1	2	2	0.7	2.6	2.2	0.8	2.8	2.2	0.8	2.8	2.2	0.6	2.9	2.05	ID
Cadmium	<5			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.0007/0.0055
Chromium	7	7	7	<0.5	0.7	<0.5	<0.5	1.7	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	0.007/0.0/27
Cr hexavalent	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0014/0.0044
Copper	<10	11	11	<1	12	3	<1	11	2	<1	8.5	2	1	11	2.5	0.0003/0.0013
Lead	<5			<0.2	5.3	0.4	<0.2	2.9	0.4	<0.2	2.3	0.5	<0.2	2.8	0.6	0.0022/0.0044
Zinc	<30	32	30	<5	34.5	<4	<5	15	<5	<5	14	<5	<5	20	5	0.007/0.015

2.11.9 Location of the Jetty Abutment and Potential Impacts to Intertidal Reefs

Issue: The submitter is concerned that the proposed jetty abutment will impact on the intertidal reef and increase turbidity in the nearshore environment during its construction.

Submitter: 8

Response: Figure 13.5a of the EIS shows the proposed location of the jetty abutment. The majority of the abutment is situated on land above the high tide mark, therefore will not have an impact on intertidal reefs. A small section of the abutment, is situated within the intertidal zone to a depth of 1m below sea level. The eggs of the GAC are mostly found within crevices, rocks and overhangs of broken reef between three to five metres deep (Hall & Fowler, 2003). Very few eggs were found attached to exposed rock surfaces. Given this, it is unlikely that that areas used by the GAC would be directly impacted by the jetty abutment.

The abutment will be constructed with a rock bund wall containing granular fill material. Geotextile filter will be used to contain the fill material. Given that this material will be placed on a rocky substrate, there is little potential for the generation of sediment during its construction or removal.

2.11.10 Nutrients and Algal Growth

Issue: The submitter is concerned that iron ore dust from ship loading facilities or spillage from the wharf may contribute to algal growth in surrounding waters.

Submitter: 8, 10, 29

Response: Material from the storage sheds will be conveyed to the ship loading infrastructure via a fully-enclosed conveyor fitted with a shielded opening at the point of intersection with the ship loader. The conveyor is designed to minimise or eliminate fugitive dust emissions; regular inspections and maintenance will also occur to ensure the system is functioning properly and fugitive emissions do not occur. Transfer points will be fitted with water (fogging/mist) sprays, where required. These measures mean that the escape of iron ore dust to the marine environment will be negligible.

In addition, as discussed in Section 14.4.3.6 of the EIS, the ore is virtually insoluble. There is already soluble iron in the range <5-15ug/L, which is available for algal growth. As it is available it is unlikely to be a limiting micro-nutrient. Any additional soluble iron, which is likely to be in the nanogram range and then in close proximity to the source, will not add to algal bloom potential.

Given the very low risk of iron ore entering the marine environment at all, and the low likelihood of it being available for algal growth should this occur, it is not considered that there is a likelihood that iron ore dust will contribute to algal growth in surrounding waters.

2.11.11 Marine Monitoring

Issue: The submitter requests that a marine monitoring program encompassing chemical and biological components should be design in consultation with, and approved by the EPA prior to construction. Santos have also indicated that the construction of the jetty may interfere with their ongoing marine monitoring program which includes sampling sites within the BCEF jetty footprint and westwards. Any impacts from the jetty on water quality or marine ecology could make it difficult to assess whether any impacts detected are due to the new facilities or to the Santos site. The Spencer Gulf and West Coast Prawn Fisherman’s Association Incorporated have requested that the marine monitoring program should include sampling for the abundance of juvenile western king prawns, their disease status and abundance and recruitment of adults.

Submitter: 8, 16, 18, 21

Response: As stated in Section 14.4.3.6 of the EIS, a marine water quality and biological monitoring program will be conducted prior to, during and post construction. It will outline which species are to be monitored, monitoring locations and timing. This will be designed in consultation with the EPA and other relevant agencies. Works will not commence until the monitoring program is agreed.

The program will outline the scope of work, including locations, methodology, frequency, duration, reporting, responsibilities and review. Preferably it will integrate with other monitoring/investigations underway or proposed in the area, to improve the quality and usefulness of data collected. In particular the monitoring program will be developed in consultation with Santos, both to ensure there is no interference to their existing program and to examine the benefits of collaboration in individual programs to avoid unnecessary duplication.

The program will contain, but not be limited to:

- A pre-construction baseline survey to confirm existing conditions, including the extent of any pest species (information could be obtained from existing programs)
- A post-construction targeted survey to confirm the actual extent of disturbance of the reef and soft bottom communities
- Monitoring of the effects of construction activities (pile driving in particular) on sedimentation and turbidity on the reef and soft bottom communities and confirm the assessment in the EIS
- In the early stage of operation, when ships start to use the jetty, a short-term investigation to measure the effects of ship propeller wash on water quality, to confirm the modelling results
- A water quality monitoring program for key parameters, for the first 2-3 years of operation, after which the scope of ongoing monitoring is reviewed
- Monitoring of the jetty piles and reef for the occurrence of new pest species (may be undertaken as part of a bigger program by others).

The scope of monitoring specifically undertaken by the proponent, its integration with other programs or use of other program data will be determined in consultation with the EPA, DEWNR and other relevant agencies and stakeholders.

2.11.12 Navigational Hazards for the Spencer Gulf Prawn Fleet

Issue: The increase in shipping traffic may be a navigational hazard where shipping channels and designated anchorages overlap with fishing grounds.

Submitter: 18

Response: Vessels calling at the BCEF will be using the existing shipping route and designated anchorage areas that are known to mariners and clearly marked and under the care and control of DPTI, apart from the shipping route immediately offshore of BCEF which will be within the port's water limit. The existing safety controls which exist within the designated shipping route will remain in place. Vessels using the channel will be under pilot for the majority of their passage, further decreasing navigational hazards. Flinders Ports will be initiating a coordinated Vessel Control System which will provide notification of all vessels using the channel under their pilotage.

2.11.13 Shipping Congestion and navigation in Tide-constrained Areas

Issue: The increase in shipping traffic, and the requirement for vessels to depart from the BCEF on favourable tidal conditions will lead to congestion at shallow areas. This will increase the likelihood of vessel collision or grounding. Submitters are also concerned that the UKC allowed for will not be sufficient to cater for larger vessels in the future, and dredging may be required to increase clearance levels.

Submitter: 23, 26, 28, 29, 30, 31

Response: The increased shipping traffic as a result of the BCEF will be up to an average of ten vessel calls a week, or less if the full 50mtpa capacity of iron ore handling is not reached. The marine traffic will be controlled and coordinated by Flinders Port who is also the Port Authority of a number of other ports in the Spencer Gulf, including Port Bonython (SANTOS jetty), Whyalla, Port Pirie and Whyalla (SPN). This will optimise the timing of boat movements, which will be under local experienced pilotage and tug-assisted at shallower areas, minimising the risk of vessel collision or grounding. Navigation through shallow areas will only occur during safe conditions (tides, currents, winds, waves, bed level and other shipping traffic), as assessed by the pilot. Refer to Appendix J2 of the EIS for further detail on vessel navigation through tidally constrained areas.

The UKC allowance, together with the berthing and mooring structures, is designed for Cape Size vessels. Catering for vessels larger than the design vessel size would require upgrading of the berthing and mooring structures, dredging works or operation restrictions. Such changes will subject to further EIS studies and approvals.

2.12 Marine Ecology

2.12.1 Impacts to GAC

Issue: A large number of submitters are concerned about both direct and indirect impacts to the Giant Australian Cuttlefish. Concerns include:

- Direct loss of rocky reef habitat
- Indirect loss of habitat as a result of:
    - A deterioration in water quality
    - Underwater noise
    - Oil spills
    - Introduction of pest species
    - Interference with migratory pathways.

Submitter: 4, 6, 7, 9, 10, 12, 20, 23, 24, 25, 26, 27, 28, 29, 30

Response:

Loss of Habitat

Primary habitat for the GAC is the rocky reef zone between Black Point and Stony Point, which extends approximately 150m offshore to a depth of between six and seven metres below mean sea level. The GAC aggregrates seasonally to breed on the reef using the crevices in which to lay eggs. A small area of this habitat (approx. 50-100m^2) will be lost as a result of jetty pile construction. This forms only a very small area of the overall rocky reef habitat available to the GAC, including that protected under Sanctuary Zone 5 (SZ-5) of the Upper Spencer Gulf Marine Mark Management Plan for the purposes of maintaining GAC breeding habitat. The BCEF is not within the Sanctuary Zone and there is no direct impact on this area. The jetty abutment does not extend into the subtidal zone. Once constructed, there will be no further physical intrusion into the intertidal or subtidal areas under the jetty. Because of the north-south orientation of the jetty, it being 10m above mean high tide and only 6m wide, shading should not be an issue. Shading at any one point will be of short duration as the sun moves.

Several submitters have also raised concerns about a number of potential indirect impacts; these are addressed in detail the following sections of this report:

Water turbidity	2.11.6 & 2.11.7
Oil spills	2.11.2
Marine pests	2.12.3
Ballast water exchange	2.12.4
Biofouling	2.12.5
Underwater noise	2.12.6 & 2.12.7

These responses indicate that whilst there is still some residual risk of indirect impacts to the GAC aggregation area, extensive management measures will be put in place to minimise or eliminate this risk. In particular, Section 2.11.7 of this report clearly demonstrates that turbidity plumes from propeller wash will not affect the rocky reef zone.

SARDI has suggested that artificial habitats (cuttlefish dens) should be considered to offset the loss of habitat to jetty pile construction. Given the small area of habitat loss, this is not deemed necessary, however SGPL will consider and discuss potential offset requirements and the benefits of artificial habitats with SARDI.

Movement to and from the aggregation area

The GAC aggregation period is reasonably well understood in recent and ongoing studies and they begin congregating on the reef at Black Point around April-May (Steer et al (2013), Hall and Fowler (2003)) and as numbers increase they move eastwards towards Stony Point (Michael Steer, pers com). As described in the EIS, construction of the jetty will commence in the summer, and it is intended that by the time of the known aggregation period (and juveniles), construction activities will be well offshore and beyond the acoustic range of piling activities.

Because of the movement of the cuttlefish eastwards along the reef following breeding, the distance offshore and localised nature of the effects of construction, it is very unlikely that the construction activities would result in a barrier to movement to or from the aggregation area.

Summary

With only a small direct impact on the GAC aggregation area, and the implementation of significant controls for potential indirect impacts, there is not expected to be a significant impact on the overall population of the GAC, enabling existing tourism operations to continue and future opportunities to be created.

2.12.2 Determining the Commencement of the Cuttlefish Breeding Season

Issue: The proponent should provide specific details such as frequency, location and timing in regards to determining the beginning of the cuttlefish breeding season so that undetected spawning cuttlefish are not exposed to construction noise and turbidity.

Submitter: 10

Response: The proponent will consult with DEWNR prior to the commencement of construction works to agree the timing, frequency and location of diving surveys.

2.12.3 Shipping Traffic and Impacts on the Potential for Increased Marine Pest Transfer

Issue: The proponent should further describe information regarding existing and future vessel movements to the existing Santos jetty and whether vessels utilising the proposed BCEF jetty will come from new donor ports, thereby increasing the likelihood of introducing new sources of marine pests. The response procedure in the event of a new pest record should be described.

Submitter: 7, 18, 20, 21

Response: The destination of the vessels leaving the proposed BCEF will be any nation with a steel making industry (likely to include China, Taiwan, Japan, Korea). Marine pests are heavily monitored and managed by the Australian Government through the *National Ballast Water Management Regulations 2006*,which in turn responds to the International Marine Organisation conventions.

To protect our marine environment and industries, the Australian and state/territory governments, along with marine industries and marine scientists are implementing Australia's National System for the Prevention and Management of Marine Pest Incursions (the National System). The National System aims to prevent new marine pests arriving, guide responses when a new pest does arrive and minimise the spread and impact of pests already established in Australia.

The BCEF will comply with all national and international standard for marine pest management.

2.12.4 Water Management

Issue: The submitter is concerned that any discharge of ballast water from vessels utilising the BCEF may generate turbidity and also entrain juvenile organisms (i.e. cuttlefish).

Submitter: 7

Response: As stated on Page 444 of the EIS, there will be no dumping or exchange of unauthorised ballast water at the BCEF, as per the requirements of the *Australian Ballast Water management Requirements* (DAFF, 2011) and the Australian Quarantine Inspection Service (AQIS). While vessels are loading cargo, water will be discharged from their ballast water tanks (under regulations, ballast water collected in open waters can only be discharged; no water collected from other ports that may contain pest organisms is discharged). The quality and quantity of this water is controlled in accordance with International Standards (IMO) and Australian Regulations. The water is generally discharged from outlets position below or in the immediate vicinity of the water line, and will occur at the end of the jetty (approximate depth of 20m). Turbidity is not a concern for this discharge water however some minor turbulence may be present in close proximity to the outlets.

Small amounts of ballast water may be taken occasionally after loading is complete to balance the vessel and ensure correct trim prior to departure. Vessels have filters on intake systems that would prevent the uptake of juvenile marine organisms.

2.12.5 Biofouling Management

Issue: The submitter is concerned that marine pests could colonise on pylons and requests that pylon wrapping be considered to prevent their colonisation.

Submitter: 7, 18

Response: As described in Sections 2.12.3 and 2.12.4 above, the management of marine pests is heavily regulated in Australia, and given this marine pests incursions are not expected. Should a breakout event occur however, marine pests would not be allowed to colonise on pylons, therefore no treatment of pilons is required.

The jetty will be monitored on a regular basis as part of the ongoing management and maintenance of the facility, and will include surveys of the piles and jetty structure to ensure identification and removal of any potential pests shuold they occur.

Furthermore, marine fauna native to the Project area will be encouraged to colonise the pylons as has occuured on the exsitng Pt Bonython jetty structure, hence it would not be appropriate to unnecessarily wrap the pylons or provide anti-fouling paint.

2.12.6 Underwater noise and Impacts on Cuttlefish Breeding Habitat

Issue: The EIS undertakes an assessment of the impacts of piling noise on the GAC, concluding that avoidance behaviour would be experienced within 300-1200m of the piling source. To avoid any impact to the GAC breeding area, the proponent has committed to avoiding inshore piling during the cuttlefish aggregation season.

The submitter (EPA) wishes to confirm that any piling closer than 550m offshore from lowest astronomical tide is undertaken outside of the aggregation season (01 May – 01 October). Additionally, the EPA requests that underwater noise monitoring of piling noise is undertaken to validate the model findings and to confirm that underwater noise at the breeding habitat is meeting compliance thresholds.

One submitter (29) questioned the impact criteria developed in the study for GAC with reference to a paper by Andre et al (2011).

Submitter: 8, 20, 29

Response: The EIS commits to not conducting inshore piling within the cuttlefish aggregation season, which may occur approximately between May and October annually. Inshore piling is defined as piling within 550m of the shoreline at Lowest Astronomical Tide (LAT), beyond which impacts are unlikely to be significant (Section 15.6.5 of the EIS) based on a review of available literature and noise modelling. Because the timing of the aggregation period can vary, surveys will be undertaken and if the presence of the GAC is not detected, piling works may occur during May and October in inshore locations until such time as the aggregation season begins (or ends) if required. Additionally, should GAC be detected outside of the May to October season through surveys, inshore piling will cease.

As outlined in Section 15.6.6 of the EIS, underwater noise monitoring will be conducted at the beginning of the construction period to calibrate the predicted impact of piling and confirm that compliance thresholds at the breeding area will be met.

The impact criteria developed for GAC are based on a comprehensive literature review of available research into acoustic damage of cephalopods.

Two criteria approaches have been developed, one using the dB_{ht} principle (quantifying how loud the sound is relative to the hearing thresholds for the animal), and considering the most stringent published hearing threshold data in the literature for cephalopods. The second criteria approach is based on the published research by Andre et al (2011) in terms of unweighted sound exposure level (SEL) values (dB re 1 μPa^2-s).

The two criteria approaches give predicted zones of impact that are very similar (e.g. for inshore piling the approach based on dB_{ht} gives an impact distance of approximately 60m for temporary hearing damage; the approach based on SEL gives an impact distance of approximately 70m)

The conclusions of the draft EIS with regard to acoustic impacts on the GAC are based on the best available evidence in the literature with regard to acoustic sensitivity of cephalopods.

2.12.7 Noise/vibrational Impacts from Jetty Operations and Impact on the Marine Environment

Issue: The draft EIS does not assess the expected noise or vibration that may be transferred from jetty operations (i.e. conveyor belts or other machinery) and the impact this might have on the marine environment.

Submitter: 10, 18

Response: Noise and vibration impacts from sources located on the top of the jetty (e.g. machinery) are not expected to be significant compared to noise from sources that are located in direct contact with the water column (which have been assessed in the EIS).

Airborne noise sources experience significant reflection loss (>99% of energy) at the air-water interface and therefore direct propagation of airborne noise sources to the marine environment is not significant.

Vibration from sources located on the jetty can re-radiate as underwater noise; however there are several losses involved in this process (losses associated with transmission of vibration from the machinery into the wharf structure itself; losses associated with propagation through the wharf structure, and additional losses as the vibration radiates into the marine environment as noise, either at the structure-water interface or via the sea floor).

The EIS has assessed underwater noise impacts from ship-based sources which are in direct contact with the water column and can radiate as underwater noise more efficiently than wharf-based sources. Noise impacts from wharf-based sources are expected to be less significant than impacts from the ship-based sources which have already been considered in the EIS.

2.12.8 Ship Strike/Shipping Noise and Impact on the Southern Right Whale and other Marine Animals

Issue: A number of submitters raised concerns about the accuracy of ship-strike data provided in the EIS and the potential for additional ship movements to increase the incidence of ship-strike as well as marine noise in the Upper Spencer Gulf, interfering with the species recovery.

Submitter: 12, 21, 28, 29

Response: Anecdotal evidence from the Spencer Gulf community has been considered in developing our approach to the protection of Southern Right Whales. The SA Whale Centre database is a collection of sighting reports from the public and other interested persons that are reviewed and verified by the SA Whale Centre before being entered on the online database. It is acknowledged that the database is more actively used in the whale watching tourism areas of South Australia, such as Victor Harbor and the Head of the Bight, but it is to be expected in these areas that are regularly and consistently inhabited by significant number of whales.

It is acknowledged that the whale sighting data presented in the EPBC Preliminary Documentation Report is indicative only, but represents the best available (verified) information. Whilst there are some additional sightings that may be added based on social media sites, the number of visitations to the Upper Spencer Gulf are still very low in comparison to recognised southern aggregation areas in South Australia.

The Conservation Management Plan for the Southern Right Whale (SEWPAC, 2012) states that the species have ‘strong site fidelity and social cues that are likely to constrain their capacity to establish regular aggregations in new or previously used locations, even where apparently suitable habitat is available’. Historical high use areas pre-whaling times correlate with current use and these areas will become more heavily used by whales, rather than expansion to new areas occurring. This indicates that the Upper Spencer Gulf is unlikely to become an established aggregation area in the future.

As outlined in the following sections, any impacts to the Upper Spencer Gulf (water quality, noise etc.) are assessed as being localised and temporary and would be considered unlikely to prevent any possible future expansion in numbers of Southern Right Whale that visit the Upper Spencer Gulf.

The best available data on ship strikes has been used to draw the conclusions made in the EIS. It is acknowledged that instances of ship strike may be under reported in larger vessels due to crews either not noticing or not reporting incidents. Nevertheless, there have been no recorded incidences of ship strike from ports of the Upper Spencer Gulf. Flinders Ports closely monitors vessel movement in the Gulf, and it is unlikely that known ship strikes would have gone unreported.

Regardless, the number of Southern Right Whales utilising the Upper Spencer Gulf remains low in comparison to the overall population, and the risk of ship strike having a significant impact on the species is considered low with the mitigation measures put in place.

The most effective measures to minimise ship strike are considered to be reducing vessel speeds and separating shipping channels from whales (IMO, 2006). Decision-making regarding these measures are controlled by the State and Commonwealth Governments; the Commonwealth are currently considering such measures through the Conservation Plan. Should current controls be amended, any vessels utilising the proposed Port Bonython facility will be subject to these.

Flinders Ports will closely monitor any incidences, which will be reported to authorities and the South Australian Whale Centre for public record. Should an increase in incidences be recorded, current proposed mitigation measures will be reviewed and amended if required.

The likelihood of Southern Right Whale ship strike will increase with increased vessel numbers, however it is still considered to be an unlikely and uncommon event. Whilst the numbers of ship strikes reported may not be accurate, the available information still does provide some indication that the numbers occurring are low. The population of Southern Right Whales is steadily increasing at a rate of 6.8% annually, despite the current level of ship movements through the southern waters of Australia (SEWPAC, 2012).

The IWC (2006) reported that Australia is not considered a high risk area due to the low intensity of shipping. Areas of high risk have significantly higher volume of shipping that that which would be experienced as a result of the Project, and include the Straits of Malacca, the east and west coasts of the US and the English Channel, as shown in Figure 13.

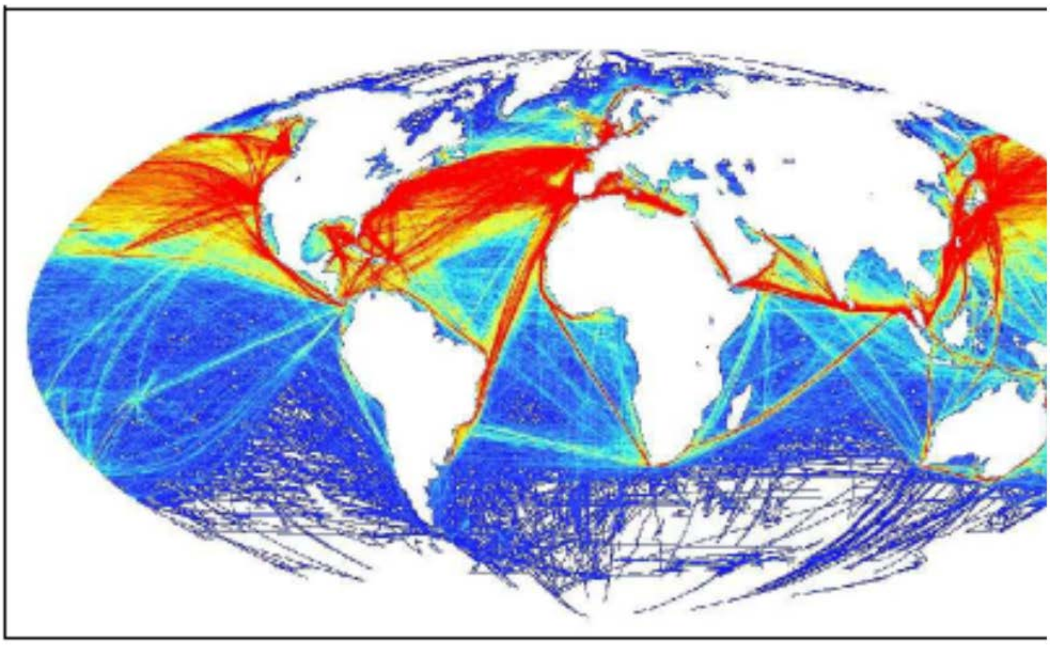


Figure 13: Global shipping routes (NCEAS, 2012 in PGM, 2012).

It is noted that some submitters referred the proponent to 10 knot speed limits imposed in the United States for the protection of the Northern Atlantic Right Whale (NARW).

Flinders Ports is responsible for the management of speed limits within the Ports limits only. Speed limits on vessels utilising the BCEF will be put in place as part of operational controls within port limits. Within Port waters, the vessel's speed on berthing will be around six to seven knots reducing as they get closer to the berth. The opposite takes place on departure, and the ships speed will be limited to a maximum seven knots within Port limits.

Ship speeds within Spencer Gulf are controlled by the *Harbours and Navigation Act 1993* and *Harbours and Navigation Regulations 2009* (section 168 and schedule 10), administered by the South Australian Department of Planning, Transport and Infrastructure (DPTI). These Acts do not currently impose speed limits on commercial vessels utilising the defined shipping lanes of Spencer Gulf.

In Commonwealth Waters, the Australian Maritime Safety Association (AMSA) is responsible for maritime environmental management under the *Australian Maritime Safety Authority Act 1990*. AMSA takes direction from and is closely aligned with the International Maritime Organisation which sets standards for the environmental management of international shipping. AMSA do not currently place restrictions on vessel speeds in Commonwealth waters in southern Australia. The Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011–2021 (SEWPAC, 2012) recommends that a National Ship Strike Strategy will be developed that will explore whether speed limits should apply in specific regions.

Should current regulations change, then vessels utilising the proposed Bulk Commodities Export Facility (beyond port limits) will be subject to vessel speeds considered necessary for the protection of the Southern Right Whale.

In regards to disturbance of the Southern Right Whale from underwater noise, the available guidance in the literature indicates that whales (including baleen whales) may exhibit avoidance behaviour when exposed to underwater noise levels greater than approximately120 dB re 1 µPa, which is the threshold given in the National Oceanic and Atmospheric Authority (2011) interim guidelines, which have been used to predict the possible zones of avoidance referred to in the report.

However, other factors mean that animals sometimes do not exhibit avoidance behaviour even at received levels where avoidance would be expected. These factors include migration routes, feeding pressures and, potentially, habituation to the noise source.

In some cases, as discussed in Nowacek et al, due to complicated underwater sound propagation the animal may not be able to hear an approaching ship until the ship is quite close (<500m); however, as Nowacek et al note, such effects are most prominent in deep water. In the case of Port Bonython, the Upper Spencer Gulf is relatively shallow and hence ship noise is likely to be more audible to whales.

Hence, the distances quoted in the EIS reflect distances at which avoidance behaviour may be expected to occur. Other factors (habituation, migration or feeding pressures) may result in no avoidance behaviour occurring.

Accordingly, the mitigation measures already proposed for managing ship strike impacts on whales are considered appropriate, since they deal with the case where a whale comes in close vicinity to a ship.

2.12.9 Potential Impact on the Upper Spencer Gulf Western King Prawn Fishery

Issue: The proposed BCEF may potentially have the following environmental impacts on the Spencer Gulf Prawn Industry:

- Damage/loss of adult and juvenile western king prawn habitat
- Displacement of western king prawns from the area

- Introduction of diseases (and other pest species) to the western king prawn population and critical habitats
- Alteration of ecosystem processes in Upper Spencer gulf that are relevant to the sustainability of the western king prawn fishery.

Submitter: 18, 20, 21

Response:

Important Habitats

While the importance of the prawn industry was referred to in Section 10.4.4.3 of the EIS, it is acknowledged that the importance of habitats, particularly the Western King Parwan *Penaeus latisulcatus*, should have been identified in the general description of the marine habitats and communities. In this regard, important areas are False Bay as a major nursery area, the soft bottom community and probably to a lesser extent the intertidal sandy intertidal habitat near Point Lowly which includes Weeroona Bay. As outlined in the EIS, there will be no direct loss of these intertidal habitats that are considered nursery areas.

Turbidity and Dispersal

As discussed above in Section 2.12.1 of this report, there will be minimal localised and transitory effects from piling on turbidity/suspended solids levels during construction or from propeller wash from vessels near the facility during operation. As shown on Figures 9, 10 and 11, the dispersion plume is away from the intertidal sandy habitats. Consequently the risk of displacement as a result of increased turbidity is negligible.

Oil Spills

As indicated in Section 2.11.2, oil spill contingency planning is a major focus for the successful ongoing operations of Port Bonython and detailed management measures to mitigate against oil spill incidents will be implemented.

Alteration of Ecosystem Processes in Upper Spencer Gulf

The uniqueness of the Upper Spencer Gulf and the importance of all the major habitats including bays, estuaries soft bottom/pelagic, seagrass, mangroves etc is recognised and discussed in the EIS, as well as its importance to commercial and recreational fisheries, migratory species etc. As well as protecting the local environment the potential impacts and mitigation measures have been considered in this broader context, it should be noted that:

- There is no direct loss of habitats, such as the intertidal habitats of False Bay, seagrass, mangroves, sandy intertidal areas near Point Lowly and only a minor impact on the soft bottom community with the jetty piles. Consequently the potential impact on habitat availability for prawns or other marine species is negligible
- There are no discharges from the BCEF which could affect water quality. The Project will have no affect on the temperature of salinity characteristics of this reverse estuary
- The jetty will not affect water movement patterns

- There is a low risk of the iron ore entering the marine environment; should this occur however, it is virtually insoluble and would be regarded as non toxic.

Disease and Pest Introduction

As indicated in Sections 2.12.3, 2.12.4 and 2.12.5, the introduction of pest species is now being managed at a national and international level, with updated guidelines and procedures. Because of the importance of this issue to the marine environment and commercial fisheries, the guidelines will be strictly enforced at the BCEF, as it is understood that once established species can be very difficult to control or eradicate. As indicated in Section 2.12.5, regular monitoring will occur at the facility so that early detection and treatment of new pest species can occur.

2.12.10 Potential Impact to the Fitzgerald Bay Aquaculture Zone

Issue: The Project may impact on the future of the existing aquaculture industry in Fitzgerald Bay.

Submitter: 15

Response: As indicated in Section 10.4.4.3 of the EIS, the decline in aquaculture (kingfish) in Fitzgerald Bay is believed to be due to a disease. There is no aquaculture currently occurring at Fitzgerald Bay. The lease areas should not be impacted by impairment of water quality either during construction or operation as a result of:

- There being no adverse impacts during construction from turbidity on the nearest aquaculture areas in Fitzgerald Bay, as determined in Section 14 4.2.6 of the EIS and in Section 2.11.6 of this report
- There are no discharges to the marine environment of sewage effluents or any other waste, which could affect water quality.

Tidal movements from the Project area are to the south and west of Point Lowly and any discharges to the marine environment would not travel towards Fitzgerald Bay.

Aquaculture could also be impacted by new introduced species from shipping using the new port. However, as described above in Section 2.11.2 and 2.11.3-2.11.5 with the strict measures already in place and those proposed, there will be a low risk.

2.12.11 Bottlenose Dolphins

Issue: Point Lowly has been identified as a high use area for Bottlenoise Dolphins. What impact will the Project have on these nursery areas?

Submitter: 21

Response: As shown on Figures 9-11 in Section 2.11.6, the dispersal of a sediment plume is eastwards away from Point Lowly and is not expected to impact on the identified nursery area. The impacts of underwater noise on dolphins was previously discussed in Chapter 15 of the EIS.

2.13 Underwater Noise

2.13.1 Ambient Noise Measurements

Issue: In-situ underwater ambient noise measurements should be undertaken to provide data on the underwater noise profile of the surrounding environment.

Submitter: 29

Response: Assessment criteria for underwater noise impacts are based on absolute threshold levels for physiological impacts to animals. These criteria fall into two broad categories – physical damage to the animal or behavioural responses. Physical damage criteria are not significantly affected by existing underwater environment (existing underwater ambient levels must be below damage thresholds as otherwise animals would have pre-existing auditory damage).

The existing ambient noise environment will only affect assessment of behavioural effects; existing ambient noise would only serve to mask noise from sources associated with BCEF and would decrease the zones of impact.
If background noise is low, no auditory masking would occur and behavioural effects would occur when the source level is sufficiently above the animal's hearing threshold to provoke a behavioural reaction. With increased background noise, the animal's hearing threshold would be raised and a higher source level would be needed to evoke the same behavioural reaction – i.e. in "noisy" ambient environments the zones of impact will be reduced due to auditory masking from the existing noise environment.

Accordingly, although data of the existing noise environment would be useful, having this data would either result in no change to the predicted levels of impact from BCEF or would result in a reduction in the predicted impacts. The approach adopted by the EIS (based on absolute thresholds for impact) is conservative.

2.13.2 Need for Further GAC Studies

Issue: Further specific studies should be conducted to determine the tolerance of the GAC to noise pollution with greater certainty.

Submitter: 29

Response: The assessment of noise on the GAC has been based on the most stringent available research in the literature for cephalopods. Our study approach and the information used for the assessment was peer reviewed by Curtin University and deemed acceptable.

2.14 Cultural Heritage

2.14.1 Consultation with Aboriginal Parties and Native Title Claimants

Issue: The submitter is concerned that no consultation with aboriginal parties and native title claimants has taken place, and requests that a heritage management plan be provided, as required under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* and the *SA Aboriginal Heritage Act 1988* be included in a RSR to be made available for public perusal and comment before it passes to the Minister for assessment.

Submitter: 28

Response: SGPL has been liaising closely with the SA Department of Premier and Cabinet- Aboriginal Affairs and Reconciliation Division (DPC AARD) who administer the *SA Aboriginal Heritage Act 1988* (AHA) to ensure that the processes followed comply with all requirements of the legislation, including consultation with Traditional Owners.

A cultural heritage management plan will be prepared that will meet the requirements of the AHA and the Aboriginal and Torres Strait Islander Heritage Protection Act 1984. This plan will not be completed in time for release of this report due to the anticipated program of consultation with Traditional Owners including the four groups identified by DPC-AARD: Barngarla, Kokatha, Adnyamathanha and Nukunu peoples).

The draft cultural heritage management plan will not be publically available prior to detailed consultation with Traditional Owners and DPC-AARD regarding the BCEF impact upon and management of Aboriginal cultural heritage.

SGPL will comply with any determination made by the Minister in regard to the impact of the proposed BCEF on Aboriginal cultural heritage under the AHA and the cultural heritage management plan will take account of the outcomes of consultation with Traditional Owners and any conditions and requirements of the Minister's determination.

2.14.2 Potential Impact to Cultural Heritage Site from Iron Ore Storage Shed Construction

Issue: The concept drawings provided in Appendix E of the EIS show impact on heritage listed site #6432/3041.

Submitter: 30

Response: The drawings provided in Appendix E are concept only, and further detailed design will be undertaken. The sheds have been designed such that they do not incur any impact on this heritage-listed site.

2.15 Hazard and Risk

2.15.1 Hazards to the Marine Environment

Issue: This chapter of the EIS does not make reference to the marine environment, with more emphasis placed on hazards to humans.

Submitter: 10

Response: Hazards and risks to the marine environment are described in Chapter 13 (Coastal Processes and Water Quality) and Chapter 14 (Marine Ecology) of the EIS. This is not repeated in the Hazard and Risk chapter to avoid repetition and improve ease of reading.

The purpose of Chapter 17 (Hazard and Risk) is to assess key health and safety risks associated with the community, workforce and visitors to the site. Potential environmental impacts are dealt with in other chapters of the EIS, including the Environmental Management Plan (Chapter 19 of the EIS).

2.16 Cumulative Impacts

2.16.1 Iron Ore Spills

Issue: Cumulative impact for potential iron ore spills into the marine environment from loading operations should be considered.

Submitter: 10

Response: A detailed risk assessment and review of the concept design was undertaken to establish the potential for iron ore spills to occur into the marine environment in the EIS. As there will be negligible impact of iron ore spill to the marine environment from the BCEF, it is not necessary to consider the cumulative impact of iron ore spills. The jetty and conveyor system have been designed in such a manner as to mitigate potential risk for iron ore spills to reach the marine environment. Fully enclosed conveyors sited within controlled, closed areas of the solid jetty structure (concrete jetty deck) provides multiple tiers of prevention for escape of iron ore. Regular maintenance and monitoring will further ensure the operation works as designed.

2.16.2 Access to Planning Documents for Existing or Planned Projects within the Vicinity of the Project Area

Issue: A number of submitters expressed concern about the extent of the cumulative assessment and the unavailability of documents upon which to base the assessment. At the time of preparing the EIS, planning documents for the Port Bonython Fuels Facility and expansion of the Arrium facility at Whyalla were not available.

Submitter: 19, 27, 28, 29, 32

Response: The proponent again requested planning documents from the Department of Planning, Transport and Infrastructure (DPTI) upon which approval for the Arrium and Port Bonython Fuels facility were granted, as a result of submissions received.

As these projects received approval under Section 49 of the South Australian *Development Act 1993*, applications are confidential due to copyright legislation. Although these reports are made available to the public during a display period, they are unable to be provided to third parties (i.e. SGPL) outside of this period.

Because of this restriction, further assessment of the cumulative impact of these projects was unable to be undertaken as part of this response document. Despite this, SGPL will seek to consult with the proponents of these facilities (and others) in regards to the management of potential environmental issues and appropriate management controls.

2.16.3 Cumulative Visual Impact

Issue: The EIS does not provide sufficient detail of cumulative visual impacts.

Submitter: 21

Response: Since the EIS was completed, a visual fly-through of current, approved and potential projects was prepared on behalf of DPTI and Whyalla Council. The visualisation tool will be accessible to the public from Monday, 21 October at the following locations:

- Whyalla City Council, Darling Terrace
- Whyalla Public Library, 7-9 Ekblom Street
- Regional Development Australia Whyalla and Eyre Peninsula, 127 Nicolson Avenue.

Staff at each of these locations have been trained on how to use the tool and will be available to explain it to residents and other stakeholders.

Figure 14 and 15 provide images from this fly-through that graphically illustrate the appearance of the BCEF, Santos facility, Port Bonython Fuels and Olympic Dam desalination plant.The infrastructure associated with the BCEF is only visable to the public from a few locations, mostly from the water and Cuttlefish Drive.

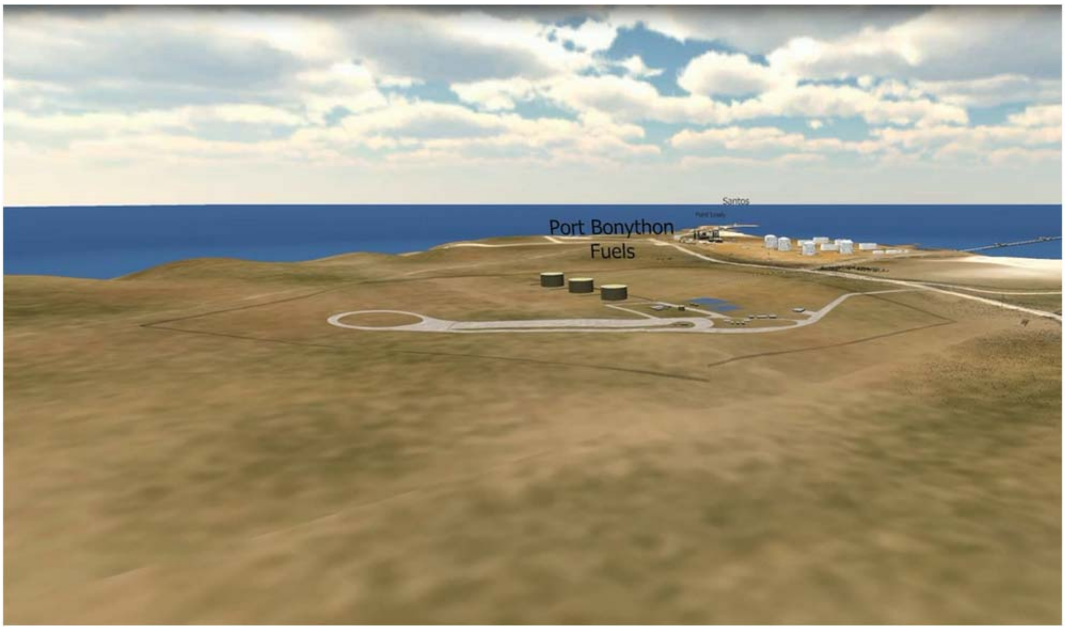


Figure 14:Aerial view of Port Bonython Fuels facility, Santos and the BCEF (Point Lowly coastal homes sit on the horizon).

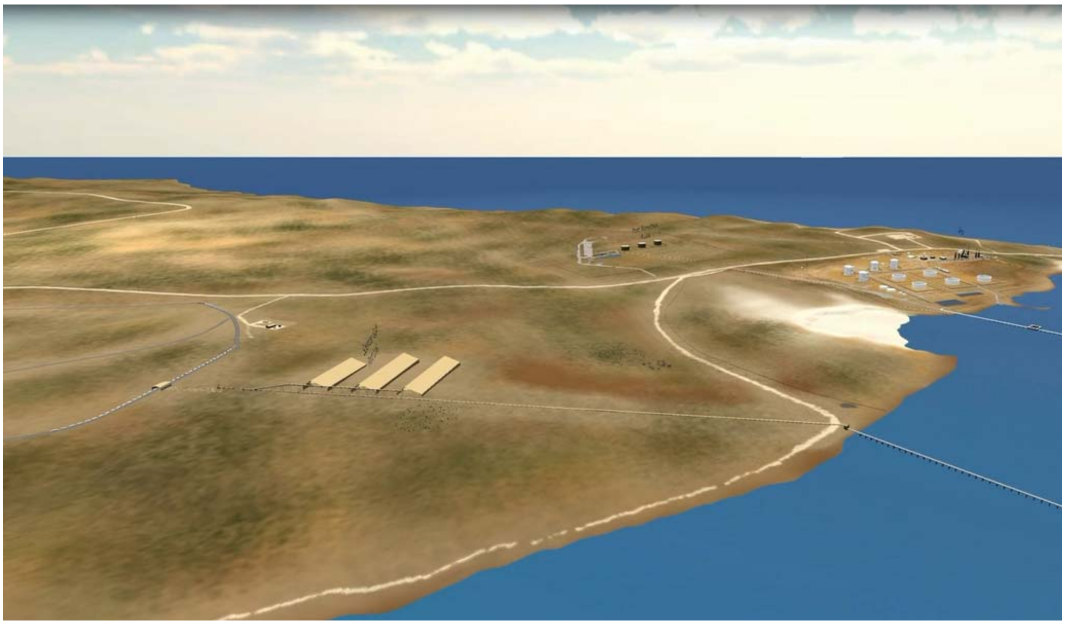


Figure 15: Aerial view of the BCEF railway, storage sheds, conveyor and jetty viewed from Stony Point, with the Santos jetty and Port Bonython fuels in the background.

2.16.4 Slender Billed Thornbill

Issue: The submitter is concerned about the cumulative impact on the Slender Billed Thornbill.

Submitter: 34

Response: As described in Section 7.5.1.1 of the EIS, the birds in the study area are part of the Gawler Ranges sub-population, which inhabits an extensive area of similar habitat extending northwest from the Project site. This includes the large

Cultana Army Training Area, which is well managed and is effectively a reserve. Also, the elimination of grazing from the the training area and what will be undisturbed portions of the Project site will improve the habitat for the Slender Billed Thornbill.

2.17 Environmental Management Plan

2.17.1 EMP Performance Monitoring and Auditing

Issue: The submitter has asked how the EMP (s) for the Project will be audited and monitored?

Submitter: 18

Response: The EMP's provided in the EIS are for planning purposes only and will be amended. The construction EMP will be updated by Leightons Contractors once detailed design has been completed, and prior to the commencement of construction. The operational plan will be updated by Flinders Ports prior to the commencement of operations. These documents will be submitted to the SA Government for review and approval.

During construction, the contractor will undertake regular internal audits to ensure compliance with the Construction EMP, conditions of approval and legislative requirements. Dedicated environmental staff will be provided to implement the Construction EMP and train all staff on its requirements.

Similarly during operations, Flinders Ports will employ environmental staff to implement and audit the Operational EMP.

It is anticipated that a condition of approval of the Project will be regular reporting of audit findings and compliance to the SA Government.

The SA Government also has responsibility for regularly auditing and monitoring approval conditions; the regularity and content of monitoring will be a negotiated and agreed with the proponent as a condition of project approval.

3 Corrections

- **Section 1.8.7:** It is indicated in Section 1.8.1 of the EIS that ARTC operate the rail line to Alice Springs. Although the line is owned by ARTC, it is currently operated by Genesee & Wyoming Australia under a concession deed expiring in 2047
- **Section 5.4.2.1:** The draft Guidelines for the Assessment of Noise for Noise Sensitive Receivers (2010) has since been finalised (2013) and is available in its current form
- The Code of Practice for Antifouling and in-water Hull Cleaning and maintenance (ANZECC 1997) has been supersceded by the 2013 National Antifouling and In-water Cleaning Guidelines. Any reference to compliance with these guidelines should be assumed to address the 2013 version

- **P381, Section 13.4.3.7**: The reference to Steer et al, 2009 as the author of a report on groundwater contamination at Santos is incorrect. The correct reference is as follows: Should be Steer et al (2013) which is cuttlefish report
- **P399, Section 14.3.1.1**: Subtropical and Temperate Coastal Saltmarsh are also environmental values of the Upper Spencer Gulf Marine Park
- **Appendix G3, Environmental Weeds:** the Carrion Flower (*Orbea variegate*), Dune Onion Weed (*Trachyandra divaricata*) and the solar Fire (*Ursinia anthemoides*) are also environmental weeds that are likely to be found in the Project area. These have been added to Appendix G3
- **P387, Section 13.**5.4.4: a reference provided for the Port Bonython Oil Spill Contingency Plan was incorrect. The correct reference is as follows:

  Flinders Ports South Australia 2005, *Oil Spill Contingency Plan*, South Australia.
- P395, Section 14.2.1: The Oil Spill Contingency Plan listed in Section 14.2.1 as being prepared for Santos in 1998 should refer to the Flinders Ports Oil Spill Contingency Plan prepared in 2005 (reference provided above), which is available publically and can be located by a web search
- P402, Section 14.3.3.1: the seagrass species *Posidonia australis* should be included in a list of seagrasses found in the Northern Upper Spencer Gulf
- An algal species is incorrectly spelt in chapter 14 – the correct spelling is *Scaberia agardhii*
- Heterozostera tasmanica and H. nigricaulis are the same species – Noted, and these are now known as *Zostera sp*
- Appendix K1 – *Haliotis rubra* is not found in the northern Spencer Gulf – noted, this species only occurs in Western Australia
- Haliotis rubra (black-lipped abalone) does not occur in Spencer Gulf north of a line from Wallaroo to Cowell. (SARDI Aquatic Sciences Publication No. RD05/0022-3 SARDI Research Report Series No. 196. 2007) – noted
- Section 14.4.3.9 – check distribution of *Platysiphonia*. Report mentions its only occurs westward of the SA Gulfs, but is also found in eastern states and NZ – comment noted, this species does occur over a broader distribution
- P67, Section 2.2.3 – ‘Whyalla, approximately 18km east of the site location’, should be replaced with ‘west of the site location’
- P58, Section 1.8.9, Table 1a – Port Nonowie mentioned as on ‘Northern Yorke Peninsula’ should be replaced with ‘Northern Eyre Peninsula’
- P454, Table 14.6a – ‘ship strike on marine mammals as a result of construction vessel movements’ should be replaced with ‘ship strike on marine mammals as a result of operational vessel movement’.

4 References

Advanced Environmental Dynamics 2012, Bunbury Port Berth 14 Expansion and Coal Storage and Loading Facility – Technical Report 9: Air Quality – Dust Emissions, Report, October 2012.

Department of Mines, SA (1968) Geological Survey of South Australia, SA Geological Atlas Series Sheet S1 53-4 Zone 5, First Edition 1968.

Environ 2004, Port Hedland Dust Modelling Assessment for Fortescue Metals Group Limited, Report, August 2004.

Environ 2010, Particulate Modelling Assessment for Proposed Anketell Port Operations 115 Mtpa Export Scenario, Report, September 2010.

Hall K.C. and Fowler A.J. (eds) (2003). The fisheries biology of the cuttlefish Sepia apama Gray, in South Australian waters. Final Report to FRDC (project No. 98/151). SARDI Aquatic Sciences, Adelaide, 289pp.

IECA, 2008. Best Practice Erosion and Sediment Control, IECA, Picton NSW.

Katestone 2009, Dust Modelling Study of Dudgeon Point Coal Terminal, Report, Katestone Environmental, October 2009.

Katestone 2013, Air Quality Assessment of the T0 Coal Terminal Project, Report, Katestone Environmental, May 2013.

Michael A. Steer, SARDI.

National Pollutant Inventory register 2012/2013 (viewed at www.npi.gov.au on 15/12/2013).

Pacific Environment Limited 2013, Hillside Project Dust and Odour Impact Assessment, Report, July 2013.

Steer, M.A., Gaylard, S. and Loo, M. (2013). Monitoring the relative abundance and biomass of South Australia's Giant Cuttlefish breeding population. Final Report for the Fisheries Research and Development Corporation (PDF 6.6 MB). South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2013/000074-1. SARDI Research Report Series No. 684. 103pp.

URS (2013) Santos, Port Bonython Groundwater Remediation and Monitoring Plan (Updated April 2013), 42657162/RO27/7, 18th April 2013.

URS (2010i) Operation and Monitoring Plan - Santos Port Bonython Groundwater Remediation System 42657065-R021-3, 14th October 2010.

Appendix A

EIS Public Response Submissions

From:	John Haese
To:	Aimee Hughes
Subject:	FW: Emailing: Port%20Bonython%20Bulk%20Commodities%20Export%20Facility%20Environmental%20Impact%20Statement%20(EIS)%20-%20Agency%20Consultation.htm [Saved to enDesign 14 Nov 2013 13:55]
Date:	Tuesday, 19 November 2013 1:09:29 PM
Attachments:	image001.png

John Haese
Senior Associate | Adelaide Office Leader

Arup
Level 7 182 Victoria Square Adelaide SA 5000
t +61 8 8413 6500 **d** +61 8 8413 6516
f +61 8 8212 1601 **m** +61 401 379 232
www.arup.com

From: Ferguson, Karen (DPTI) [mailto:Karen.Ferguson@sa.gov.au]
Sent: Thursday, 14 November 2013 1:37 PM
To: John Haese
Subject: Emailing: Port%20Bonython%20Bulk%20Commodities%20Export%20Facility%20Environmental%20Impact%20Statement%20(EIS)%20-%20Agency%20Consultation.htm [Saved to enDesign 14 Nov 2013 13:55]

From:	Carter, Martin (DMITRE)
Sent:	Wednesday, 13 November 2013 9:44 AM
To:	DPTI:PD Public Submissions
Cc:	DMITRE:Ministerial; Mares, Tim (DMITRE)
Subject:	Port Bonython Bulk Commodities Export Facility Environmental Impact Statement (EIS) - Agency Consultation

Good Morning

Thank you for your letter dated 3 October 2013 and the opportunity to provide comment on the above EIS.

The relevant divisions of DMITRE have been consulted and the Energy Markets and Programs Division provides the following comments:

- On page 363 it is stated that purchased electricity will be the largest contributor of GHG emissions during the operational phase, representing 93% of emissions. This electricity will be used for conveyors, ship loaders, sewage treatment plant operation, lighting and general port management. However, the mitigation measures listed on page 365 seem to focus heavily on passive building design, reducing fuel use, materials and renewable energy.
- There appears to be scope for greater consideration of mitigation measures from the use of energy efficient electricity consuming plant and equipment such as motors, pumps, fans and lighting. These may offer significant opportunities for energy savings and greenhouse gas mitigation.
- The discussion on the federal context on page 358 does not include consideration of the Energy Efficiency Opportunities Program.

Please contact me if you have any queries or seek clarification on the comments provided.

Regards…Martin

Martin Carter
Senior Policy Officer

Strategic Policy Division
Department for Manufacturing, Innovation,
Trade, Resources and Energy (DMITRE)

T – +61 (8) 8303 2283

Level 9 The Conservatory

131-139 Grenfell Street
Adelaide, South Australia 5000

GPO Box 1264
Adelaide, South Australia 5001

SOUTH AUSTRALIA

Government of South Australia
Department for Manufacturing, Innovation, Trade, Resources and Energy

From:	John Haese
To:	Lisa McKinnon; Marissa Powell
Cc:	Aimee Hughes
Subject:	FW: Major Project - Port Bonython Bulk Commodities Export Facility - EIS
Date:	Wednesday, 20 November 2013 3:53:42 PM
Attachments:	image001.png

Another one

John Haese
Senior Associate | Adelaide Office Leader

Arup
Level 7 182 Victoria Square Adelaide SA 5000
t +61 8 8413 6500 **d** +61 8 8413 6516
f +61 8 8212 1601 **m** +61 401 379 232
www.arup.com

From: Ferguson, Karen (DPTI) [mailto:Karen.Ferguson@sa.gov.au]
Sent: Wednesday, 20 November 2013 3:10 PM
To: John Haese
Subject: FW: Major Project - Port Bonython Bulk Commodities Export Facility - EIS

Hi John, comments from DPTI marine attached.

Karen Ferguson

Chief Environmental Officer
Assessment Branch\Statutory Planning Division
Department of Planning, Transport and Infrastructure

t +61 (0) 8 8303 0733
f +61 (0) 8 8303 0753

Level 5 Roma Mitchell House, 136 North Terrace, Adelaide, South Australia 5000

e Karen.Ferguson@sa.gov.au

From: Short, Peter (DPTI)
Sent: Wednesday, 20 November 2013 12:06 PM
To: Ferguson, Karen (DPTI)

Subject: FW: Major Project - Port Bonython Bulk Commodities Export Facility - EIS

Hi Karen, FYI

Peter Short
Project Director
Strategic Projects, Office of the Chief Executive, Department of Planning, Transport and Infrastructure
Telephone: 08 8402 1793 Mobile: 0458 779 909 Facsimile: 08 8463 6229 email: peter.short@sa.gov.au
Address: Level 12, 136 North Terrace, Adelaide (GPO BOX 1533, Adelaide SA 5001)

From: Ferrao, Walter (DPTI)
Sent: Wednesday, 20 November 2013 12:01 PM
To: Loughron, Reece (DPTI)
Cc: Rositano, Joe (DPTI); Llewellyn, Ian (DPTI); Hood, Marilyn (DPTI); Short, Peter (DPTI)
Subject: FW: Major Project - Port Bonython Bulk Commodities Export Facility - EIS

Hi Reece,

Comments from Marine Services as follows;

1. Currently under the Harbors and Navigation Regulations 2009 (Restricted Areas -Schedule 5) there is a restricted area around Port Bonython marked on navigation charts . Vessels loading at the new bulk loading facility will need to navigate over a small area of this restricted zone when approaching / leaving the new berth. Hence amendments will be required to be made to the regulations or an exemption granted by Santos to permit the vessels to traverse their restricted area.

2. To ensure safe navigation and efficient traffic management between ships calling at Port Bonython and the new bulk terminal, an approved VTS System must be put in place prior to commencement of operations at the new terminal.

3. Understand that the maximum draft of the Cape size vessels at the new berth would be around 18metres ,The maintained depth declared at the berth box is the responsibility of the proponent.

4. Any future dredging of the berth box and the approach channels (if required) would also be the responsibility of the proponent.

5 Terminal to have on the premises approved oil pollution equipment suitable to contain Tier 1 oil spills. Trained personnel must be made available to use of this equipment in an emergency.

6. Some navigation aids currently in position for Port Bonython may have to be re-located . New navigation aids if determined necessary by DPTI (including lead lights) will have to be installed and maintained by the proponent. .

7. A Risk assessment document for this project must be prepared by the proponent and copy submitted to DPTI.

8. A Port Operating agreement and Port rules will need to be developed,and followed up with regular audits
.
9. Pilotage of loaded cape size vessels (drafts greater than 16 metres) similar to Project Magnet

vessels on outward journey is compulsory

10. All expenses relating to Notices to Mariners ,signage's, tide boards etc will be debited to the proponent.

Regards
Walter

Marilyn-Please put a copy of this in our DAC File

From: Loughron, Reece (DPTI)
Sent: Thursday, 14 November 2013 2:41 PM
To: Ferguson, Karen (DPTI); Ferrao, Walter (DPTI)
Subject: RE: Major Project - Port Bonython Bulk Commodities Export Facility - EIS

Thanks Karen, the additional time is appreciated.

Walter, please note the urgency on comments. Note that an extension til Friday 22nd November is available, however **please send through ASAP**.

Thanks,
Reece

From: Ferguson, Karen (DPTI)
Sent: Thursday, 14 November 2013 2:32 PM
To: Loughron, Reece (DPTI)
Subject: RE: Major Project - Port Bonython Bulk Commodities Export Facility - EIS

Hi Reece,
Yes that should be Ok.
No later though please!

Karen Ferguson

Chief Environmental Officer
Assessment Branch\Statutory Planning Division
Department of Planning, Transport and Infrastructure

t +61 (0) 8 8303 0733
f +61 (0) 8 8303 0753

Level 5 Roma Mitchell House, 136 North Terrace, Adelaide, South Australia 5000

e Karen.Ferguson@sa.gov.au

From: Loughron, Reece (DPTI)
Sent: Thursday, 14 November 2013 2:28 PM
To: Ferguson, Karen (DPTI)
Subject: FW: Major Project - Port Bonython Bulk Commodities Export Facility - EIS
Importance: High

Hello Karen,

I am coordinating TSD comments in relation to the Port Bonython EIS. I have been requested to see if an extension can be granted for some internal marine comments.

Can you please advise if an extension till Monday 25th November is possible?

Thanks,
Reece

From: Ferrao, Walter (DPTI)
Sent: Thursday, 14 November 2013 12:22 PM
To: Loughron, Reece (DPTI)
Subject: RE: Major Project - Port Bonython Bulk Commodities Export Facility - EIS

Hi Reece
Could you please arrange for an extension on this EIS until the end of next week-22nd November
THanks
Regards
Captn Walter Ferrao

From: Loughron, Reece (DPTI)
Sent: Thursday, 31 October 2013 3:55 PM
To: Rozaklis, Lillia (DPTI); DPTI:Northern & Western Region; Ferrao, Walter (DPTI); Triantafillou, Chrys (DPTI); Shaw, Justin (DPTI); Williams, Mark D (DPTI); Slobodian, Andrij (DPTI); DPTI:PD Network Strategy
Cc: Llewellyn, Ian (DPTI); Reichstein, Carmel (DPTI); Reichstein, Carmel (DPTI)
Subject: Major Project - Port Bonython Bulk Commodities Export Facility - EIS
Importance: High

Hello All,

TSD has received the above EIS for distribution and comment.

The EIS is available via the following attached knet links:

DAC letter #764990
Draft EIS # 8058990
Appendices #8058963

An electronic link which provides all the above info and the Executive Summary is also provided: http://www.spencergulfportlink.com.au/?page_id=647

All internal comments will be forward to the proponent, Spencer gulf Port Link (Flinders Ports), who will then prepare a response via a 'Response Document' followed by the preparation of an Assessment Report.

Please review the documentation and provide feedback to dpti.luc@sa.gov.au mailbox by **Monday 11th November 2013**.

Note: If there are other internal groups that need to make comment please forward on my behalf.

Regards,

Reece Loughron | Development Officer | Land Use Coordination | Transport Services Division | DPTI

p: 8343 2569 (internal 22569), | **f:** 8343 2725 (internal 22725) | **e:** reece.loughron@sa.gov.au | **w**: http:/dpti.sa.gov.au

SATC/13/00507

18 November 2013

Karen Ferguson
Chief Environmental Officer
Assessment Branch
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5001

**PORT BONYTHON BULK COMMODITIES EXPORT FACILITY
ENVIRONMENT IMPACT STATEMENT**

Dear Karen,

I refer to your recent letter seeking comments from the South Australian Tourism Commission (SATC) regarding the above Environmental Impact Statement (EIS).

SATC's primary concern is the impact of the proposed development, especially the 3km jetty and ship loading wharves on the giant cuttlefish and the aggregation area which the cuttlefish use to breed each year.

Visitors come from South Australia, interstate and overseas to view the cuttlefish during the breeding season each year. A vessel is not required to access the site and the giant cuttlefish can be easily observed through a shore dive from Point Lowly using snorkel or SCUBA equipment. Word-of-mouth advertising is the main driver – particularly through dive clubs and associations.

The cuttlefish have a high profile internationally and are promoted in Whyalla/Eyre Peninsula regional and SA tourism websites and visitor guides. A number of documentaries have been made about the cuttlefish which helps to increase the profile of the region.

Notwithstanding the recent decline in numbers, as cuttlefish breeding season extends from May to August each year, this attraction provides valuable tourism to the region in what is a traditionally a slow tourism period during winter. Cuttlefish visitors also benefit the local regional economy through additional indirect spending.

SATC is supportive of the considerable effort and resource that Government, private business and research institutions are currently applying to increase knowledge about the cuttlefish, including identification of possible causes for the decline in cuttlefish numbers and ways the future of the population may be ensured. SATC is also supportive of the additional legislative protection that has been extended to the cuttlefish throughout the northern part of the Spencer Gulf.

It is acknowledged that the EIS has identified the giant cuttlefish as a species of significance and that mitigation measures have been identified, including:

- Scheduling piling works for the jetty to avoid the breeding season of the cuttlefish, and that surveys will be undertaken to confirm timing of the breeding season and presence of the species
- Avoiding jetty construction at night to avoid the need for lighting
- Noise from ships when the jetty is operational will be at a distance from the aggregation area and are predicted to have neglible impacts on the cuttlefish
- Wastewater and soil erosion from onshore will be managed so it will not impact on water quality
- Minimizing jetty lighting and using low-spill lights
- There will not be any fuelling of ships at the jetty nor will wastewater be discharged from vessels

SATC supports these measures but does not have the expertise to determine whether these mitigation measures will be sufficient to protect the cuttlefish and aggregation area. But given the tourism value described above SATC strongly advocates that all appropriate measures to mitigate impacts on the cuttlefish and aggregation area are fully examined and applied, to ensure the population can survive into the future.

Other agencies with relevant expertise (PIRSA, SARDI, DEWNR) will be providing submissions and I strongly encourage all issues raised by these agencies regarding the cuttlefish or aggregation area are adequately addressed.

Finally, as acknowledged in the EIS, there is currently easy access for divers and snorkelers at Stony Point to enter the water to view cuttlefish and a viewing platform and interpretive signage are provided. SATC supports the proposal that these facilities be relocated by the proponents (as opposed to being lost) and that the form of this infrastructure will be discussed with relevant stakeholders and local community. Opportunities to upgrade the viewing and interpretive facilities should be considered, to further improve the visitor experience.

Thank you for the opportunity to provide comment. Should you have any queries please do not hesitate to contact David Lake, Manager Policy on 8463 4551 or david.lake@tourism.sa.com

Yours sincerely

RODNEY HARREX
CHIEF EXECUTIVE

Cc: Brad Riddle, Tourism Development Manager, 89 Liverpool Street, Port Lincoln SA 5606
Diedre Turvey, Chair, Tourism Target Team, C/- PO Box 146, Port Lincoln SA 5606

SA Water
SOUTH AUSTRALIAN
WATER CORPORATION

Select SAW Address above
Select SAW Address above
Select SAW Address above Select
SAW Address above

Phone +61 8 7424 1978
Fax +61 8 7003 1978

ABN 69 336 525 019

15 November 2013

Our Ref: AC32458

Karen Ferguson
Chief Environmental Officer
Assessment Branch
5th Floor
136 North Terrace
Adelaide SA 5000

Dear Karen

Port Bonython Bulk Commodities Export Facility

Thank you for providing a copy of the Environment Impact Statement (EIS) for the Port Bonython Bulk Commodities Export Facility as part of the public comment period.

SA Water has reviewed the EIS and notes that the documentation indicates water for the proposal will likely be sourced though connection to the existing 200mm main that extends to Port Bonython from the Morgan Whyalla No. 2 pipeline, or via a new pipeline that connects to the No. 2 pipeline.

SA Water suggests Spencer Gulf Port Link consult with SA Water in relation to its water requirements and connection to SA Water's infrastructure. Please advise them to contact Debbie Snoswell, Client Proposals Manager, on 7424 1133 to discuss their water supply needs.

If you have any queries in relation to this response, please don't hesitate to contact Tara Hage, Mgr Environment and Heritage Services on 0457 502 029 or via email tara.hage@sawater.com.au.

Yours sincerely

James Crocker
Snr Mgr Environmental Services

22 November 2013

THE CORPORATION OF
THE CITY OF WHYALLA

Civic Building
Darling Terrace
Whyalla SA 5600

Telephone
(08) 8640 3444

Facsimile
(08) 8645 0155

P.O. Box 126
Whyalla 5600

E-mail
council@whyalla.sa.gov.au

Internet
www.whyalla.sa.gov.au

ALL CORRESPONDENCE TO
BE ADDRESSED TO THE
CHIEF EXECUTIVE OFFICER

Minister for Planning
Attention: Robert Kleeman, General Manager,
Assessment (Statutory Planning)
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

Dear Mr Kleeman

Draft Environmental Impact Statement for the proposed Port Bonython Bulk Commodities Export Facility (Deep Sea Port).

Thank you for granting the extension of time for Council's submission on the above draft Environmental Impact Statement for the proposed Port Bonython Bulk Commodities Export Facility (Deep Sea Port). I can advise that Council received a report on the draft EIS at its meeting of 18 November 2013. At a subsequent special meeting on 21 November 2013, Council resolved to endorse the following comments as its submission on the draft EIS.

Council's comments on the EIS are set out below. Council also resolved to include comment on the results/ outcomes of previous community engagement on prospective increased industrialisation at Point Lowly, presented later in this submission.

1. The proposed project is overall to be seen as of high importance to the region as a whole. Council is aware of the essential role played by major infrastructure in economic development, particular the resources sector into the planning period. The bulk commodity export facility would be of key significance to the Eyre and Far North region as a whole and, as such, of overall benefit to the wider community. It addresses the current lack of capacity in existing bulk loading / transport facilities and offers an essentially optimal location for the facility in relation to land-based transport infrastructure for mining projects in and perhaps beyond the surrounding region.

2. While there is economic benefit to Whyalla in terms of additional employment, there is also likely to be benefit to business activity and investment locally as well as the region. Council considers that the latter issue has not yet been explored to any great degree in the EIS report.

3. The proposal is not in material conflict with the Whyalla Development Plan overall, given the bulk of the facility is to be located within industrially-zoned land. However, portions of the conveyor infrastructure and port facility are located across the Coastal Conservation Zone. These zoning.

provisions are not satisfied in respect of conserving/ enhancing natural features of the coast and contributing to the desired character of the zone as defined; these provisions seek development to ensure natural elements remain dominant to any introduced elements to protect its scenic qualities

4. The proposal is likely to be at variance with a number of provisions of the Land Not Within a Council Area (Coastal Waters) Development Plan without careful management of the design and construction phases. These provisions include, in summarised form:
   - Managing development in coastal areas to sustain or enhance the coastal environment (there is some risk that this may not be achieved);
   - Protection of the coast from development adversely affecting the marine and on-shore coastal environment by pollution, erosion damage or depletion of resources (some localised effect may be anticipated during construction);
   - Development not interfering with environmentally important features including wildlife habitats (the project may result in some localised loss of, or disturbance to, marine organisms eg Giant Australian cuttlefish);
   - Preserving areas of high landscape/amenity value (visual impacts of varying significance from different viewpoints are identified in the EIS).

5. Improved mitigation of noise impacts during construction of the railway line, in respect of False Bay residents in particular, should be considered and introduced.

6. The EIS has identified inadequate length of the right turn lane from Lincoln Highway into Port Bonython Road, which will need to be rectified. In addition, the EIS does not contain a thorough analysis relating to rail movements. A more thorough review of the safety of the existing road/rail crossing on Bonython road is recommended, bearing in mind the proponent's recommended grade separation of the proposed new rail link crossing of Port Bonython Road for safety reasons.

7. The proposed structures, in particular the large bulky storage sheds and overhead conveyor infrastructure, will detract from views able to be obtained from various vantage points within the Point Lowly peninsula. A significantly greater effort to lessen the visual impact of these structures is needed than shown to date in the EIS, particularly for the large and bulky storage sheds, comprising two buildings of 250 x 70 metres and one building 190 x 70 metres, each with heights at 30 metre. Design revision should incorporate measures to reduce bulk, such as reviewing/ lowering building heights, articulation of each building form, revising the design to respond to landscape eg with some curvilinear elements, use of vertical or horizontal offsets, breaking up / avoiding long expanse of blank walls, window recesses/ projections and detail, panel profile and colours, use of design motifs etc. Council is prepared to provide further input to this requested revision if need be.

8. The report does not identify the site to which the giant cuttlefish viewing point would be relocated; Council seeks to provide direction on the process of relocation and redesign of this facility.

9. It is believed that more work will need to be done in relation to the impacts of propeller wash from Cape-sized and Panamax vessels during operation of the proposed port.

10. It is unclear whether the proposed port is to be excluded from the USG Marine Park and the implications of that in relation to the USG Marine Park Management Plan.

11. Acknowledging the highly fluctuating numbers of the giant cuttlefish, the aggregation may be at somewhat increased risk with the development of the port infrastructure; more detail needs to be provided on the extent to which the rocky coastline forming their breeding habitat can be protected for this purpose.

Ref: JW:CS

12. Satisfactory arrangements need to be put in place to cater for the point in time beyond its effective life. The tenure to be offered should thus be on a long-term leasehold basis, with both approval and lease conditions framed to ensure that the site is effectively rehabilitated after the use of the facility is terminated and infrastructure removed, rather than simply abandoned.

Council understands that the EIS assessment needs to be founded on a systematic evaluation and weighing of all the criteria. However it is also aware that the assessment process will also take into consideration views of representations received. It needs to be recognised that many within the Whyalla community, including local property owners around the peninsula and Fitzgerald Bay, would not welcome further industrial development on the peninsula. To demonstrate this, the following points should be noted:

- Council unanimously adopted the recommendation of the Point Lowly peninsula Task Force at its 16 February 2009 meeting, resolving *that in view of feedback to Council as a result of engagement with the local community regarding the development of a deep sea port at Point Lowly, the Whyalla City Council call upon the State Government to:*

    - *immediately review current site selection process to encompass a regional approach and seriously consider alternative port proposals;*
    - *initiate a new site (or sites) selection process for the establishment of a deep-sea port (or ports) to meet the long term needs of all current and proposed future developments of the mining industry in the region;*
    - *ensure that the new selection/decision-making process involves regional communities from the start and that the process embodies genuine triple bottom-line planning (environmental, economic and social); and*
    - *form a new Committee/Working Party which includes representation from State Government, regional Councils, Regional Economic Development Boards, the private sector, local indigenous groups and local and State based environmental groups which has the task of implementing an IAP2 (International Association for Public Participation Australasia) engagement process to establish criteria for port infrastructure and site selection*

- Survey information collected on behalf of Council in 2008 showed a majority opinion that: the peninsula and Fitzgerald Bay coastal area is seen as sensitive and should be promoted for tourism, that further industrialisation will result in a loss of environment, and that an alternative port site should be pursued. Some 10,300 surveys were distributed to households in Whyalla, with 345 responses received; a copy of the survey outcomes is enclosed for your attention.

- Council also undertook community engagement forums which concluded inter alia that there is strong concern over the impact of industrial development on Point Lowly, support for an alternative site south of Whyalla, and support for retention of Point lowly peninsula for recreation and protection of the environment. The Council at its 15 December 2008 meeting endorsed a recommendation of its Point Lowly Peninsula Task Force to make available the report from the community engagement forums, a copy of which is provided here as an attachment.

The prevailing opinion from the above described community engagement of 2008 is likely to be still in line with that held by many within the Whyalla community. Council is in no way discounting the inherent difficulties with locating and developing an alternative port south of Whyalla in the Nonowie area, as revealed through agency advice about the biological diversity and ecological sensitivity of this coastal area, in response to a statement of intent for the Port Nonowie DPA.

An appropriate resolution of the industrialisation issue nevertheless remains outstanding. Council therefore also submits that the Whyalla community would instead support a joint State / Council review of the current potential industrialisation of the peninsula that gave better protection of the recreation and environmental values of the Point Lowly – Fitzgerald Bay coastline and adjoining landform.

Thank you for providing the opportunity to comment on the draft EIS. Please contact the undersigned should you wish to clarify any aspect of this submission.

Yours faithfully

Jason Willcocks
A/Group Manager Planning & Development

Ref: JW:CS

WHYALLA CITY COUNCIL

POINT LOWLY PROPOSED DEVELOPMENTS

Focus Groups Report

December 2008

Prepared by Barbara Chappell

Simply Speaking

Seanachai

chappell@aapt.net.au

ABN: 29580357859

Table of Contents

POINT LOWLY PROPOSED DEVELOPMENTS FOCUS GROUPS REPORT

EXECUTIVE SUMMARY

BACKGROUND

The Whyalla City Council passed a resolution on 19 May 2008 to commence a comprehensive community engagement process on proposed developments at Point Lowly Peninsula. One of the first engagement activities undertaken was the preparation of an information sheet for the community. The second activity was the preparation of a survey to identify the level of knowledge in the community about the developments, the information sources the community found most useful and how they wanted to be engaged. The results of the survey were used to design the format for the Focus Group engagement sessions. Council's main objective for conducting the Focus Groups was to provide opportunities for the community to share their views on the proposed developments to guide Council in determining their approach to State Government on behalf of the community. Council believes that the issue affects the whole community and therefore, should form its views after a careful deliberative process with the community – not in advance of it.

METHODOLOGY

Notice to the people of Whyalla that the Point Lowly Focus Groups sessions were being held was delivered in a variety of ways including, direct invitation by mail, newspaper and radio advertising, notices in the libraries, Council notice board in the Westland Shopping Centre, Council office and on Council's web site. Invitations to register for a Focus Group session were mailed to everyone on a list of contact details extracted from the survey conducted in August 2008 and from a list of people who attended the State Government run information session held May 2008. Feedback during the Focus Group sessions indicates the list was incomplete. Measures have since been put in place to ensure all contact details submitted are recorded for this project. Three notices about the Focus Groups were placed in the "Whyalla News" on Thursday 20 November 2008 and a notice placed on Council's web site. See **Appendix A.** A total of 73 people registered for the four sessions.

The four Focus Group sessions were held on the following dates:

- Monday 24 November 2008 at the Left Hand Club, 12 Dick Street, Whyalla from 10:00 am – 12:30 pm
- Monday 24 November 2008 at the Left Hand Club, 12 Dick Street, Whyalla from 7:00 pm – 9:30 pm

- Tuesday 25 November 2008 at the Whyalla Economic Development Board Building, 127 Nicolson Avenue, Whyalla from 10:00 am – 12:30 pm
- Tuesday 25 November 2008 at the Whyalla Economic Development Board Building, 127 Nicolson Avenue, Whyalla from 7:00 pm – 9:30 pm

Some suburbs were more heavily represented than others (see **Table 1**). Younger age groups were not well represented in any of the sessions apart from 3 young people who attended the fourth session on Tuesday evening of 25 November. Young people have chosen to participate in the discussions about Point Lowly via Facebook. There is a petition on the web site with 837 names listed with the majority of comments relating to protecting the environment and an absence of commentary on the issues of economic development for Whyalla.

The format for the Focus Group sessions included:

- ✓ Participants listing their expectations for the session on arrival
- ✓ An overview of the proposed developments at Point Lowly by Whyalla City Council CEO Phil Cameron at the Monday sessions and Stewart Payne at the Tuesday sessions.
- ✓ Structured facilitated session based around a series of questions designed to generate discussion on the proposed developments. The aim of the discussions was to assist all involved in gaining insights into the diverse attitudes, perceptions, beliefs and opinions of all participants and to allow everyone to state their needs, ideas and concerns about the proposed developments at Point Lowly.
- ✓ All comments from participants were recorded on a laptop computer and displayed on screen to enable a review and revision of comments to ensure clarity and to provide participants with every opportunity to discuss all they had on their minds and not leave out any issues of importance
- ✓ A summary of how the information from the session will be used to provide information to Council about the direction the community wants the proposed developments at Point Lowly to take was provided at the conclusion of the session
- ✓ Finally, participants were invited to write down any further comments they wanted to have included as part of overall recording of the sessions

The purpose of each of the activities outlined above is explained in the **RESULTS** section of the report.

CONCLUSIONS

The collated information throughout this report is a collection of the written and verbal comments from Focus Group participants. The conclusions are based on observations of the data and what took place during the Focus Group discussions. The summary results provide a snap shot (and quick read) of the common and diverse views expressed by participants throughout the sessions. The complete record of the all the expectations the participants had, the comments they made and questions asked during the sessions are listed in **Appendices B, C** and **D** respectively. The comments need to be read in conjunction with the summary results to get the complete picture of the communities perception on the proposed developments at Point Lowly.The comments from the Focus Group sessions reflect those made in the survey conducted in August 2008 (copies of the survey results are available from Council).

Throughout the collated data there is continuous reference to:

- support for industrial development, but not at Point Lowly
- support for an alternative site (south of Whyalla) for industrial development
- strong concern for the impact of industrial development on Point Lowly
- strong support for economic development for the future of Whyalla
- strong support for the protection of the environment
- strong support for the retention of Point Lowly as a recreation area for the people of Whyalla and tourists
- need for the Whyalla community to present a united front to State Government to ensure their input into the proposed developments at Point Lowly is acknowledged as a serious representation from the community
- call for Council to take a stand on the proposed developments and represent the majority view of the Whyalla community
- call for State Government to consult the Whyalla community on the proposed developments

The level of interest and knowledge about the proposed developments at Point Lowly expressed by the participants was of a very high standard. During the Focus Group sessions it became clear that the majority of the participants were not against industrial development. They were against it at Point Lowly. A small number of participants represented the view that the economic development of Whyalla is being put at risk because of opposition to the proposed Point Lowly developments. It was important for these people to be able to present their views as equally as all other participants. One concern about the equity of the process was that people who are strongly in favour of the developments may not have attended the sessions. However, in two of the sessions in particular there was realisation for some participants that the majority of people in Whyalla share a common view in that they do not oppose industrial development. How it is achieved is the main concern and challenge.

Based on the general attitude to the proposed developments by the people who represented the Whyalla community at the Focus Group sessions, they would recognise the concept of a mutual gains approach to the issue. This approach has been researched by two senior academics and it is a credit to the knowledge and creativity of the people of Whyalla that their approach to dealing with the proposed developments strongly reflect s the principles of the "mutual gains"[1] approach. The six principles involved in this approach are as follows:

- acknowledge the concerns of the other side
- encourage joint fact finding
- offer contingent commitments to mininise impacts that may occur: consider how to compensate for knowable but unintended impacts, such as, providing education and training for people who do not have the required skills to compensate for low full time employment for people living in Whyalla
- accept responsibility, admit mistakes and share power
- act in a trustworthy manner at all times
- focus on building long term relationships

It is recommended that these principles guide the approach to community engagement with all the key stakeholders including the Council, community, mining companies, business developers and the State Government.

[1] The Mutual Gains Approach to Resolving Disputes, Lawrence Susskind and Patrick Field

RESULTS FROM THE FOCUS GROUP SESSIONS

The results have been divided into **4 key** areas:

1. **Location** and **occupations** of participants
2. Participant **expectations** for the Focus Group sessions
3. **Comparison summaries** of discussion responses to the questions posed to the four Focus Groups
4. **Questions raised** during the Focus Group discussions

POINT LOWLY PROPOSED DEVELOPMENTS FOCUS GROUPS REPORT

1. Location of participants

Table 1 lists the number of participants from each suburb and occupation group represented. This data is included to provide insight into the spread of participation in the Focus Group sessions.

Table 1

Suburbs	Monday 24 November 2008 (morning session)	No.	Monday 24 November 2008 (evening session)	No.	Tuesday 25 November 2008 (morning session)	No.	Tuesday 25 November 2008 (evening session)	No.
Whyalla	8 Residents 3 Council Officers	11	1 Elected Member 4 Residents	5	1 Elected Member 4 Residents	5	1 x Business Person	1
Playford	1 Elected Member	1	2 Residents	2	1 Elected Member 1 Business Person 1 Resident	3	7 x Residents	7
Norrie	1 Elected Member 4 Residents	5	2 Residents	2	1 Elected Member 3 Residents	4	1 x Elected Member	1
Stuart	-	0	-	0	-	0	1 x Business Person 14 Residents	15
Jenkins	-	0	-	0	1 Council Officer 1 Resident	2		0
Point Lowly	6 Residents	6	2 Residents	2	1 Resident	1		0
Totals		**23**		**11**		**15**		**24**

POINT LOWLY PROPOSED DEVELOPMENTS FOCUS GROUPS REPORT

2. EXPECTATIONS

Participants were asked to share their expectations at the beginning of the Focus Group sessions to: (1) provide a snapshot of individual views up front to identify commonly held and diverse views on the proposed developments; (2) to inform the session facilitator about the expectations of the participants for consideration throughout the session; (3) to enable the facilitator to clarify any misconceptions about the purpose of the session.

A summary of the **common expectations** of all participants at each session is recorded in **Table 2.** A complete record of the expectations recorded during the sessions is listed in **Appendix B.** No two sessions were the same; however there were common expectations that came out of all four sessions.

Table 2

Monday 24 November 2008	Monday 24 November 2008	Tuesday 25 November 2008	Tuesday 25 November 2008
• All viewpoints to be taken into account - listen • Value community input • Need to know Councils position on the proposed developments • More information all round on developments, including Defence SA proposals • Want economic growth and protection of environment and recreations space • Want alternatives to development at Point Lowly to be seriously considered • Benefits of desal plant to Whyalla residents • Consultation process concerns – done deal	• Council actively listening and valuing community input and representing community to State Government- • not to assume the decision is already made • Long and short term views of all positives and negatives of development • Explore options for diverse development that is sustainable and compatible with social and physical environment • Help redirect efforts to move the port south of Whyalla and move the desal plant to a much better location on the west coast (open ocean) • Hear the benefits that	• Balance view of the Lowly Developments (have all the alternative options been raised). • Ensure Council hears and relays to State Govt a balanced view of public opinion in the interest of Whyalla – more jobs and protect the environment • Council's approach to the issue to be made known • Not a done deal • Information on the development and how far it has advanced • Any development should be in the best area which will have the least impact on environmental and social	• To gather information regarding pros and cons of the development • To express concerns, hear other people's view points • Expect nothing as Govt has made up its mind • Make the whole process clearer in terms of getting our voices to be heard in respect to objections to development at Point Lowly. • Not against industry, just against it being at such an environmentally fragile location with a huge recreational attendance from both locals and tourists alike • To give some direction to

	industrialisation of the Point Lowly Peninsula will bring to Whyalla, its community and the region	future • Aspects of cuttlefish breeding and hatching to be fully covered	Council so they will act with speed and strength to effect the process as decided by the community • Proof that all options have been really considered and not just cheapest option • Long term view 10 – 20 years • Effects of desal on Cuttlefish safety along with beauty and serenity of Point Lowly • Environmental effects – tourist attractions will be gone, future generations deserve a chance to experience the wonders of Point Lowly

GENERAL SUMMARY:

Common expectations included; wanting to listen to all viewpoints, more information on the proposed developments and whether long and short term views have been considered, finding out about Councils approach to the proposed developments and how they might represent the community to State Government, the developments are a "done deal", exploration of all options for development, and a balanced approach to economic growth and environmental protection.

3. COMPARISON SUMMARIES

A summary of the responses to the questions posed to the Focus Groups are presented in **Tables 3 to 6** to provide comparisons between areas of commonality and diversity. Key points have been captured to inform Councils approach to the proposed development of Point Lowly Peninsula and to facilitate community understanding of the diverse viewpoints. The complete record of the comments recorded is listed in **Appendix C.** Questions raised during the sessions have been collated as **Appendix D** and will be sent to the Point Lowly Taskforce for action.

Question 1- What do you know or what have you heard about or are concerned about the proposed developments at Point Lowly Peninsula?

Table 3

Monday 24 November 2008 Morning session	Monday 24 November 2008 Evening session	Tuesday 25 November 2008 Morning session	Tuesday 25 November 2008 Evening session
• Considerable discussion on the proposed number of mines (30) for the region and the impact on transport corridors through Whyalla (by –pass) and general capacity of port • That the State Government has to have the port to get royalties. This would be lost if it was transported through Darwin. • Government and industry to seriously look at an 'optional' port (in the vicinity of Whyalla)? • Develop one super port on the peninsula between Lincoln and Whyalla? • All information from sessions	• Considerable discussion on the State Governments approach to the process, ie. it's a done deal • Conflicting information on the credibility of results of the Billiton EIS • Range of questions asked about the transportation of ore • Acceptance of a 25 year old agenda • No deals done - Council resolved to write to Provincial Cities and EPLGA to gather support for Council to lobby the State Government to get a percentage of royalties. • Communities should be entitled to a slice of the	• Considerable discussion about the unique character of Point Lowly, the desire for economic development and protection of the environment • Long term strategic plan to ensure a balance between quality of life/business/economic growth/recreation to secure better infrastructure and attract people to live and work in Whyalla • Use past experiences so the same mistakes are not made, eg. growing Santos footprint /Cultana expansion • Port Bonython will not be a strategically viable port in the long term.	• Considerable discussion about access to Point Lowly. • Loss of a very significant beach and impact of industrial development on Cuttlefish and Tourism at Point Lowly • Exclusions off and on the water (eg. Santos Jetty) – Aboriginal heritage site in exclusion zone • Santos has provided employment to the people of Whyalla • Council uses Point Lowly for tourism • Learn from past history • No strategic approach to this development. • What is the real economic

to go to all government departments – eg Tourism, Infrastructure etc. • Whyalla is being ignored at the expense of SA – no benefits to Whyalla. • Nothing set in stone yet • Desalination Plant and potential impacts on the environment discussed	mining royalties.	• State Government process entirely top down – regional communities left to react to a decision making process that has already commenced. • Very little to offer the ordinary people for recreational use in the area. • Concern that alternative ports have not been looked at sufficiently • Concern that opposition to development will put economic development at risk	benefit for the proposed development? If we are willing to trade off something what is the trade off? • Are we giving up Point Lowly to fund projects outside the region? • Are we risking economic development if we oppose the industrial development • If the proposed port goes down South it may be a better option, but Whyalla will not get the benefits if the port goes a long way down South

GENERAL SUMMARY:

Common issues	**Issues of diversity**
Alternative options for a port to be looked at, a long term strategic plan is needed to plan for the future and ensure the same mistakes from the past are not repeated, support for economic development, support for protection of the environment and for the State Government to engage with the Whyalla community on the proposed developments	Although the 4 groups shared common ideas about the proposed developments each group tended to have distinct priorities for discussion such as truck transportation through Whyalla, credibility of EIS research, past history of industrial development and access for locals and tourists to Point Lowly

POINT LOWLY PROPOSED DEVELOPMENTS FOCUS GROUPS REPORT

Question 2 - What might what we have discussed mean for you?

Table 4

Monday 24 November 2008	Monday 24 November 2008	Tuesday 25 November 2008	Tuesday 25 November 2008
• Representation – Council needs to let Government and people know that they are concerned. • Need and numbers support from the people of Whyalla to ensure concerns and opinions are valued.	• The focus of discussion in this group was on an alternative site for the proposed developments.	• An obligation regarding the cuttlefish aggregation to do all you can to protect it. • Some view of the long term issues attached to the Lowly Peninsula – let's have both. • Need to look at community development, how the mines/facilities are set up in regards to accommodation – need to be integrating the 'mining community' into the Whyalla community. • Embed as much economic, recreational, social, health, education, transport, sport, tourism activity within the community – to encourage people to live and stay in Whyalla. • Don't want Whyalla to end up as a ghost town when mining is finished - what are we going to leave behind for future generations - how can we find a balance.	• Are we giving up a local amenity/lifestyle/heritage to industry? • We pay all the costs and industry get all the benefits – Whyalla as a dumping ground • Do we have a choice between Pt Lowly and somewhere else? • What is the long term loss for the short term gain? • Want what economic progress/development can give this city– but needs to occur in the right way. • Tourism – locals proud of Point Lowly – somewhere to take visitors to • Lack of consultation by the State Government – devalues us • In one generation the beach that was very popular has been lost to the community. • Every industry in Whyalla has difficulty in attracting people to work.

			• Threat to people's property investments. • Proposed army spread around Whyalla will take away areas that are now being used for recreational space. This with Point Lowly will reduce the areas that Whyalla use for this purpose. • There is nothing else around Whyalla that can be used for recreational space

GENERAL SUMMARY:

Common issues	Issues of diversity
Support from everyone in the community to deal with the issues, State Government to value local community views, focus on community development to ensure the long term sustainability of the Whyalla community.	The community may be overlooking the importance of economic development for Whyalla and the advantages it can bring. People against industrial development at Point Lowly are not against economic development for Whyalla.

Question 3 – What do you think needs to happen?

Table 5

Monday 24 November 2008	Monday 24 November 2008	Tuesday 25 November 2008	Tuesday 25 November 2008
• People would like to hear the thoughts of Council and Elected Members about their concerns for the community • More detailed information in regards to the proposed developments and effects on quality of life in Whyalla and the Gulf. • A range of questions to be answered to identify the impacts of each of the proposals on Point Lowly and Whyalla • An appreciation from outside organisations as to the importance of Point Lowly to Whyalla • Needs to be a genuine report on costings etc on the port South of Whyalla as an alternative. • Want to have the results of the EIS for public consultation before development commences • A good outcome for the community from the	• Promoting what we have and still promote an alternate port. • Would like the Stony Point Environment Consultative Group be reconvened • People (in authority, those proposing developments) need to acknowledge that what is being proposed out there is a highly compromised port with associated risks. • EIS of the Southern site – need to look at all aspects from mine through to transport to ship site. • Council to ask the State Government through the Environment, Resources and Development Committee of Parliament to come and meet the people of Whyalla and hold an enquiry. • State Government to conduct an independent in-depth study of the Southern and Northern port options looking at the long term	• State Government needs to look at /reassess its process in engaging community(s) • Northern Spencer Gulf Resource Processing Strategy used as an engagement model and to include communities from Port Lincoln thru to Whyalla (Economic Development Boards etc) to go thru a decision-making process. • This process to take into account the social, economic, environmental, recreational, indigenous amenity of the area. • Community apathy needs to be addressed – spark the passion. • Identifying the ways that different groups (eg. schools and young people) need to be involved within the community - (eg. using Information Technology) need interactive social network sites. • Council should take	• Show the advantages and disadvantages. • Council takes on board thoughts and opinions of local Action Group– and shows the positives and negatives. • Council to steer/influence/facilitate the Government into looking at an alternative site (South). • Split the refinery industry(s) into two separate projects – refinery could stay at Point Lowly and the tank farm could be located at the Cultana Industrial Estate. • Desal plant – best place to be on the West Coast (Elliston). • Most advanced technology to be used in the running of the desalination plant. • In all decisions - can we get the best outcome/plant and not the cheapest! At least the two best options not the only option. • Process that the Council/SA Water used for the recycled

information collated from these focus groups.	economic impacts to enable a balanced assessment of the two sites. • Regarding the fuel facility and potential refinery consideration to moving the tank farms to the Cultana Industrial area to take advantage of existing infrastructure at that location • Desal plant should run on 100% renewable energy	responsibility for funneling a cohesive community view into a cogent plan to influence the State Government. • All alternative options for developments are looked at very seriously and the results and/or process are followed through with consultation and input with the stakeholders (everyone in community, Local Government, people of knowledge)	water – terms of looking into the options – was good for the community. An outcome that was good for the whole of community. • Could still have desal plant producing 95% potable water at point lowly a second stage desal module located point lowly to produce potable water for the Eyre Peninsula and another module at Roxby Downs to produce potable water for the residents. • Further follow up focus groups (open community engagement groups) where developers/researchers/scientists can give their proposals to the community. • Council could take advantage of the current economic turmoil – there is less need for these projects to be rushed through. • Government to check into the financial sustainability of the developers – are they (the developers) always going to take the cheap option because it is not viable for them to work other ways. • Council should be talking to Flinders Ports Consortium (all

			of the various stakeholders). • Power of the community • Letters to ministers – they are obliged to answer letters. • Media coverage – someone with experience that knows how to do it. • Proposal was sent to separate mining companies – re invite to attend a meeting for a presentation re alternate site in December 08. Southern Port alternatives: • Opens access to Eyre Peninsula • Potential Grain Terminal (access for other commodities) • Reduces road traffic through Whyalla • Lower cost option for the Eyre Peninsula miners • Close to existing largest iron ore mine in SA (Onesteel) • Large area of flat land which is easily developed • Very large area of deep water – no dredging required – easy channel • Greenfield Site: • No restrictions on development • No hazardous neighbours

			• No ordnance clearance required • No existing tourist activity • No existing recreational activity • Close access to deep water (20 metres) • Could be developed into combined export facility for Eyre Peninsula and North of SA eliminating the need for new or upgraded ports at Port Lincoln, Arno Bay, Pt Lowly • Minimal impact on visible amenity • Eliminates the need for a Whyalla by-pass to allow Eyre Peninsula access to a port

GENERAL SUMMARY:

Common issues	Issues of diversity
Council to support the local community to put their case forward to State Government for an alternative port, community to come together to deal with the issues, improved consultation with the Whyalla community.	There were a range of suggestions as to how the Council, State Government and the community need to be involved to address the development issues. There were suggestions for long range research and short range action plans to address the issues

Question 4 - What would you like not to happen?

Table 6

Monday 24 November 2008	Monday 24 November 2008	Tuesday 25 November 2008	Tuesday 25 November 2008
• No brine added to the Gulf. • Whole concept is wrong – geology of the area, flora and fauna, marine etc has been ignored – short sighted on behalf of Government to use this area. • Wouldn't want them to discard the alternative developments that are better for the Whyalla community. • Benefits of developing and of not developing not being discussed. • Young people not represented	• Buffer Zone (Public Exclusion Zone) around the proposed jetty – diving area will be compromised. • If we stuff up Point Lowly we have to go 100 kms to go to a decent beach	• Don't want Point Lowly industrialised • Alternatives ignored • Inadequate consultation with the community • Don't miss out on the opportunity – we want both • Don't want to lose the one thing that is accessible from home (Point Lowly) • Don't want to lose a unique world event (Cuttlefish) • Don't want Council/all levels of Government to hold onto information that can be provided to the community • Don't want to lose the potential for eco tourism and coastal living • Don't want the current government view that 'they own the land and that this will be good for you mentality' • Need to get Cr Eddie Hughes' motion off the table – and get the area rezoned. • Need a far more comprehensive Government approach for community consultation.	No comments recorded under this heading for this group

		• If developers make a wrong decision in the location of a development which causes an environmental disaster there would be a strong likelihood of costly litigation. Would this likely deter future development in the Whyalla area? *(received via email after focus group)* • With the State Government not consulting the local community in full it could mean political suicide for the local seat and further afield. *(received via email after focus group)*	

GENERAL SUMMARY:

Common issues	**Issues of diversity**
Want effective consultation on the proposed developments, do not want to lose unique environment/recreation area, do not want to lose opportunities for economic development,	Some groups recognised the lack of representation from young people in the community. A few young people attended the session on Tuesday evening and provided valuable contributions

APPENDIX A: Advertising notices placed in the Whyalla News on Thursday 20 November 2008

Council to hold focus groups

The Whyalla City Council is holding focus groups to provide local residents with information about the Point Lowly developments.

There are a number of developments proposed for the area, including a desalination plant to service the Olympic Dam expansion, a deep water export jetty and a fuel refinery and tank farm.

The groups will be involved in the direction the council takes on the issue.

"It will influence that," council chief executive Phil Cameron said.

"We want to solicit people's thoughts and opinions to enable council to get some feedback about thoughts at Point Lowly.

"We're hoping people from either side of the camp turn out to the focus groups.

"There may be people with one or two issues, some may be against the whole thing and some people might be for it, so it's to see what might be ticking over in people's heads."

The focus group meetings will be facilitated by consultant Barbara Chapell who has been working with council's internal working party in relation to Point Lowly.

The meetings will be held on Monday November 24 at the Left Hand Club and on Tuesday, November 25 at Whyalla Economic Development Board.

Participants must register through the council.

Contact Jane Hayward on 8640 3422 for more details.

Focus: Council chief executive Phil Cameron (left) is pictured here with Deputy Mayor Eddie Hughes at Point Lowly during an excursion by council's Point Lowly task force.

CITY OF WHYALLA

FOCUS GROUPS

24/11/08

POINT LOWLY PENINSULA DEVELOPMENTS

Are **YOU** interested in participating in a **FOCUS GROUP** re Point Lowly Peninsula developments?

For information contact Jane Hayward, Whyalla City Council on 8640 3422 or email jane.hayward@whyalla.sa.gov.au

Registration for participation is essential.

Monday and Tuesday

Point Lowly focus groups

The Whyalla City Council invites everyone to attend facilitated focus groups on the proposed Point Lowly developments. The focus groups will allow residents to gain access to information the proposed developments, and provide input into the future direction of industrial and recreational development in Whyalla. Sessions will be held on Monday and Tuesday, November 24 and 25 at 10am until 12.30pm and 7pm until 9.30pm. On Monday, 24 at the Left Hand Club on Dick Street, and on Tuesday, 25 at WEDB meeting room on Nicolson Avenue, Whyalla. For more information call Jane Hayward on 8640 3422.

APPENDIX B - EXPECTATIONS

The information in **Appendix B** is a record of all the expectations of the participants who attended the Focus Group sessions.

Focus Group – Monday morning 24 November 2008

- To listen and try to gauge the true facts instead of conflicting facts given to us over the last few months
- Information about the planning/deadline process
- Decision taken by Council with regard to the issue
- More in-depth information on the proposal
- To be respected as I respect others for their views
- The truth on Councils stand on this development and why they won't stand up for Whyalla
- Listening to others points of view
- Get some action going to let the Government know that Whyalla community cares
- That Whyalla residents do want economic growth etc. but not at the expense of the environment
- Information on what is going to be put out there and how much is negotiable or is it already cut and dried
- To find out how much notice will be taken of our concerns, as well as the published concerns of recognised academics, particularly regarding the desalination plant
- Honest information presented as to proposed developments and timetables
- Focus group sessions not a waste of time because everything is already cut and dried as was the Santos development
- To get correct knowledge of industrial developments proposed for Point Lowly
- Voice concerns for developments and the effects they will have on the environment
- To sort out what and where everyone is headed in respect to the future of Point Lowly eg. Council, business and community
- A better knowledge of exactly what is happening and where it is at present
- Accurate information
- Desal plant – fresh drinking water - will we get additional supplies
- Questions answered if possible
- No desalination plant
- Discover community opinion
- State Government stand/justification for development
- Concerns re: consultation processes/definition
- Will current economic issues effect proposal
- What effect if any will Defence SA project have on the region
- What ever happened to wind generation project
- Better understanding of all issues
- Understanding of community values of importance and measures to ensure these are respected as far as practicable
- Let us know what happens to Point Lowly
- A greater awareness of the Whyalla community of what is being proposed and what will be lost
- Greater awareness of the alternatives that could satisfy the needs of all without destroying the recreational and tourist potential of Point Lowly
- To listen and learn what this meeting has to offer the residents of Whyalla

- To see why the government and industries want to use our only recreational area
- To find out more information on this topic and to try and get Council members to stop sitting on their hands
- To have a better idea of other people's feelings and concerns

Focus Group – Monday evening 24 November 2008

- Ensure Council are actively listening to the input from the community and not to assume the decision is already made
- Information assistance on how to promote the positives of Point Lowly as it is and the liability to the people of Whyalla and the environment if the industrialisation of this area goes ahead
- Help in presentation and support of a deep sea port south of Whyalla
- Reinforce need to explore options for diverse development that is sustainable and compatible with social and physical environment
- Promote northern coastline for clean and green enterprise
- Promote southern coastline where appropriate for "grey" enterprises and export port
- Frank discussion and no hidden agenda
- Positive consideration for all opinions
- To hear residents views in relation to the proposed developments on Point Lowly Peninsula
- Find out why Council has "no position"
- Find out why Point Lowly should be sacrificed
- Understanding of concerns and opportunities created by Point Lowly proposal
- Understanding of community's values and what is important to be retained
- Increase awareness of shortfalls of Point Lowly Peninsula for future heavy industry
- Enforce other to look at long term in lieu of short term
- Any development (tourism, aquaculture, recreation, recreational and commercial fishing, etc. to be sustainable and compatible with current activities without risk to those activities
- Things to do
- Information
- Some direction as to what to do to help prevent the industrialisation of Point Lowly
- Information regarding progress and reports on progress – possible progress stoppers or issues
- Help redirect efforts to move the port south of Whyalla and move the desal plant to a much better location on the west coast (open ocean)
- Commitment from Council that they will actively and aggressively represent locals once an informed decision (yes or no) has been made or else this is a waste of time
- How is community opinion being canvassed (measured) – surveys so far have not asked pertinent questions
- State Government versus Whyalla Council. How do they interact? Do we as the Whyalla community "have a say" through the Council. Or is the State Government merely relaying information to us (the community) via the Council?
- Listen to constructive concerns of the community regarding any industrialisation of the Point Lowly Peninsula
- Hear the benefits that industrialisation of the Point Lowly Peninsula will bring to Whyalla, its community and the region

Focus Group – Tuesday morning 25 November 2008

- Balance view of the Lowly Developments (have all the alternative options been raised).
- Understanding on how to engage Local Community/Local Govt to go forward as a cohesive committed group on Lowly development issue (the opposition being the Govt – bad guys)
- Hope to get some feedback on how our Council feels over the issue and on a way forward for the preservation of the Lowly Peninsula
- Balanced view on developments
- More information on developments
- Information on the development and how far it has advanced
- Environmental concerns and protection
- Jobs against environment
- Hear public opinion – the whole community
- Ensure Council hears and relays to Govt a holistic view of public opinion in the interest of Whyalla
- To hear both sides and people's opinion and receive more information
- To ensure project goes ahead for the future of Whyalla, create more jobs.
- Any development should be in the best area which will have the least impact on environmental and social future
- Hope to get some feedback on how our Council feels over this issue and on a way forward for the preservation of Point Lowly Peninsula
- Speak honestly about all the ramifications of the industrialization of Point Lowly Peninsula
- Seriously consider alternative sites
- Understand impact on the coast line and potential changes to access for the coast road
- Aspects of cuttlefish breeding and hatching fully covered
- Why are developments so scattered?
- Work through issues, states, lack of community engagement, alternatives to current proposals
- Devaluing of environment and amenity values by the state government
- To obtain an unbiased/balanced feel of local people to the proposed development
- Be involved in a balanced process as concerned the process has been hijacked
- To be informed about the current situation
- To go away thinking that it is not a "done deal" to proceed with the industrialization of Lowly Peninsula
- To hear both sides and peoples opinion and receive more information
- To ensure project goes ahead for the future of Whyalla, create more jobs
- Council to take some leadership on behalf of the community

Focus Group – Tuesday evening 25 November 2008

- Expect nothing as Govt has made up its mind
- Make the whole process clearer in terms of getting our voices to be heard in respect to objections to development at Point Lowly. Not against industry, just against it being at such an environmentally fragile location with a huge recreational attendance from both locals and tourists alike
- How to make the State Government transparent in their dealings with these developers
- Want to make sure the State Government do not allow the cheapest option to the developers because that's what the developers want at the expense of the community

- That the report represent the strength of support for an alternative to Point Lowly
- That the Council act with speed and strength to effect the process as decided by the community
- Hear and listen
- To gather information regarding pros and cons of the development
- To express my concerns re proposed developments including desal plant at Point Lowly
- To hear other people's view points
- To give some direction to Council
- Come to consensus for this group for a plan of action from here
- If consensus is not possible, produce a list of issues to be dealt with and how.
- Real information – not "hype". Good and bad outcomes for environment recreation amenities etc
- Proof that all options have been really considered and not just cheapest option
- Get a firm understanding of Councils position and how they intend to move forward with the public of Whyalla's expectations
- Council commitment all information is "put on the table"
- To get the opportunity to express my opinions and concerns and be listened to and taken seriously
- To learn more about the proposed development and its impact (positive and negative) on the Whyalla community
- Yes to oil refinery (tank farm)
- Deep sea port to be part of One Steel area. If possible – harbour dredging
- Definite no to desalination plant at Point Lowly (move further south)
- To try see how the future of Point Lowly and surrounding areas may be impacted by the proposed developments
- To gauge what the community thinks about the proposed developments
- Have a true, honest view of future expectations of the port. If other sites have actually been looked at by the co-ops.
- To find out if this is just a process or are our views going to count for anything
- A much broader view of this issue. At the moment the focus is on Point Lowly. But what will produce the best results for the community and the participating companies in the long run ie. 10 – 20 years
- Questions about the desal plant answered. Cuttlefish safety is my main concern, along with beauty and serenity of Point Lowly
- Environmental effects – tourist attractions will be gone, future generations deserve a chance to experience the wonders of Point Lowly (will they get the chance?)
- What development proposals are actually before Council
- What other sites are being looked at for development

APPENDIX C - RECORDED COMMENTS

The information in this section is a record of the comments made during the Focus Group sessions.

Question 1- What do you know or what have you heard about or are concerned about the proposed developments at Point Lowly Peninsula?

Focus Group – Monday morning 24 November 2008

- That the State Government has to have the port to get royalties from the port. This would be lost if it was transported through Darwin.
- Proposed mines in the vicinity of the region – rail transport does not have the capacity to rail the ore to Darwin. Ore trains are very long – 4 and 10 million tones through port facility – rail network would have the capacity.
- If information regarding the proposed 30 mines is available – can we find out this info from the State Government?
- Government and industry seriously look at an 'optional' port (in the vicinity of Whyalla)?
- Cheaper for mines to use this 'optional' port rather than truck ore through Whyalla.
- Bulk commodity storage on the peninsula does not look big enough for the proposed 30 mines etc.
- Why not develop one super port on the peninsula between Lincoln and Whyalla?
- Who do we put these questions to? Who is going to action these questions? Questions – (best way forward) – all information is collated forums, through Council – Council's Point Lowly task force, senior officers etc and then forwarded to the Department of Cabinet - State Government.
- Send information to all government departments – eg Tourism, Infrastructure etc.
- Truck transport (tonnage – 7 to 13 million tonne) down Playford Avenue – (because it cannot be railed) – who is going to deal with this? Significant point that should be made to the State Government – push for the by-pass.
- Plan for by-pass but it is long term.
  Whyalla is being ignored at the expense of SA – no benefits to Whyalla.
  Nothing set in stone – Centrex (biggest organisation) – looking to ship out from Tumby Bay – if they do need to come thru Whyalla there will be a by-pass.
- Desalination Plant – re 'dodge tide' (in the top of the gulf) how do they know that salinity levels won't change the impact on marine life? – refer to published scientific references to this.
- Is there an option on the dodge tide that the plant can be shut down?
- What will happen to BHP if/when damage is done – will they stop producing the water or will they keep producing?
- Is the Desal Plant part of an indenture which is part of BHP Billiton's project (Olympic Dam)? Subject to an Environmental Impact Statement? What would happen to the brine – does it have to go into the sea?
- Too much salt being developed to be left on land – from BHP Billiton open meeting. No salt industry that can handle the quantity of salt.
- Are they going to produce drinkable water from the Desal Plant?
  BHP Billiton has told Council – first pass water is in the World Health Standards for drinkable water. Government's first intention to have potable water – they have changed their mind ... Council have written to State Government re this. Government have changed their stance – it is their call (not BHP Billiton's).

- What are the State Governments plans – what do they look like? - the one on the State Government's pamphlet is Council's plan.

Focus Group – Monday evening 24 November 2008

- It's a done deal – the general public's perception is that we are not going to change the Government
- (we don't own the land – the Government owns the land)
- Conflicting information – Billiton EIS being favourable in relation to Cuttlefish breeding – some Scientists (Adelaide Uni) say it is detrimental to the Cuttlefish breeding.
- Billiton Scientists (Melbourne Uni) – one wonders – Unis are political institutions?
- What is the truth?
- The credibility of the information source to BHP Billiton?
- Is Billiton going to use the jetty to transport copper and zinc concentrate? And what might be the implications if there is a spillage?
- Presentation by Robert Jenkins stating that copper concentrate would not be transported from the jetty,
- Ore would be transported by covered conveyors etc.
- Council asked the question to BHP Billiton – they are going to rail their concentrate to the port of Darwin – currently consulting with Alice Springs. Going to be containerized.
- What controls do we have on what is transported from the jetty?
- What possible ores of any are to be transported from the jetty? Can we have a guarantee that no product that is detrimental to the marine environment is transported from the jetty?
- Ship traffic – what effect the increase in ship traffic (ballast water etc) will have on the gulf?
- How deep is the water out there? What is the draft of these cape sized ships? Where are we going to be able to sail (recreational uses) (ship traffic)?
- Concerns in increased potential for oil spills.
- Distillate from the refinery – major problems if there is a major spill?
- Who might pay for the cost of a major spill?
- Accepting an agenda which has been given to us for 25 years.
- We have heard that this is going ahead and Council have already been told what $/tonnage they are going to get.
- Council resolution – write to Provincial Cities and EPLGA to gather support for Council to lobby the State Government to get a percentage of the royalties.
- No other deals done. Communities should be entitled to a slice of the mining royalties.
- If the EIS – (for all proposed developments) is not favourable will it still go ahead?
- No chance for the community to say yes or no? ... feel good exercise...(information sessions only) ..

Focus Group – Tuesday morning 25 November 2008

- It is beautiful and unique – if industrial goes ahead it will change it dramatically.
- Tidal flow isn't sufficient to clear the area of any impurities.
- Santos originally said they would have a smaller footprint – as they developed it got bigger - the State Govt had very little communication with the community and it was a done deal.
- Look at what has happened in the past and use some of this so we don't make the same mistakes.

- Process is being driven by one company – Western Plains Resources – process only commenced when discussions were cut off by OneSteel with WPR (denied opportunity to use OneSteel port). (WPR Annual General Report – information from this states the above).
- If people were to read comments by Bob Duffin (WPR) there is an option at OneSteel for the export of iron ore.
- OneSteel is already barging iron ore out to the cape sized vessels in the gulf.
- Port Bonython will not be a strategically viable port in the long term.
- State Government process entirely top down – regional communities left to react to a decision making process that has already commenced.
- This group is not looking at the economic viability of Whyalla in the future – need to take this into consideration (and remember the years of past). City needs to move forward.
- Fine to have development but probably in a different location – a location which is more suitable – what happens if an environmental disaster happens?
- Better tidal flows (down South) more acceptable to the community.
- Community is very pro development – issue with this development is the distinct lack of information and communication from the State Government to the community.
- State Government (State Government land and project) they need to be out there driving the community consultation processes.
- Elements within this Government that have indicated that there is more than iron ore to be shipped out of this port.
- Good community consultation – you can drown in facts....
- The whole thing hinges on balance – quality of life/business/short term focus but a long term strategic plan
- Look at alternatives that are available
- Someone needs to take leadership to get the whole thing to be looked at in a balanced way
- Concerned it is a knee jerk reaction that there has not been a business like view on the impacts on this city in the long term – short term vs long term strategic fix.
- Where is the industry going to get the water from – to operate these industries? Water crisis ...
- BHP EIS not due out till next year – so many unknowns ... arguing over unknowns – same for the jetty – how is this going to impact on the environment – how is it going to be designed? Are we still going to have access to the coast road?
- Business potential – this City is very reliant on OneSteel – it would be a good thing to have another opportunity for more than one industry to draw incomes from – (diversity in the income stream).
- Leaving our kids a decent world.
- If this does go ahead – significant infrastructure will be built – it will become the industrial hub. Everything that needs to come to Whyalla would be able to be located in this area.
- Resist in losing recreation area for the future.
- Very little to offer the ordinary people for recreational use in the area.
- That there is a land grab in PL and this will happen with new developments – exclusion zones etc. They will grab more than they really need. Access to areas.
- Concern that alternative ports have not been looked at sufficiently.
- Because of the current economic downturn we need to be careful that we don't 'drop the rage'.

- Loss of major land area in regards to the Defence Department – Cultana expansion. Diminish our economic strength rather than enhancing it.
- (Has the potential of keeping people in jobs more difficult. Recreational needs to being met – people move on to something better). Loss of amenities.
- Want to keep workers here – lifestyle needs to encourage people to stay here.
- Have not developed the potential of Point Lowly.

Focus Group – Tuesday evening 25 November 2008

- Point Lowly is accessible – because there is a Santos – bitumen road.
- It was accessible before the bitumen road.
- Rat Bags out there because of the bitumen road – positives about the access as well as negatives.
- No positives about the access out there.
- Lost access to Weeroona Bay.
- Lost access and the natural beauty that was there – now it seen as an opening and it is being ruined by Industry.
- Hate looking at the ugly Santos site.
- Loss of a very significant beach (best swimming beach) - any further development has the opportunity to further halt access to area
- Exclusions off and on the water (Santos Jetty) – more exclusion zones on the water
- You don't have to have an exclusion zone around a jetty.
- Why can't the proposed jetty have a dual use?
- Free trade agreement – all ports have to be secured? How will the public have access to the jetty if this is so?
- How are they going to build the proposed jetty and not contradict Aboriginal Heritage issues?
- Aboriginal heritage site in exclusion zone – don't want that to happen again
- Use by date for Santos? No good will between industry and community
- Santos has provided employment to the people of Whyalla
- Council uses Point Lowly for tourism
- What is the next best place in this whole process and what would be the alternate costs? How do we make a wise decision? No strategic approach to this development.
- We don't have any alternatives – is there a better option for this development?
- No power – big negative
- Paying taxes on greenhouse – desalination plant run by alternate energy – start a fresh – before hooking into the power line.
- How popular the area is – lighthouse cottages etc – always turning people away – very popular
- It is a very popular destination for caravans, tourist homes etc.
- Statistics are available for numbers for the light house cottages (Uniting Church)
- If there is no Point Lowly would the Government say Whyalla would not get a port at all?
- Better option for industry down South – too dear? Are we under devaluating Point Lowly over development down South?
- Tourism over industry?
- Development is purely driven by costs for a short term
- Tourism – 3 operators who could provide quantifiable data.
- Tourists visiting want to dive (cuttlefish) (over anywhere in Australia) in Whyalla.

- Cuttlefish need rock shelf structures to breed.... Let's not assume that any structure built into the gulf near the cuttlefish breeding ground may be adverse to the cuttlefish breeding.
- Seawall marine cuttlefish are a different species.
- Jetty out there has not had a detrimental effect on the cuttlefish.
- No fugitive dust comes off the Santos jetty.
- What is the real economic benefit for the proposed development? If we are willing to trade off something what is the trade off?
- Are we giving up Point Lowly to fund projects outside the region?
- If the proposed port goes down South it may be a better option.
- If the port is down South we get less road traffic through Whyalla.
- No consideration of opening up the Eyre Peninsula – no consideration of opening up a by-pass.
- Some coating on the Santos jetty affected the periwinkles and it has taken some time for the crustaceans to come back.
- Learning from history that we don't make the same mistakes.
- Lost access and the natural beauty that was there – now it seen as an opening and it is being ruined by Industry
- Business in Whyalla will not get the benefits if the port goes a long way down South
- Nothing has been said about how vehicles are coming into the sheds at the proposed developments at Lowly etc. red dust issues attached?
- How will the red dust from the road vehicles be combated?
- Is there was to be a by-pass who is paying for it?
- Assurances by the State Government that they will not do to Whyalla what they have done Kakatha Mula nation (SA/WA board) – open slather?
- Esperance – exporting iron ore .. loss of bird species
- What assurances by the Government are we going to be given that only iron ore is being transported out from the proposed jetty?
- How far out into the Gulf will the desalination brine be put out into the gulf?
- Needs to be dispersed a lot further out into the gulf.
- Need to have an assurance that this needs to be dispersed a lot further out into the gulf.
- Does the dispersion pipe (from the Desal Plant) form a barrier to the cuttlefish migration?
- The independence of the EIS – how much energy/credibility is going into the EIS? Needs to be independently funded - to be paid by Council, State and Industry.
- Are there any other chemicals added to the water to be dispersed from the desal plant that may be dangerous to the environment.

Question 2 - What might what we have discussed mean for you?

Focus Group – Monday morning 24 November 2008

- Not going anywhere – if we cannot get Council or people that this affects – concerns going nowhere – opinions need to be valued (in a big group).
- Representation – Council needs to let Government and people know that they are concerned. Support to put an end to this
- Need and numbers support from the people of Whyalla.
- How do you want to find out about community engagement activities?
- To promote community engagement processes where people gather eg outside the normal areas of Council - ... clubs, pubs etc.

Focus Group – Monday evening 24 November 2008

The focus of discussion in this group was on an alternative site for the proposed developments.

Focus Group – Tuesday morning 25 November 2008

- An obligation regarding the cuttlefish aggregation to do all you can to protect it.
- Some view of the long term issues attached to the Lowly Peninsula – let's have both.
- People have short sighted view – what are we going to leave behind for future generations - how can we find a balance.
- Concern we don't want to lose what we have now.
- Concern being - Whyalla being a fly in fly out, sophisticated camp to support mining – a port to support mining with nowhere to go when you are not working or mining and when the mining has finished Whyalla will become a ghost town.
- Need to look at community development, how the mines/facilities are set up in regards to accommodation – need to be integrating the 'mining community' into the Whyalla community.
- Embed as much economic, recreational, social, health, education, transport, sport, tourism activity within the community – to encourage people to live and stay in Whyalla.

Focus Group – Tuesday evening 25 November 2008

- Are we giving up a local amenity to industry?
- We pay all the costs and they get all the benefits.
- Do we have a choice between Pt Lowly and somewhere else?
- What are we giving up 20/30 years from now – maybe use renewable energy?
- What is the long term loss for the short term gain?
- Lifestyle and heritage of Point Lowly
- Tourism
- Economic Progress – all developments will give the city this
- Family camping ground – place to go and spend time and enjoy life .. (Lifestyle)
- Peaceful environment – people with sickness (oncology) utilise the Point Lowly cottages for the serenity etc.
- The Cringe City – we are not allowed to have anything pretty in Whyalla – dumping on Whyalla because we are the sewer of the State – take one for the State
- There is a feeling throughout wider regions that Whyalla is a dumping ground.
- State Government is not listening at all – done and dusted thing.
- The reasons I live in Whyalla is being taken away – things of beauty destroyed to make money.
- Lack of consultation by the State Government – devalues us
- Every community that has built solely on mining ends up with a hole in the ground and a ghost town. Another step downwards.
- Want to see development but it is looking to be developed in the wrong place.
- Trying to get people to Whyalla is hard enough – it is seen as a dirty industrial city. Have it in the right place!
- In one generation the beach that was very popular has been lost to the community.
- Every industry in Whyalla has difficulty in attracting people to work.
- Development at a cost to the community.

- That is our Sydney Harbour – what would people think if a jetty like this was built next to the Sydney Opera House.
- Threat to people's property investments.
- Any family that has visitors from overseas, interstate visitors – people always to take them to Point Lowly – to show the diverse environment.
- If the development needs to go there – it needs to be an absolute effort to screen away the nasty look of the industry.
- Want the development – but needs to occur in the right way.
- Proposed army spread around Whyalla will take away areas that are now being used for recreational space. This with Point Lowly will reduce the areas that Whyalla use for this purpose.
- There is nothing else around Whyalla that we can use for recreational space – Point Lowly is loved.

Question 3

What do you think needs to happen?

Focus Group – Monday morning 24 November 2008

- People would like to hear the thoughts of Council and Elected Members. *People don't appreciate what they have .....until it is lost....*
- The people want to know about what is going to happen out there .... We need to know – more detailed information in regards to the proposed developments...
- Answers about what is going to affect the quality of life out there – affect the quality of life in Whyalla, and the Gulf.
- A range of questions need to be answered to identify the impacts of each of the proposals on Point Lowly and Whyalla. (*an appreciation from outside organisations as to the importance of Point Lowly to Whyalla)*
- Needs to be a genuine report on costings etc on the port South of Whyalla as an alternative. *Short term gain for long term pain $$$$$.*
- What is the stance regarding the proposals from the Department of Environment and Heritage and Tourism?
- Councilors' need to be more open and concerned re concerns from the community. *(Having views respected and be neutral about it). Councilors' stand as community leaders .... General public look somewhere for leadership – development should have been debated a lot more in Council (reported in the news etc from this discussion). You need somewhere and somebody to get message across. Industry and government listening to industry here – promoting industry....Need Elected Members to debate in Council – to form a stance for the community.*
- Can we have the results of the EIS before for public consult before development commences?
- A good outcome for the community from the information collated from these focus groups.

Written comments handed by participants at the end of the session

- I want to see any proposed industrial development for the Whyalla area put south of Whyalla where there is more deep water and not so invasive on our community in Whyalla
- I want to see the SA Government make a serious and thorough feasibility study of the alternatives for a deep sea port south of Whyalla taking into account a long term view
- Environment and landscape values of Fitzgerald Bay retained

- Water quality of gulf maintained and fauna protected
- Noise and dust impacts from rail transport of iron ore managed so as to be minimal on peninsula
- Noise and dust imports of volume road transport through Whyalla urban area prevented via a commitment to a by-pass
- Care in the positioning and design of buildings and structures in Point Lowly
- I want the people to be told all the impacts for each project, ie. noise, light, space, transport (rail/road), any impact on the area, extra road transport impact on the public
- Council to be the carrier of information
- The Government need to be held responsible
- Beach area/lighthouse retained in pristine condition
- Want arrogant Premier to listen to us and our concerns
- For some development in the area
- Concerned about army land issues and proximity to Whyalla community boundaries – particularly "noise factors"
- As a group I would like to help reach the public about the importance of Point Lowly to Whyalla residents, tourism and future generations. One mistake could ruin this pristine environmental wonderland forever – for everyone
- We need to make sure the Cuttlefish are protected and need to make sure they are not destroyed before it is too late
- With industry being developed, we need to make sure it is done properly with no impact on the environment and the life we can provide for the kids of the future, and the quality of life that we enjoy out there today as being a shack owner with no noise pollution, toxic chemicals in the environment etc. As we already have to put up with the army bombing on Easter break which shakes and rattles the windows etc. on a religious holiday break, up to midnight which is unacceptable, but it happens. Protect us for the future.
- Other sites to be seriously considered (within Whyalla area) in less sensitive areas for super port and handling facilities
- Build a multipurpose jetty to be used by all companies south of Whyalla
- Debate the alternatives in what is better developments on the Point Lowly Peninsula
- Industry and Government to have a genuine respect for the amenity value and the long term good of Whyalla rather than short term political gains and profit
- Stand up and be counted, say what you want to see happen at Whyalla and Point Lowly
- Mayor to speak for the people
- Want to see Government officers making themselves available to speak to the community – several sessions – not just one appearance
- Cancel the whole industrial development at Point Lowly – declare it as a reserve at least
- No salt water into the gulf – not enough exchange of water overall (marine biologist)

Focus Group – Monday evening 24 November 2008

- If anything goes out there it has to be compatible and sustainable with the existing uses out there and not to put those uses at risk. Promoting what we have and still promote and alternate port.
- The Northern Coastline (from False Bay North right up to the Army enclosure) is appropriate for clean and green activities (recreation, tourism, aquaculture, wind farm, coastal living)

- Can the Stony Point Environment Consultative Group be reconvened?
- What happens when Port Bonython runs beyond its sustainable life?
- People (in authority, those proposing developments) need to acknowledge that what is being proposed out there is a highly compromised port.
- Highly compromised industrial estate for that area (the Port Bonython area is restrictive) - EIS of the Southern site – need to look at all aspects from mine through to transport to ship site.
- Council to ask the State Government through the Environment, Resources and Development Committee of Parliament to come and meet the people of Whyalla and hold an enquiry.
- When are they going to do a full depth study into an alternative southern site for a deep sea port and associated industrial estate?
- State Government to conduct an independent in-depth study of the Southern and Northern port options looking at the long term economic impacts to enable a balanced assessment of the two sites.
- When are we going to have a comprehensive long term plan for utilising our Northern coastline for:
- Eco tourism
- Recreation
- Recreational and professional fishing
- Tourism (Caravan parks, camping sites, walking trails, diving facilities etc)
- Coastal living (retrieve 50 allotments for coastal living)
- Aquaculture
- Wind farming
- If we stuff up Point Lowly we have to go 100 kms to go to a decent beach.
- What are the real measurable benefits of the proposed developments to Whyalla (economic and social)
- Regarding the fuel facility and potential refinery consideration to moving the tank farms to the Cultana Industrial area to take advantage of existing infrastructure at that location. The increase costs of pipeline and pumping would be more than offset by the reduced transport costs incurred by then user over the longer term.

Written comments handed by participants at the end of the session

- It was good to hear the concerns and they were mostly constructive and positive. The south coast versus the north coast locations (clean and green) a very good comparison
- Encouraging to hear that individuals and groups will be proactive and write to State Government departments and mining companies
- Real benefits of industrialisation wasn't really answered as group thought very little employment (long term) advantages available
- Council (and State Government) should fund consultancy brief to evaluate long term merits of Mullaquana and Point Lowly on economy and environment. If that fails, petition Environment Resources and Development Committee of Parliament to investigate and report on merits/demerits of Mullaquana and Point Lowly sites while holding further development of port

Focus Group – Tuesday morning 25 November 2008

- State Government needs to look at /reassess its process in engaging community(s). Northern Spencer Gulf Resource Processing Strategy used as a model and to include communities from Port Lincoln thru to Whyalla (Economic Development Boards etc) to go thru a decision-making process.

- This process to take into account the social, economic, environmental, recreational, indigenous amenity of the area.
- Community apathy needs to be addressed.
- Leadership and strategic direction from someone re issues of development
- Within community – address apathy - get community involved
- Local Council to represent community – drive a cohesive community view to get to State Government
- State Government to represent the State with due regard to Local Government and community
- Federal Government
- Negative view of the town
- Involve schools? – identifying the ways that different groups need to be involved within the community - (using Information Technology) need interactive sites.
- Linking the social network into this process.
- People to people power – spark the passion
- Want numbers – need people to speak up
- Need to sell the concept.
- Council engage someone full time – needs ownership
- Council has got to in some way reach a view on what best represents the communities views – then Council has to have a 'business plan' on what the community wants. Need to lobby the State Government.
- Council should take responsibility for funneling the communities view into a cogent plan to influence the State Government.
- All alternative options for developments are looked at very seriously and the results and/or process are followed through with consultation and input with the stakeholders (everyone in community, Local Government, people of knowledge)

Written comments handed by participants at the end of the session

- Want industrial development and Point Lowly kept as it is
- Alternate sites looked at
- Want to see EIS for Point Lowly
- Yes to industries
- Good clear facilitation – thank you
- Point Lowly and Fitizgerald Bay highly scenic – one of the few areas in SA that overlook water and see a mountain range – highly attractive. Has great potential
- Hard to fully discuss when EIS and designs not available
- Why are our governments taking such short views on development at all costs? What are we going to leave behind for future generations? No more minerals, no environment, just a large mess to clean up after the mining companies have finished with our resources.

Focus Group – Tuesday evening 25 November 2008

- Government do an equal amount of costing and development – what are we comparing it with? Look at costing of alternative sites?
- Show the advantages and disadvantages.
- Pro development – but at the right location.
- Core group (incl John Scott) has recognised an area South of Whyalla. No environmental issues – opens up whole of the Eyre Peninsula – no by-passes (other than a rail line)

- All of the advantages but none of the disadvantages.
- It is an Action Group that is not against development – just put it in the right place.
- Pro development in the right way.
- Council takes on board thoughts and opinions – and shows the positives and negatives.
- Council to steer/influence/facilitate the Government into looking at an alternative site (South).
- Split the refinery industry(s) into two separate projects – refinery could stay at Point Lowly and the tank farm could be located at the Cultana Industrial Estate.
- Desal plant – best place to be on the West Coast (Elliston).
- Chemicals etc that are put into the brine and pumped back into the sea.
- Most advanced technology to be used in the running of the desalination plant.
- In all decisions - can we get the best outcome/plant and not the cheapest! At least the two best options not the only option.
- Process that the Council/SA Water used for the recycled water – terms of looking into the options – was good for the community. An outcome that was good for the whole of community.
- Could still have desal plant producing 95% potable water at point lowly a second stage desal module located point lowly to produce potable water for the Eyre Peninsula and another module at Roxby Downs to produce potable water for the residents.
- Further follow up focus groups (open community engagement groups) where developers/researchers/scientists can give their proposals to the community.
- Salt back onto the land? (from the desal plant) – problem with the volume of salt.
- Council could take advantage of the current economic turmoil – there is less need for these projects to be rushed through.
- Use the economic turmoil to the community's advantage.
- Government to check into the financial sustainability of the developers – are they (the developers) always going to take the cheap option because it is not viable for them to work other ways.
- Council should be talking to Flinders Ports Consortium (all of the various stakeholders).
- Power of the community – how do you empower the community?
- 3 bus loads of people down to Adelaide to stand on the State Government steps – with placards.
- Letters to ministers – they are obliged to answer letters.
- Media coverage – someone with experience that knows how to do it.
- Proposal sent to separate mining companies – re invite to attend a meeting for a presentation re alternate site.
- Invitation has also been sent to the Mayor to be part of this process.
- Request for Council to provide resources to gather data etc for this presentation to go ahead.
- Southern Port alternatives:
- Opens access to Eyre Peninsula
- Potential Grain Terminal (access for other commodities)
- Reduces road traffic through Whyalla
- Lower cost option for the Eyre Peninsula miners
- Close to existing largest iron ore mine in SA (OneSteel)
- Large area of flat land which is easily developed
- Very large area of deep water – no dredging required – easy channel
- Greenfield Site:
- No restrictions on development

- No hazardous neighbours
- No ordnance clearance required
- No existing tourist activity
- No existing recreational activity
- Close access to deep water (20 metres)
- Could be developed into combined export facility for Eyre Peninsula and North of SA eliminating the need for new or upgraded ports at Port Lincoln, Arno Bay, Pt Lowly
- Minimal impact on visible amenity
- Eliminates the need to a Whyalla by-pass to allow Eyre Peninsula access to a port

Written comments handed in by participants at the end of the session

- Best outcome not the cheapest for all the Eyre Peninsula
- Other costs factored into the proposals, extra road trains, other roads/wider roads, rail lines etc.
- Guaranteed safety of beaches/environment/Cuttlefish – not just suggested/encouraged etc.
- Council to seek a slow-down in the process to allow best possible decision to be made. February is way too early to get this finalised
- Would like to see more communication between the "SWAT" (Action") team and (us) the community and all the help this group needs to progress with alternative sites and uses of the port
- The most important thing is to go to an alternative site south of Whyalla and this has to be seriously explored
- We talked about acting with Council when meeting with developers and State Government – did we lose this idea? Mayor invited to attend meeting.
- Point Lowly is the soul of Whyalla. I want it to remain free of more industrialisation
- Make sure the approach taken is a professional one to match the approach that businesses involved use and that Government will use
- Make use of the Council, WEDB and local business resources to prepare and present or lobby relevant stakeholders
- Most importantly make the development happen but with the right decisions to enable the community lifestyle to remain and the business developers achieve their $ outcomes
- Want to make sure the State Government do not allow the cheapest option to the developers because that is not what the developers want at the expense of the community
- Synergies and externalities need to be considered to determine the best site for development

Question 4

What would you like not to happen?

Focus Group – Monday morning 24 November 2008

- No brine added to the Gulf.
- Whole concept is wrong – geology of the area, flora and fauna, marine etc has been ignored – short sighted on behalf of Government to use this area.
- Wouldn't want them to discard the alternative developments to be put out on the peninsula that is better for the Whyalla community.

- What are the benefits for the State from these developments – and what are the benefits of not developing.
- Where are the young people represented within the focus groups? – no young people at this forum group.

Written comments handed in by participants at the end of the session
- Don't want to see the gulf polluted with salt, iron ore etc.
- I do not want to see "fait accompli" development at the Point Lowly Peninsula as happened with Santos, with permanent loss of an area that could compete with the Greek islands as a tourist attraction
- No brine added to the gulf
- Degradation of the environment of the Point Lowly Peninsula
- Pollution affecting aquaculture industry
- I don't want our comments and views to be ignored by the Government
- I don't want the mining companies to build a jetty at Point Lowly
- I don't want our Council to be seen to be passively accepting what the State Government wants – be noisy (like Peter Davis) and use the media to benefit our cause
- What I don't want to see is dust in the air, brine in the water and loss of recreational areas
- Don't keep going over all the same ground in every forum – keep getting peoples views
- Don't be complacent

Focus Group – Monday evening 24 November 2008

- Buffer Zone (Public Exclusion Zone) around the proposed jetty – diving area will be compromised.
- The desalination plant should run on 100% renewable energy.

No written comments handed in by participants at the end of the session

Focus Group – Tuesday morning 25 November 2008

- Don't want Point Lowly industrialised
- Alternatives ignored
- Inadequate consultation with the community
- Don't miss out on the opportunity – we want both
- Don't want to lose the one thing that is accessible from home
- Don't want to lose a unique world event (Cuttlefish)
- Don't want Council/all levels of Government to hold onto information that can be provided to the community
- Don't want to lose the potential for eco tourism and coastal living
- Don't want the current government view that 'they own the land and that this will be good for you mentality'. It is just not 'cricket!'
- Need to get Cr Eddie Hughes' motion off the table – and get the area rezoned.
- Need a far more comprehensive Government approach for community consultation.

Written comments handed in by participants at the end of the session
- Don't want to lose the economic opportunities
- No to locating industry at Point Lowly

Focus Group – Tuesday evening 25 November 2008

No comments recorded under this heading during the session for this group

Written comments handed in by participants at the end of the session

- The development at Point Lowly just because it has already had work done on it
- Whyalla being given another bad name
- The development not benefiting Whyalla in some way
- I don't want Point Lowly spoilt by industrial development
- Native title and heritage not to be compromised
- Don't want this forum meeting to merely be a "feel good" exercise, but have the Council to take the strong feelings of Whyalla to finance and provide resources to push our cause
- No development at Point Lowly – relocate to alternative site down south

APPENDIX D - QUESTIONS RAISED DURING THE FOCUS GROUP DISCUSSIONS

These questions will be put to the Point Lowly Task Force for further action.

- State Government versus Whyalla Council. How do they interact? Do we as the Whyalla community "have a say" through the Council. Or is the State Government merely relaying information to us (the community) via the Council?
- If information regarding the proposed 30 mines is available – can we find out this info from the State Government?
- Can Government and industry seriously look at an 'optional' port (in the vicinity of Whyalla)?
- Why not develop one super port on the peninsula between Lincoln and Whyalla?
- Truck transport (tonnage – 7 to 13 million tonne) down Playford Avenue – (because it cannot be railed) – who is going to deal with this?
- Desalination Plant – re 'dodge tide' (in the top of the gulf) how do they know that salinity levels won't change the impact on marine life?
- Is there an option on the dodge tide that the plant can be shut down?
- What will happen to BHP if/when damage is done – will they stop producing the water or will they keep producing?
- Is the Desal Plant part of an indenture which is part of BHP Billiton's project (Olympic Dam)? Subject to an Environmental Impact Statement? What would happen to the brine – does it have to go into the sea?
- Is BHP going to produce drinkable water from the desalination plant?
- What are the State Governments plans – what do they look like? - the one on the State Government's pamphlet is Council's plan.
- How credible is the BHP Billiton EIS?
- Is Billiton going to use the jetty to transport copper and zinc concentrate? And what might be the implications if there is a spillage?
- What controls do we have on what is transported from the jetty?
- What possible ores of any are to be transported from the jetty? Can we have a guarantee that no product that is detrimental to the marine environment is transported from the jetty?
- Ship traffic – what effect the increase in ship traffic (ballast water etc) will have on the gulf?
- How deep is the water out there? What is the draft of these cape sized ships? Where are we going to be able to sail (recreational uses) (ship traffic)?
- Who might pay for the cost of a major spill?
- If the EIS – (for all proposed developments) is not favourable will it still go ahead?
- Chance for the community to say yes or no to development?
- Fine to have development but probably in a different location – a location which is more suitable – what happens if an environmental disaster happens?
- Where is the industry going to get the water from – to operate? Water crisis.
- BHP EIS not due out till next year – so many unknowns ... arguing over unknowns – same for the jetty – how is this going to impact on the environment – how is it going to be designed? Are we still going to have access to the coast road?
- Why can't the proposed jetty have a dual use?
- Free trade agreement – all ports have to be secured? How will the public have access to the jetty if this is so?
- How are they going to build the proposed jetty and not contradict Aboriginal Heritage issues?

- What is the next best place in this whole process and what would be the alternate costs? How do we make a wise decision?
- We don't have any alternatives – is there a better option for this development?
- What is the real economic benefit for the proposed development? If we are willing to trade off something what is the trade off?
- Are we giving up Point Lowly to fund projects outside the region?
- Nothing has been said about how vehicles are coming into the sheds at the proposed developments at Lowly etc. red dust issues attached?
- How will the red dust from the road vehicles be combated?
- Is there was to be a by-pass who is paying for it?
- Assurances by the State Government that they will not do to Whyalla what they have done Kakatha Mula nation (SA/WA board) – open slather?
- What assurances by the Government are we going to be given that only iron ore is being transported out from the proposed jetty?
- How far out into the Gulf will the desalination brine be put out into the gulf?
- Does the dispersion pipe (from the Desal Plant) form a barrier to the cuttlefish migration?
- Are we giving up a local amenity to industry?
- Do we have a choice between Pt Lowly and somewhere else?
- What is the long term loss for the short term gain?
- What is the stance regarding the proposals from the Department of Environment and Heritage and Tourism?
- Can we have the results of the EIS before for public consult before development commences?
- Can the Stony Point Environment Consultative Group be reconvened?
- What happens when Port Bonython runs beyond its sustainable life?
- When are they going to do a full depth study into an alternative southern site for a deep sea port and associated industrial estate?
- Government do an equal amount of costing and development – what are we comparing it with? Look at costing of alternative sites?
- Where are the young people represented within the focus groups?

QUESTIONS HANDED IN AT THE CONCLUSION OF THE DISCUSSIONS

- Are the concerns of the community going to be put back to the mining companies and government?
- When will the government talk to the people?
- How is the Council going to present themselves to the State Government on our behalf? Will it be in person or by other media?
- How will power for the developments be supplied?
- What effects will the projects have on greenhouse emissions?
- Who and how do we harass the government?
- Are there other native title claimants on Point Lowly and seas in the gulf other than Barngala group?
- I want to know the likelihood of change in plans – are we fighting a losing battle?
- If developers make a wrong decision in the location of a development which causes an environmental disaster there would be a strong likelihood of costly litigation. Would this likely deter future development in the Whyalla area?

University of
South Australia

Applied Statistics Unit

SURVEY RESULTS

DEVELOPMENT OF POINT LOWLY

John Petkov
Applied Statistics Unit
University of South Australia

EXECUTIVE SUMMARY

There were 10,300 surveys distributed to households within Whyalla of which 345 were completed and returned to Council. There were several surveys which were completely blank and thus were omitted from the count. Most respondents (65%) indicated that their level of knowledge was general of some or most proposals or had limited knowledge of the proposals overall. The local newspaper and local television were the main sources of knowledge in this area. Nearly 55% of the respondents were agreeable to further participation. Nearly 70% are against the proposal; it is noted that the comments and responses received from this group were emotive in their language. There were 68 respondents who did not indicate or were unclear with respect to approval/disapproval. Most of these did not record a comment at all. The rest (23) indicated that there was not enough information or that maybe another site could be chosen but were not clear in their decision. The comments are shown in this report for approval/disapproval.

With respect to approval the following dot points summarise the comments:

- There is a water shortage and the desalination plant will be a great benefit
- Whyalla needs jobs and this development will go a long way in alleviating the job shortages, especially for the younger residents. The development will be good for Whyalla
- Whyalla and Point Lowly are industrial areas as it is. People should recognise this or should have recognised this when they moved here.
- Few people cared about Point Lowly in the past. Why is this big issue now? How many people protesting the development have actually been there?
- The concern about cuttlefish is overstated. These have survived in the past and the new jetty will provide another home for them.

The comments that show disapproval are shown below.

The following dot points summarise the disapproval comments:

- This development will result in a loss to the environment simply to satisfy the ambitions of the mining companies at the expense of the Whyalla community. The area is sensitive and needs to be taken care of.
- The Peninsula should be promoted for tourism. Overseas visitors comment on the beauty of the area.
- Whyalla is not a particularly attractive city. Point Lowly is the only real place where one can escape the industrial nature of the city. There should be more to Whyalla than just mining and industrial activities.
- The issue of cuttlefish is mentioned very frequently. There is concern that the development will affect the life and population of the cuttlefish. Given that this area is one of the very few breeding grounds for cuttlefish, the area should be protected.
- Not all sites have been fully investigated as viable alternatives to the proposed development at Point Lowly. Why not develop south of Whyalla?
- Point Lowly should be preserved as a legacy for the children of Whyalla.
- There is concern at the increase of trucks travelling along Playford Avenue. Issues of air pollution, dust increase and safety for children are common concerns.

- There is a cynical attitude amongst some respondents. The development is a "done deal" according to some and the Council is just issuing this survey as a token effort to assess community opinion and then this opinion will be ignored. In essence the community will be "rail-roaded".
- Santos has already taken away a large proportion of the available beach.
- Where do we go for recreation?
- There was good support for Eddie Hughes' proposal.

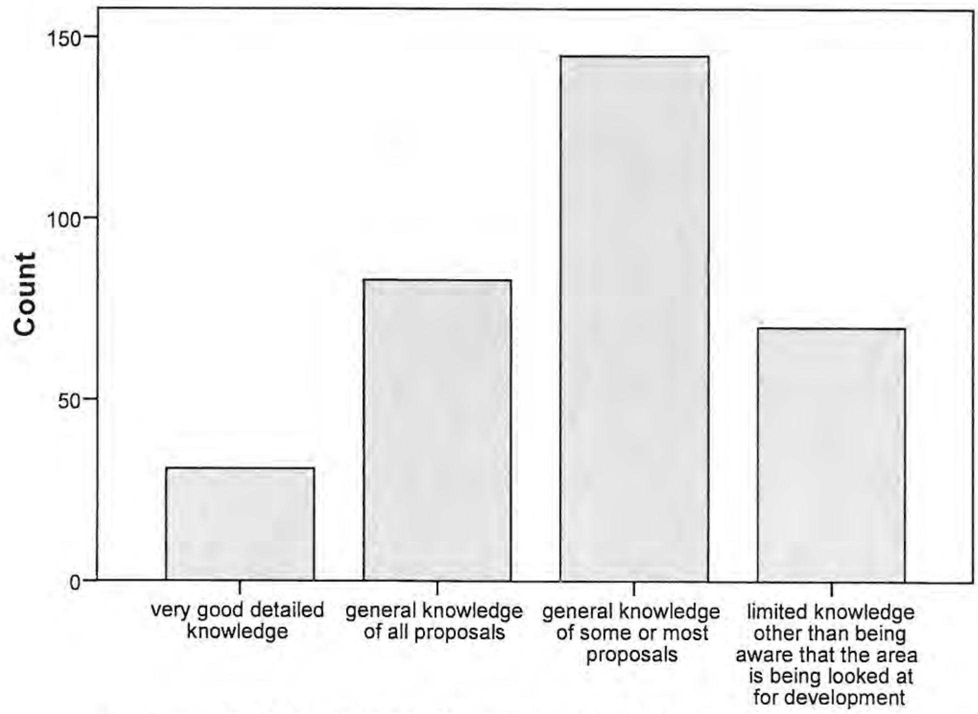
Essentially, the protest is not against development per se, but rather at the proposed site. This was the common theme. These respondents are concerned about the fragility of the area and the loss of what is regarded as the last site of aesthetic beauty in the area.

There are 345 respondents. There were a number of blank survey forms returned.

How would you describe your knowledge of development proposals for Pt Lowly Peninsula

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	very good detailed knowledge	31	9.0	9.4	9.4
	general knowledge of all proposals	83	24.1	25.2	34.7
	general knowledge of some or most proposals	145	42.0	44.1	78.7
	limited knowledge other than being aware that the area is being looked at for development	70	20.3	21.3	100.0
	Total	329	95.4	100.0	
Missing	System	16	4.6		
Total		345	100.0		

16 respondents did not answer this question. The modal (average) category is "general knowledge of some or most proposals".



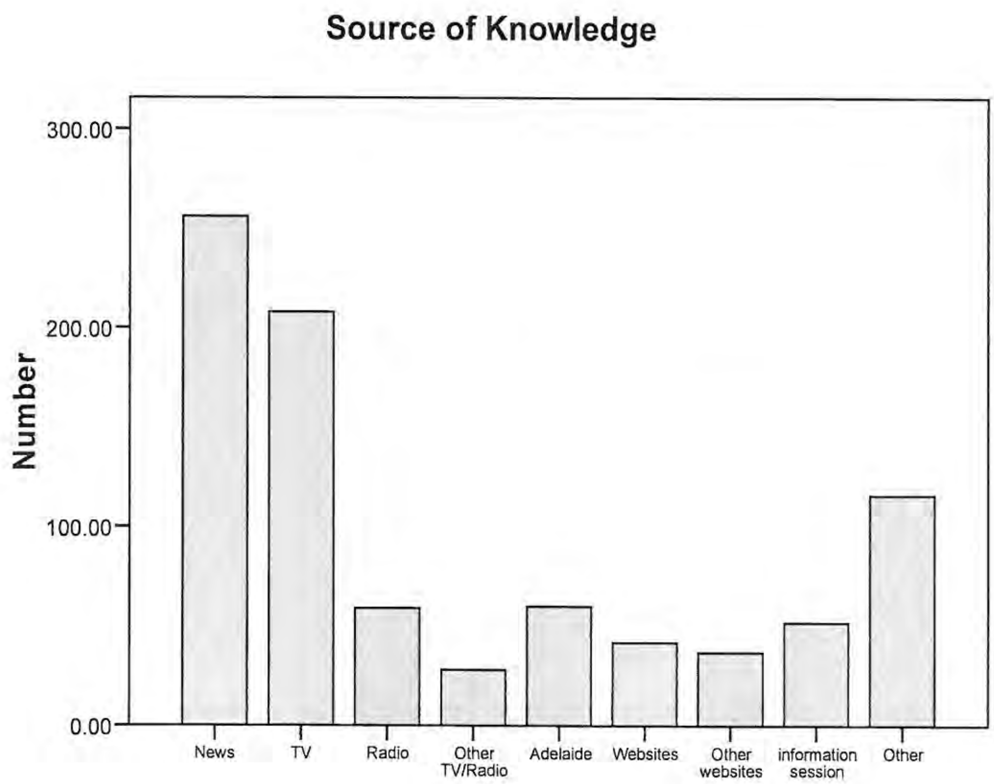
How would you describe your knowledge of development proposals for Pt Lowly Peninsula

SOURCE OF KNOWLEDGE

Source of Knowledge

	Responses	Number
Local newspaper Whyalla News	322	256.00
Local TV news service of Southern Cross	322	208.00
Regional ABC radio	322	59.00
Other local/regional radio	322	28.00
Adelaide based media (TV, radio or newspaper)	322	60.00
Websites of individual development proponents	322	42.00
Other websites	322	37.00
Attended the initial information day	322	52.00
Other	322	116.00
Valid N (listwise)	322	

The modal (average) categories are the local newspaper and local television service.



PARTICIPATION:

Do you wish to participate further if there are other opportunities in which to be involved in determinig the future of Point Lowly Peninsula

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	138	40.0	45.1	45.1
	yes	168	48.7	54.9	100.0
	Total	306	88.7	100.0	
Missing	System	39	11.3		
Total		345	100.0		

TYPE OF PARTICIPATION:

How could you see yourself as becoming involved ?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Be part of the focus group	36	10.4	21.4	21.4
	Attend the discussion forum	72	20.9	42.9	64.3
	Provide further written feedback	60	17.4	35.7	100.0
	Total	168	48.7	100.0	
Missing	System	177	51.3		
Total		345	100.0		

(The survey forms have been marked with an identifier. When Council decides to proceed further with the consultation process, a random sample for each category can be drawn and lists provided with names and addresses. This will be done for approval and disapproval sentiments.)

APPROVAL:

This question is not in the survey proper. These results have been arrived at by the comments (if any) in the survey.

Approval

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	37	10.7	10.7	10.7
	no	240	69.6	69.6	80.3
	unknown/unclear	68	19.7	19.7	100.0
	Total	345	100.0	100.0	

The modal (average) category is clearly disapproval. If we assume that this sample is a random sample then we can conclude that, at present, the clear disapproval rate lies between 64.4% and 74.4%. This is confirmed by the exact 95% confidence interval below. It is clear that the results are not by chance. A result due to chance would include 50% in the interval and this is clearly not the case. There are no further significant statistical relationships between approval/disapproval and knowledge or willingness to participate.

Single proportion

Total = 345, response = 240
Proportion = 0.695652

Exact (Clopper-Pearson) 95% confidence interval = 0.644117 to 0.743791

Using null hypothesis that the population proportion equals 0.5
Binomial one sided P < 0.0001
Binomial two sided P < 0.0001

APPROVAL

They did not discuss the plant good enough but they should still be going through with it.

I think the proposed development is a good idea so long as the company takes the necessary precautions to ensure the cuttlefish breeding program continues.

We need to really think about the desalination plant as we are now on water shortage. This would also help with unemployment. I am afraid you can't stop progress.

I was a teenager during WW2 and saw the massive destruction to our town (Bristol) but also saw the huge efforts to rebuild in a short time. Coming to Whyalla in 1967 I have always has the impression that Australia was 40 years behind the times of the progressive world. The proposals you are making, should they be carried out, are not only definitely needed in this area but will show the other states we are at least making an effort to go forth and prosper.

I do believe in progress and development - this will benefit the community greatly.

The desalination plant should provide water to the Upper Spencer Gulf.

I would like to see all the developments go ahead. It is important for Whyalla's development, future and jobs. I am sure that all these developments can go ahead in an environmentally sensitive way.

Very few people were interested in Pt Lowly when there was a dirt road. No one cared about cuttlefish until someone started harvesting them by the tonne. They have been around the steelworks ever since they were built. A jetty will give them another home. Don't waste time - get on with this project and help our kids have a future.

Please go ahead - it will be good for Whyalla.

This development is clearly needed and the Santos plans should go ahead at the existing site. But surely there must be a site south of Whyalla for a minerals port.

Get that thing built or are we still a one horse town.

I would like to see some of the proposals to establish potential employment opportunities.

Whyalla needs to move forward. We can't sit on issues because a few people disagree. If we don't go ahead with this proposal then Whyalla will not go forward. Just because a few "greenies" don't want this proposal doesn't mean we should all suffer. Council needs to be firm and not gutless. Council is there for the betterment of our town. WE need to get it together and stop being the laughing stock of the Gulf. We need to grow and if it means a few get their noses out of joint then so be it!

While I don't wish to see any environmental impact from development at the area I strongly feel that that the industrial initiatives should go ahead. It's easy right now to sit back and say we don't need this while the economy in the area seems fine. The state of this area has never been more promising than now. If we don't take advantage of these opportunities while they exist we may regret it far into the future. Without industry Whyalla would not be here in the first place and these people would not be here making negative comments.

Build Point Lowly! This is good use of a featureless boring landscape. The shack owners are not going to lose access to their areas. Mines and farmers will be able to access cheaper fuel due to processing of diesel fuel in the area. A desalination plant is desperately needed to endure water supplies in the future not just the minor water saving measures that will be minimal in impact as the state expands and temperatures rise. Also it would be good to see more community members being engaged rather than the usual bunch - Jim Pollock, Eddie Hughes, Stuart Payne, Phil Cameron and Steven Arndt.

I have been in business in Whyalla for 48 years and have a shack at Port Douglas for 44 years. I am in favour of the proposed development at Point Lowly. My shack was only 500 metres from the water pipeline dredging at Pt Douglas and we had a dirty sea for a few months but then it settled and has become pristine ever since.

As an import from WA I have noticed that if it were not for OneSteel Whyalla would become a ghost town. It seems that all the locals are keen to rile them for the highly paid jobs and benefits. Most of the residents of Point Lowly do so only because they "squatted" there and got their half-million dollar shacks for a peppercorn. Sure, make them abide by stringent standards but the town and businesses need OneSteel to survive.

I do hope that the desalination plant will supply all Whyalla people with good and enough water for our non-restricted use. It is a good project and I hope it gets off the ground and becomes real.

I think the development should go ahead because it would be great for Whyalla and it would create more jobs and it is good for the future.

Let progress go ahead. Stop wasting rates. Let the experts get on with it. Council does not know what it is doing.

We believe that there is plenty of opportunity to satisfy the needs of the community re recreation and the needs of the future employment of our young folk. It is important to reflect on how Santos and current aquaculture has benefited the area rather than hinder it. There is no evidence to suggest that the cuttlefish have been affected since Santos has been there. Many fishermen suggest that the fishing has improved. I do not believe that the local member should be voicing the opinion of the "noisy" without all the facts and community opinion.

Proceed with development but respect the environment and cuttlefish.

Too many people left our town when the shipyards closed. We need all the work which comes to the town.

I support the development at Point Lowly. I see no reasons why this development should go ahead. Admittedly there may be some effect. I do not believe it will affect the cuttlefish. Let it proceed.

I am in full support of the proposed development at Point Lowly. The desalination plant is a must for the region. This should not cause any problems as it will use the Santos jetty to deliver the product. The new jetty will not affect the cuttlefish in any way. I have lived in Whyalla for 66 years and I can tell you that the cuttlefish have thrived under the jetty. As for the copper concentrates I cannot comment as I have no knowledge of what harm this could do.

Providing the developments meet the EIS guidelines and road trains are diverted around the city and do not travel on Playford Avenue I support this.

Before I came to Whyalla in 1969 I was told that it was an industrial town with plenty of work, I was very happy since we had 5 children. But many of my family have moved out because of idiots trying to stop more factories coming to Whyalla. It's time that those people who are against development realise that it is an industrial town and we need work before more people leave.

I believe that these developments are in the interests of the community and are a step forward for everyone-commonly called progress. Point Lowly is the only logical place for a deep water outlet and would be cheaper to construct than elsewhere.

The development of an existing industrialised location is on balance a very goof project. That cements Whyalla as very important transition point for future exports and wealth that this country needs. As the delivery of raw materials to the rest of the world it will become a primary income producer and will grow in a positive manner as have others. I am in full support.

I would like to see development on the Point Lowly peninsula as it would mean future for Whyalla and the young people of the town. Much has been said regarding the cuttlefish. However I feel sure that will be protected by the EPA etc.

I support the development and provision of local jobs for my kids. Simple fact - we have to have water. If they can produce it with minimal damage to the environment the all is well.

Go for it. Let the companies free. The country has spent money helping fish farms that have not generated money. The cuttlefish will survive as they are above the OneSteel wall.

I am in full support of the project. If people decide to locate to an industrial town then they should be fully aware of the pros and cons. Whyalla's public sentiments seem so negative but advancement is needed to maintain and keep our children employed.

Perhaps a door knock of the community needs to be taken to gain actual data in relation to how many residents have actually been to Point Lowly. In 31 years I have never fished there myself and have taken my children twice and stayed at the cottages. I work at the

Santos jetty and so my interest is in the development which will enable me to secure employment for my retirement. Our state can prosper from this.

I'm happy for there to be industry so as it doesn't muck up the gulf and gets decent infrastructure.

Point Lowly is already an industrial area. Santos and OneSteel have operated for decades with cuttlefish thriving in recent years. SA and Whyalla must continue with these developments in an environmentally sustainable manner for future prosperity. Few people enjoy the Lowly beach which can still be enjoyed with industry as it is now.

DISAPPROVAL

Any further development at Point Lowly will mean a loss of the general environment of this lovely area. I have lived in Whyalla for over 35 years and hope this region will not be lost in exchange for the mining industry and other companies gains. I have heard this deal has all but been given the green light but time will tell if this survey is all a useless exercise and in the great scheme of things our input doesn't really count. We only have to look at the 2-way street debacle in town – 99% of the Whyalla Community didn't want this to happen but Council went ahead anyway – enough said.

Don't want to see any further industrial development of Point Lowly Peninsula I believe that the area should be for recreation and tourism. The Peninsula should be promoted as such. The area is already well known to a number of overseas visitors who come to see the Cuttlefish. Visitors that I have taken to the area have always commented on how beautiful it is. My response is "No more industrial development".

Do not want to see further industrial development of Port Lowly Peninsula. I believe it should be for recreation and tourism and should be promoted as such. The area is already well known to overseas visitors who come to see the Cuttlefish. Visitors I have taken to the area comment on how beautiful it is. So I say again No more Industrial development.

What's wrong with the place John Scott put in the Whyalla News. Why do we have to develop Point Lowly? Has Council looked into any other location i.e. John Scott Proposal, if not why?

I have to agree with the local resident, Mark Green over his letter to the editor, Sept. 4th page 5. Mr Green raised several key points to which I have similar views. The most notable, Mr. Green's point about resources not going anywhere and no decision should be rushed. I am a young adult born and raised in Whyalla. The impact that the proposed developments (should they be carried out) will result in further degradation of the coast. I am certain that should these plans be carried out my grandchildren will not appreciate a rushed decision.

I work at OneSteel and get covered in red sh... everyday. I go to Point Lowly to get away from Iron Ore dust and now it is proposed to ship Iron Ore out from Point Lowly. Where can we go for recreation purposes if we no longer have Point Lowly and False Bay and Black Point? This is one of the best things that are good about living in Whyalla.

The way we promote Whyalla is through the visual aspects of Point Lowly and our Cuttlefish. We use this promotion not only for tourism but to encourage people to move here, to show people there is ore to Whyalla than just an industrial dirty city. The add semi movements through Whyalla is detrimental to the proposed industrialisation of Point Lowly. I would encourage the council to look at the feasibility of using a site south of Whyalla to try to keep our cit as clean as possible. I would like to have the opportunity to have more discussions on this project proposal.

Leave the area as is. No further development.

I want clean and safe beach/areas for all marine creatures and for all people to enjoy what we have now.

No industry at Point Lowly.

The way I remember Point Lowly has that it had a beautiful sunset where the sun had hit the sea and the bright beautiful colours shot across the sky. I remember diving, swimming, snorkelling and having BBQ's. If the desalination plant is built Point Lowly will be ruined and the Cuttlefish will slowly die off.

Leave it how it is.

I don't agree with it.

No, No and No. This should not happen at all – go elsewhere. I might be one person of many saying no you do this to use where are we to go to enjoy the wild life, family outings and many more I disapprove of this and help to help destroy as much.

I think it is wrong to industrialise Point Lowly.

Why can't you build the desalination plant somewhere else away from our Cuttlefish? Point Lowly will be all muddy and no one will go there for picnics or camping. This means no fun times or family get togethers any more. Let's keep our fun times alive.

I think it's a bad idea to build a desalination plant at Point Lowly. It is a lovely place and I don't want it destroyed. I have fond memories and would like to build upon them in the future.

I am a student at Whyalla High School and I don't think you should put a desalination plant at Point Lowly because Point Lowly is a wonderful place to be with your family. It's got lots of great Cuttlefish. You should put the desalination plant somewhere else. If you put it at Point Lowly the Cuttlefish are going to die.

No to the development. Don't ruin everything.

Some people think Point Lowly is fine the way it is. I hope the Cuttlefish don't die from the desalination plant by products, if the desalination plant ends up going to Point Lowly and all the Cuttlefish do die Point Lowly will become an horrible and unfriendly place. We would like to create more good memories. Don't make our Point Lowly an unsightly place.

I spend a lot of recreational time at Point Lowly and Black Point and am concerned these areas will no longer be available for fishing and water sports. I am also concerned the large increase of trucks coming through Whyalla. I have heard about another area south of Whyalla which seem more feasible.

Please keep the land as natural as possible. I like to go fishing and camping.

Want to keep Point Lowly as natural as possible. Let nature take its course. But I voted for council to keep the environment good for future generations.

Point Lowly is a fantastic place. It is a place full of amazing memories. If the desalination plant gets built in Point Lowly the beach will no longer be a beautiful and fun and relaxing place to be. It will be a polluted, cold and an unsightly place. If we really need t a desalination plant I think it we should put it in a place that isn't so valuable and precious. Our amazing Cuttlefish are unique don't let them die and become extinct.

I don't at all like the idea of more industrial development at Point Lowly. It's a great weekend place people can just say "let's go to Point Lowly" and 20 minutes later you can spend the rest of the day at a beautiful beach. But at more expense, "What about the Cuttlefish" that choose Point Lowly as their breeding ground and bring in hundreds of tourists every year. And all the fish and dolphins that live in that area. Yes we may need fresh water but can't desalination plant to somewhere more deserted. It's too much of a sacrifice at Point Lowly.

Don't want it to go ahead.

The thought of putting a desalination plant in Point Lowly and killing the fish and environment makes me shudder. Clean water would be great but I would miss travelling to Point Lowly to just run around and have a BBQ. I would hate to think that the council would want to take away the beauty and the good times. If we wanted to develop Point Lowly in any way I would vote to keep it the way it is and I hope that in the future I could still be going there for BBQ's and a look at the sea life.

I believe that Point Lowly is a bad choice for a desalination plant. The area has given back to industry with the Santos fractionation plant and shipping terminal. Please don't put more strain on this beautiful natural wonder. The wonder is of course the Cuttlefish breeding grounds. One of the only places in the world that this happens. I am open to both sides and believe that a desalination plant should be built, but in a place with better water flow so it doesn't decimate our beautiful sea life. I believe that the desalination plant will kill all of the beautiful sea life.

I love Point Lowly, I love going to the cottages and meeting up with family and friends over a BBQ. I have fond memories of swimming in the ocean and snorkelling for fun. If the desalination plant is built then I won't be able to do that. Point Lowly is a nice friendly and peaceful place to go to get away. So please don't build a desalination plant there. Build it somewhere else because I don't want to loose the sea life I love so much or the beautiful place that I have so many memories of.

I would love Point Lowly to stay how it is. It is fine how it is and if you make a desalination plant, it will change the coastal life cycle. The Cuttlefish might leave because of the high salt level. It may cause less fish and swimmers the beach. Global warming will grow as well as the temperature. The higher the temperature will lower tourism and will affect the wildlife. Increasing the number of snakes and lizards. So please don't make the desalination plant or you will destroy the balance.

Don't build a desalination plant in Point Lowly. Why not build it somewhere else. I like Point Lowly the way it is so don't change anything about it. People like going snorkelling and looking at the Cuttlefish but if there is a plant built there won't be any Cuttlefish at all. I went there when I was little and if there is a plant built, it won't be the same now. Keep our Cuttlefish alive and build the desalination plant somewhere else. Save Point Lowly beach.

The proposed developments for Point Lowly Peninsula are ludicrous considering the sensitivity of the area especially with the world's largest and only breeding aggregation of Cuttlefish. Not much fore thought went into the planning side of things by the State Government or BHP Billiton.

It's going to be boring as Point Lowly is where you go for fun and swimming. I've been camping there with both the school and family. Just leave Point Lowly how it is. Thank you.

I think it is bulls...t they should leave it like it is. We have too much development at the moment. Finish what you are doing first.

I do not believe all alternative sites have been investigated fully – cheaper options for development. Proponent does not mean it's in the best interests of community and the environment – lets fact it they have one objective – make money at all costs. The knowledge we have now about environmental issues as a result of industry should surely be put into perspective considering the Pellet plant history – shouldn't we be environmentally smarter. Who is going to be responsible for the mess left when these proponents have got what they achieved – financial target. As a Community we should stand together – not be railroaded and ignored by the State Government.

The desalination plant plan is not so good because it would affect the habitat of Cuttlefish. I have heard about the development proposal from my dad and Southern Cross News. Yes, I would like to participate and improve future of Point Lowly.

I don't think a desalination plant at Point Lowly is a good idea. It will destroy Lowly's natural beauty. The Cuttlefish won't have a good environment and will soon be gone. Lots of people go to Lowly for fun and to see the Cuttlefish.

I think that Lowly should stay the ay it is especially for the Cuttlefish.

It will effect the environment and the Cuttlefish. Too much water is getting pumped out of the Gulf everyday.

Please save our Cuttlefish. This is a natural occurrence and only a few places in the world that has this. Do you want to save our tourism or not.

Point Lowly used to be a great place where people could swim without cutting themselves on old rusty rubbish that's in the sea. The old Point Lowly was great and beautiful everywhere so let's try to get it back to the old way which is not killing the Cuttlefish or any other sea life. Clean up the beach and there's lots more people can do if you want to help I just want to go to Lowly like in the old days. A nice swim and BBQ to finish off the day. Help get it back the way it was.

I do not want Point Lowly to be developed any more then it is. Sure we need a desalination plant but it's too much of a risk for our Cuttlefish. Point Lowly is the Cuttlefish breeding ground; we don't want to destroy it. I'm not saying no to a desalination plant and fresh water, it's just that it shouldn't be in Point Lowly.

I don't want the government to put a desalination plant on Point Lowly. I remember the last time I was at Point Lowly I used to skip rocks over the deep blue sea. But soon that will all start to change. I believe we need a desalination plant due to the disappearance of water at the River Murray but not at Point Lowly. There are many different locations across Australia where the Desalination plant will go. I like Lowly the way it is and wish it to stay that way for years to come.

If you put a desalination plant at Point Lowly you will be killing something everyone loves.

If we allow the desalination plant to be built we have to give up our great sea life that includes our Cuttlefish. Each year the desalination plant will pump two million tonnes of salt back into the sea.

Point Lowly should stay the same. Even if we save the Cuttlefish it will make people loose jobs up in the Mining areas. The Government could change their minds and put the desalination plant somewhere else like Port Lincoln. If the government won't change their minds our coastal environment will die from the desalination plant. Without the mines up north we won't have power and water to run our homes.

I believe that Point Lowly should stay the way it is. It is a good place for family and people to camp there and a good place to fish on the Jetty and on a boat and they should not build or develop. Sure we need fresh water but what about our Snapper and fish.

It would affect Whyalla as a tourist destination. Could see a drop in Cuttlefish population. Salt content could affect the Cuttlefish eggs.

I fully support Eddie Hughes motion tabled on 21/7/08. Whilst I am fully supportive of new Industries being based in and around Whyalla, adequate research needs to be conducted in regard to the potential negative impact that this development would have on the environment of the region.

I am strongly opposed to the proposed industrial development at Pt Lowly – including the Desalination plant and especially fuel storage, diesel refineries and an ore jetty which may ship out copper concentrate, which is deadly to the marine environment. I support a process which involves Council being pro-active in looking for an alternative site and which keeps the community well informed through a variety of media and forums. The Council must be a strong voice for its community in the face of government and industry pressure. I am appalled that the Government seems to be sanctioning proposals that may threaten our unique cuttlefish aggregation and the long term eco-tourism industry at Pt Lowly. We must put a price on the potential loss and damage to the community and the environment and hold the government and industry accountable.

Please look at other sides as well.

It will affect the water creatures.

It isn't very good for the Cuttlefish in fact it is dangerous for the Cuttlefish. The reason why it's dangerous for the Cuttlefish is because all the desalination is going into the water.

It will affect the environment and the Cuttlefish. It will most probably end up stopping tourists coming to Whyalla.

I think it's a bad idea because the plan could affect the Cuttlefish or other animals in the ocean. The Council should move the plan to another location. If the Council build the plant, the effects on the Cuttlefish is bad.

I feel that people should take charge and help get rid of the desalination plant. Not only all of the fish and Cuttlefish going to be killed but also are some peoples' memories. A lot of people are not going to be able to make more memories.

I don't think the plant should be put at Lowly because the Cuttlefish are such a big attraction in SA. Especially in Whyalla. The salt content could affect the Cuttlefish and have an adverse effect on the Cuttlefish population. We are responsible for the well being of our planet.

Done Deal! The Whyalla Council's endeavour to influence the outcome of the SA Govt. and its attitude regarding anything that interferes with progress has already being illustrated with the Adelaide Council saga. The government is akin to a runaway express train called the Mining Boom! And any environmental aspiration the Whyalla population may uphold to influence the course of the express train would be akin to the mayor standing in the centre of the railway track and trying to halt this runaway express with a lollipop halt sign. I have lived in Whyalla for 38 years, raised a family, all of whom remember Pt. Lowly sadly it can now only be a memory.

As a child I know what its like to have fun swimming watching Cuttlefish and fish swimming around. Sure it great to have fresh water but what about the fresh fish or even Cuttlefish. When I grow up and have children of my own I would like to take them out to Pt Lowly to watch the Cuttlefish swim and fish play. If they put a desalination plant out there some of our memories might fade.
I love Lowly it my favourite BBQ and Birthdays there.

I think Pt Lowly should be left alone and not developed with a desalination plant. Sure we may need fresh water for industry and human consumption and all but Pt Lowly is already accommodating SANTOS fractionation plant and shipping terminal. If anything else is built it will wreck the landscape. The desalination plant will pump too much salt back into the ocean and kill our Cuttlefish and marine life. We are lucky that the Cuttlefish choose Pt Lowly as their breeding area. I don't want it changed in any way at all as it holds many memories for me.

The survey is a complete farce, you know, and we all know that the Council and State Government want this stage to go ahead as it will. This survey is only to make the Council look as if they seem to be doing something about it. There is no yes do you want industrialisation at Port Lowly or no you don't. The wheels are in motion now as there are surveyors out there already. Council know it I know it and most of Whyalla don't care to know about it, it its going to happen anyway. I only hope that you will all be held responsible when the gulf gets stuffed up.

I am dead set against industry at Pt Lowly. Not that I am against industry but keep it in Whyalla and not at Pt Lowly. The two bob mining companies will only be around for a short time. They don't care about stuffing up Lowly, they only care about the dollar. I believe the State Govt. is treating Lowly as a mining dump. They wouldn't put this at Glenelg. The Govt. and the Council should sign a declaration to be held responsible for ruining Pt. Lowly. There is more money coming into Whyalla through the tourists that come and stay at Pt Lowly. The desalination plant is going to stuff up the gulf and turn this beautiful gulf into a dead sea within eight years.

I believe that they shouldn't put the desalination plant at Pt Lowly it's such a beautiful place to hang out and chill. To even think about putting the plant in such a beautiful environment is wrong. The sea life is amazing and if you put the plant there it will be all gone. The amazing breeding grounds of the Cuttlefish and the beautiful snapper. I love going down to meet up with everybody and having a BBQ. I think they should extend SANTOS but don't interfere with the ocean life.

Stay as is nothing changed.

I think that the desalination plant is a bad idea. It is a bad idea because it is going to kill nearly all sea life at Pt Lowly. It will kill the Cuttlefish. Pt Lowly is the only place in Australia to have a breeding area for the Cuttlefish. I understand that people are building a desalination plant to get more fresh water to drink and I am thankful for that but I would rather see the sea life than see all of them die.

I think people shouldn't put the desalination plant in Pt Lowly because slowly all the Cuttlefish will die. Also it will make Point Lowly a polluted and not a nice relaxing place to be.

Point Lowly shouldn't become a desalination plant. If it does become a desalination plant it will lose a lot of tourists. Ten towns around Pt Lowly will also lose a lot of customers. And lastly the environment will become even more polluted then what it already is.

It will effect the environment and Cuttlefish. It takes a lot of water out of the Gulf.

It will effect the environment and Cuttlefish. Too much water is getting pumped out of the Gulf today. It's going to give more jobs out.

It would affect Whyalla's tourism. The high levels of salt will kill off the Cuttlefish. It would affect the fishing, therefore ending the local Snapper competition.

I am totally against the project at Lowly. Please put it at another location down south. It may be a long jetty but we will not have the trucks through town. I am for desalination but not out there The pool will get bigger as tide goes in and out. I am a fisher person. Please put Jetty down south so we do not have any more buildings out there. If we do it will be wrong. The future will pay for it against us who made these decisions. NO. Do not let government railroad you.

Some people may think Eddie Hughes is a bit of an eccentric but at lease he extensively researches topics so that the knowledge he posses is accurate and unbiased. Not like some people that go off half cocked and are more interested in themselves than the community. We should (the community and Council) preserve the Lowly Peninsula it is the closest used beach, fishing and recreational area to Whyalla and is used by everyone.

Having lived here for 46 yrs. and going out to Lowly with our family (6) away from the town enjoying the peace of the place I feel that this will be lost. It is a special place. Money and development seems to be a priority and are these people listening to use.

I am not surprised that people have not returned these. Questions are about media not Point Lowly which is confusing? Point Lowly has the best beaches, scenery, diving etc. Close to Whyalla. I would describe it as" Whyalla's Lungs" clean fresh air, white sand. Working in tourism I always suggest visitors go to Point Lowly so that they go home with a picture of Whyalla in their mind that is not industry and red dust. When the "boardwalk" was being built for divers it was not able to go past high water mark as it was an "Aboriginal" site. How can they build a multi purpose jetty on that same site? Promote Whyalla as Cuttlefish capital to the world then destroy it.

I took my brother who was on holiday from Scotland to Fitzgerald Bay and along the coast drive He was astounded at such beauty on our backyard. Industry does not last forever so why spoil this magnificent area.

It is unbelievable/inconceivable that company's and governments would allow as many trucks to use the roads as suggested to use the roads to carry ore, gas, fuel together it is possible that the trucks be only 15 minutes apart on the Pt Lowly road at the same time public vehicles between trucks and that is incoming traffic, outgoing the same. I can only hope this does not happen.

Desalination plant - my main concerns are the amount of fish food that is drawn into the intake pipe, this fish food will be lost to the larger fish.

Allowing this development to take place would surely affect Whyalla as a tourist destination, it may also affect the Cuttlefish population and further more it may even affect other sea creatures so I do not feel this will have many positive effects than negative effects.

It will spoil the surroundings which is currently scenic and tranquil. The desalination will ruin the beauty of the place. Worst still, it would affect the environment and kill much of the marine life. Why take the risk.

I don't think a desalination plant is a good idea because it going to affect the Cuttlefish and Point Lowly's marine life. They could put it somewhere else not near any marine life.

Point Lowly is a great place to take my wife and child for family picnics and fun. Keeping Point Lowly as it is should be the focus of all Whyalla residents.

This would destroy the free recreational area's appeal for the Whyalla residents. This area is used by myself my children and grandchildren on a regular basis.

I am OK with development but not at the cost of one of the few remaining places that I can afford to take my children to be free of industry pollution or at the cost of a beautiful area for relaxation.

The industry at Pt Lowly will harm the fish and Cuttlefish which I watch when I visit and ruin the water which my children play in and there won't be much point to going out there any more with so much industry.

I visit Point Lowly regularly to relax and get away from Whyalla with friends. Filling Lowly with Industry you will destroy this opportunity that is used by many of my friends and other Whyalla Residents.

Why should Whyalla be faced with eyesore of desalination plant when no benefit for city. Why destroy a great recreational facility. OK for others outside of Whyalla to make decision for us. Release more land for shacks/houses in area. How much of the Peninsula will be restricted further with buildings and closed areas. Pt Lowly is a lovely recreational area and has been used for years by the people of Whyalla and visitors. We have already lost one area and a great beach to SANTOS this at least has provided ongoing jobs for locals. Will ongoing jobs be in significant numbers? Numbers result form proposals at present – this is not so.

I am against any industrial development in the Upper Spencer Gulf area.

I don't have more than a general idea about what is planned BUT that is more than enough. Whyalla is not an anaesthetically pretty place, its industrial. But just up the road is a wonderful resource – its quite beautiful and refreshes the soul. Other people will have greater scientific and environmental knowledge than I have but why are we even thinking about destroying our greatest scenic asset. The bloody great sheds on the left as you go in are already an eyesore. Whyalla city is industrial retain the remaining beauty of the Lowly area – people need to see more than $ signs.

As a shack owner at Point Lowly we attended the information sessions and were given blurred information and answers and filled out the feedback sheet asking for further information and received nothing, left meeting very disappointed. Having travelled overseas recently we have come to realise people here don't realise what people have at the doorstep and it should not be ruined by industrial development. The Cuttlefish should be preserved for all to see and not try and fix any disasters in 20 yrs. If we do get the desalination plant there the water should definitely be drinkable not just their benefit it needs to be ours TOO!

I do not wish to see any of the proposed prospects or any further industrial development at Lowly. The government should be putting pressure on BHP to allow an iron ore loading terminal to be placed alongside the current one. If anyone of the project is given the go ahead we will have an open slather situation and no matter how many people protest they will be ignored. These Companies cannot guarantee their prospects are safe. It is highly likely that we would lose our Cuttlefish and tourism. Lowly is the only beautiful are that Whyalla resident can visit. Who would wish to take their visitors to that area to walk or sit surrounded by sheds, tanks and the like along with the noise of trains and trucks rumbling along 24/7?

I don't think it should be out there and my son thinks it shouldn't be there either as he comes home all black and red from OneSteel.

I believe that Lowly is a lovely family place. Industrialising this area is WRONG leave the area to the Families and Cuttlefish.

We have been here for 40years, many years ago we lost a really good family beach at Weeroona Bay and we feel for the potential risk for an accidental spillage will ruin the rest of this beautiful area. Also we feel Whyalla and it community will be no better off with these facilities in either monetary return or labour return.

Point Lowly a sit is now is a great asset to Whyalla. We believe adding more industry would be wrong. What would happen to the cuttlefish and the shack owners who have made this beautiful area their own? Industry is good for Whyalla surely there is another area that can be developed. The easy option is not always the best option!!

Please leave our only beauty spot as it is. We need Point Lowly to stay clean and beautiful as it is our one escape from the industry of Whyalla.

Please don't kill off our cuttlefish for a desalination plant.

Leave Point Lowly and Fitzgerald Bay alone.

I hope Council will support those who are trying to find an alternate location for a deep water port and facilities; I think that it the best way to go. Point Lowly is too sensitive. Like them I am not against development but not at any cost. Please help to get it down the coast a bit.

Fear that the proposed industrial changes and then subsequent extensions in the future will do irreversible damage to the ecology of the area.

I totally oppose the construction of a desalination plant or any other industrial development at Lowly. The Spencer Gulf will become a dead sea, which to me seems pretty obvious. The explosion of mining licences relies entirely on a fresh water supply but if it cannot be supplied from the West coast of the Eyre Peninsula then we should just leave the minerals in the ground. I personally couldn't care less about the greed driven mining boom. It is about the people of South Australia just an opportunity for a few cronies to pat themselves on the back.

Hands Off!!! Point Lowly. Leave it for the next generation to enjoy! Against development.

We are concerned about the Cuttlefish. They are a world class phenomenon. Recreational of social amenity and public access to beaches. Also pollution emissions. Mistakes made in the past, we do not want it to happen in the future. We want Point Lowly to be left as it is. We take visitors out there to show them how beautiful it is.

This so called "survey" is pointless. It reveals absolutely nothing about what we the community want to happen at Point Lowly. What we need is for the government to subsidise a major port facility south of Whyalla to service all the mining companies involved. The govt. stands to make a lot of money from royalties and taxation etc. To develop an area south of Whyalla satisfies all parties and particularly the Whyalla community who do not want their precious recreational area sacrificed to big business who are only interested in making money and not the welfare of the community and environment.

Build desalination plant at Port Stanvac. Leave River Murray for irrigators and northern are water supply. Keep Whyalla for Iron Ore dismemberment and leave Point Lowly for aquaculture and recreation.

Whyalla residents are well provided with recreational facilities within the city limits. However, outside the city limits there are very few opportunities to visit natural recreation sites. Point Lowly is one of the few spots to visit ourselves or take visitors. The formerly pristine area has already been encroached by SANTOS. The proposed developments together with the take over of land by the Australian Army puts this area further in jeopardy.

Point Lowly is the only natural beauty area we have, the area has been spoiled enough with SANTOS being there. Having had the pleasure of taking my children there and also grandchildren. I pray that the beauty of the area is left for my great grandchildren to enjoy.

We all must protect what is left of our precious Spencer Gulf. We lose the jewel of the Iron Triangle to the greed of these industries, the population and our beautiful coastline will end up like the River Murray which hungers for water. Whyalla will cop the lot. We are known for the red and black dust, destruction of aquaculture, talk about desalination in the Gulf (it's not on). The beautiful scenes by air of Lowly and the lighthouse, the coastline to ruin all this to Mining is ludicrous. All Mineral exports should go straight to Darwin via rail. Desalination to open coastline. Aquaculture shipped off to Mauritius. Heritage list our Gulf and lighthouse for future generations to. Enjoy. RIP.

Don't sell Whyalla's beautiful escape down the drain for a quick buck. Please let's learn from previous mistakes. When the mining boom is over, what then? But if this area is further promoted and a little bit of work, this area could be further enhanced and would be further utilized by the already vast amount of tourists that visit the area. Tourism is what will keep this town going through boom and bust periods. The council needs to think of this and be remembered for saving the area, not for being responsible to give the go ahead to destroy it forever.

There are already more than enough developments at Lowly. In Whyalla we have very few nice places to go with our families that are in close proximity to the town. The Cuttlefish breeding grounds are unique in the world and should not be jeopardised. Those of us who remember Point Lowly and Fitzgerald Bay prior to SANTOS and Aquaculture being introduced already know how much we have lost. Please don't let the almighty dollar rule this decision! Let the involved developments find other sites to set up their business.

I would like to see these projects being located elsewhere. I'm quite sure that a solution will be found as long as we are all willing to work together and compromise but not at the expense of the environment. I also feel that a desalination plant will do more damage than good and feel that we could look to Salisbury Council on the saving and storing of water.

This is ridiculous....If the Whyalla Council really wanted its peoples' opinion on the development at Lowly why don't they go about it properly with a local vote on it. But NO, what the Council wants the Council will get if the town wants it or not. With all the coastline around here why does this have to be around the one good thing Whyalla has? YOU SHOULD BE ASHAMED OF YOURSELVES.

I do think this area should be left as it is. Not made ugly with industries.

Please leave our coastline alone. Point Lowly is valuable to us. It belongs to the people. Remember we voted you in we have a no confidence vote in the council. You are gutless.

As a shack owner I am quite concerned about development to the area, concerning Cuttlefish recreational areas, tourism, restriction to fishing areas along the coastline and destruction of the environment. The majority of industrial development should be within the OneSteel area where there are already existing amenities and room for expansion. My main concern is the building of a Jetty; this should be built at OneSteel where there is an existing rail service.

We do not want to see any development at Point Lowly. The traffic will be a problem for the city. Also too much pollution will be caused.

My husband and I do not want the Gulf spoilt by all the minerals etc. Also the Gulf is for Cuttlefish once gone they are gone forever. Point Lowly is the one place people can go to enjoy a picnic. Whyalla has enough problems with Cancer now.

The Point Lowly area is used by so many different groups and individuals for a wide variety of uses. Council and the general community have been happy to claim the Cuttlefish aggregation as their own, now they have to stand up for this amazing creature. I have seen first hand the delight of divers who view this event. Developers drag out the old chestnut "there will be no spills". They treat us like idiots, the current unidentified leak at SANTOS "is causing no problem' is a perfect example. It certainly isn't doing the area any good. No more Industry at Point Lowly.

As an employee of SANTOS and a regular visitor to the Point Lowly area and beach I have concerns over any further development in this area. SANTOS has very high standards in regards to the environment with protecting it and maintaining its natural state. "But accidents do happen". With greater activity in the Point Lowly there is greater chance of environmental damage occurring. I'm all for development and progress but the right area must be found.

In regards to all planned development at Lowly Peninsula – these developments must not endanger the Cuttlefish breeding grounds which provide a potentially massive, ongoing and internationally significant tourism resource to the Eyre Peninsula (Cuttlefish area is important economically to all potential tourist economies of the region and possible costs to this extended tourism economy need to be clearly valued to assess the benefits or harm. Point Lowly developments may have. It would appear on cursory viewing that the total sum of planned development does not provide enough economic employment and long term benefit to outweigh the risk to the cuttlefish tourism economy potential

Leave Point Lowly as it is. People with shacks don't need these industries to be out there. They want a clean environment to take their kids to. Also fisher people like to fish from the rocks out there. Yes build the Marina and do something constructive for a change and "don't half do it" and some brainwave thinks you should do something different. I am totally for leaving it as it is. For a desalination plant, bloody wrong place.

I feel very strongly that the Point Lowly Peninsula should be retained as it is. Even the desalination plant will cause long term problems for the Cuttlefish eventually due to the extra salt in the seawater which will cause eggs being unfertilised. Tropical fish have the same problem even in aquariums (such as Discus fish) due to water hardness. Please leave this beautiful area as it is for future generations to enjoy because let's fact it – in my lifetime I no longer have access to the SANTOS jetty area which was a prolific provider of Whiting, and Fitzgerald Bay fish arms area is taboo as well. Enough! No more! Cuttlefish bring in thousands of tourists, do you really want it to stop.

Having been a professional master mariner, the recent proposal of the 3km jetty into 24m water well South of Whyalla would seem the logical way to go. Lowly Peninsula would be spared the noise, dust, railway etc. involved with the present proposal. Whyalla town itself would presumably be relieved of most of the extra traffic on our major roads. Perhaps the State Government might actually do something for Whyalla.

Whyalla already has limited leisure areas that are easily accessible – these were large but have already been reduced by SANTOS and the Army. Any further reduction is not acceptable. Provided leisure areas are retained then I am not against progress. The position of the second jetty does cause concern as there is already a jetty in the area. There are also suitable areas in Whyalla but OneSteel refuse to allow them to be used is a pity.

The only further development at the Point Lowly Peninsula for consideration would be the Diesel fuel proposal mainly because of the SANTOS plant and jetty able to accommodate its installation. Because of the environmental concerns plus the size of the proposes diesel plant and bulk commodities for ore shipments, these projects should be built lower down the Gulf, in fact the diesel plant should be built near Ceduna so that it could assist the water needs of future mining ventures. The state and federal government if they are serious about Australia's water shortage must make a huge contribution to the plant.

The only project that should not be allowed at the Point Lowly Peninsula is the desalination plant with its residue going into Spencer Gulf. It would be better to have it built at Ceduna or somewhere on the west cost of Eyre Peninsula.

My concerns simply are: waste if any and how it is removed. Cuttlefish and the eco system as a whole. Access for the public in areas they proposed not any corporation.

I find it hard to contemplate that the Whyalla Council would even consider the idea of having trucks travelling through the town again after the problems created y project magnet. It is a safety hazard. Dirty red stains on the road. Damage to roads, all to create 10 jobs it's not worth it. We could get that many jobs if we opened a Red Rooster chicken shop. Whyalla should not become the dumping ground for the Eyre Peninsula. I support the desalination plant and solar power plant, but not the iron ore jetty.

I support industry but not for us to lose the recreational area. Also to keep the environment safe for the Cuttlefish. I agree with what Eddie Hughes and Lyn Breuer say.

General public cannot possibly have "very good detailed knowledge" of proposal as mining sector has not released exact location or what intentions they have for future exports. Marine Biologists have indicated the desalination plant should not be in the Gulf as there is high potential for micro organisms, fish egg loss. As a property owner in the area with an appreciation of the area that spans some 30 yrs very disappointed that there is no consideration to industrialise, this would have a detrimental effect on the natural beauty and amenities for Whyalla. The increase in Fish Farms has obviously affected sea grass with notable increase in Sand/Barren areas around Peninsula. All endeavours should be made to locate both desalination and seep sea port to more suitable locations which are available! Council should actively advise the public of the negative impact of industrialization.

I essentially agree with the motion from Eddie Hughes. Apart from desalination plant which may be the only solution to keeping the necessary water supply in and around Spencer Gulf all other proposals can be carried out away from Point Lowly. OneSteel should be prevailed upon to co-operate with transport expansion. There is plenty of land around Whyalla which can be used for more tanks. Point Lowly is one of Whyalla' major tourist attractions and this industry provides diversification of industry. The majority of Whyalla's families would agree that Point Lowly is the major natural attraction and would have many fond memories of the area and would hate it to be changed by pollution (air, noise and scenic).

Intimate knowledge but think it would be very bad for people in the community and for the environment. Mainly from Newspaper and from action group website and general discussions. Already part of an action group "Cuttlefish Coast Coalition". There are alternatives to using land on the Point Lowly Peninsula. Please consider them.

I am alarmed at the prospect of more trucks passing through Whyalla. Just when OneSteel get their act together it looks like the people of Whyalla are going to be "in the RED again". I cringe when I think of our lovely Point Lowly are being spoilt – all in the pursuit of the mighty dollar. We have to be aware of the dangers to the marine environment i.e. fish farms and desalination not just the obvious degradation of the beaches etc.

At this stage I do not support development of Point Lowly there are still too many unanswered questions. Effect on the environment. Loss of areas available to the public. Noise, light, safety (increase in large traffic both through our city and on roads into and out of our city) how many truck movements per day. I believe other areas are available. How many jobs will be created? Have other areas been looked at by proposed developers. The government is there to represent the people so the land at Lowly belongs to the people.

It seems very sad that one of the few beauty spot could be ruined forever. Hopefully the industry section can be positioned to allow for continual use of the recreational sector. SANTOS stole the best beach in our area and any further industrial development will only add to the recreational demise.

Don't change Point Lowly.

Point Lowly and its surrounds are a tourist attraction. With so little effort being placed on Whyalla as a tourist attraction the Council need to consider this future potential. Any and all industrial facilities will prove detrimental to the marine environment in the area, which is unique. There are other areas where any port facility would be more favourable and be less of an impact on the tourist potential of Point Lowly.

To allow any further industry at Point Lowly would be a disaster, once they set a foot in the door – so to speak. The area would gradually be destroyed both by visual and dust pollution etc. You only have to look anywhere in the modern world to see what happens to an area when industry arrives, even thought they will promise you the earth and tell you why their industry will be squeaky clean, pollution will eventually destroy what was once a natural clean area. I would cautiously support a desalination plant after a favourable environment impact study simply because we so desperately need the water. SANTOS may look a clean and tidy plant but think of how the area used to look with family shacks and families really enjoying healthy happy weekends.

I have two main objections to the development of the Point Lowly Peninsula. The first is the obvious loss of a wonderful recreation area for the people of Whyalla and surrounds. Indeed we lost our own family shack (built by my father Basil Pickhaver in the 60's) when the SANTOS area was acquired. The second is the potential loss of the world renowned spawning area for the Giant Cuttlefish. The developers have a choice where to build their requirements, the Cuttlefish do not. It's that simple – profits and big business should not always be the yardstick by which we measure the importance of a project.

Please find an alternative port side. We love going for drives out to Point Lowly. Been doing that for years now and have started to take our grandchildren for drives out there and they love it.

As a long term member of the community and holding an officer position in a local fishing club, I keep abreast of most land/water interface proposals. Have been on BHP e-mail list for updates re: their proposal for 2-3 yrs. Follow all reports I can find on internet re: desalination and other issues. I am retired but very busy person and plan to be travelling a bit in the near future and as such will find it difficult to participate as I would like. However, I say hands off Point Lowly. Deep water ports by their nature attract further developments (who knows what). Put this forward as an argument for further employment at Point Lowly.

This survey is not asking for rate payers opinions it is questioning their bonafides in a most condescending and dismissive way. A proper survey would be asking questions like: do you support the proposed development at Point Lowly, if you do not support the development give reasons why etc. It is not up to Council to decide this issue it is up to the rate payers and it is not up to the SA Government to decide either. I do not support the proposal.

I commend council for its commitment to preserve our very important recreational and fragile ecology at Point Lowly and coast and thank them for listening to what the community is saying. I only hope they are able to stay strong in the fight to stop the destruction and devastation that all the proposals will cause despite the very small amount of real work or financial benefits to the community. I would like to also see a stope to the Army getting its hands on anymore of our land. Totally opposed to development.

What about the ecology, fishing and tourism. What will they do? Cuttlefish are more important than money. They have feelings. Leave something for my grandkids.

Council members are simply not strong enough to stand up to corporate/government proponents. Whilst community consultation may be worthy what will it achieve who will listen to the community and accept the view of the community. If it is clear people want to protect their recreational area and its significant tourism value why would you want to live in this region if Point Lowly is to be stuffed up by industry.

I oppose the multi development of the Point Lowly Peninsula because: the desalination plant will be detrimental to Gulf waters and also I believe it will be developed much larger than advised. I would like this plant moved south of Whyalla where the Gulf is wider and away from the uniqueness of the Cuttlefish. I believe the other proposed jetty, railway line and bulk facilities should be developed south of Whyalla. I believe the Point Lowly area should be for the recreation and use of the people of Whyalla, as we are so isolated the Point Lowly area is a good place to go for a short break. I have lived in Whyalla since 1943 and feel I may be aware of our history and mistakes that have happened before.

If this goes ahead we are moving out of Whyalla and many other are feeling the same way.

I am concerned abut the impact of proposed development on the Point Lowly Peninsula.

We lost our best beach to SANTOS, now we are being railroaded into a decision which will take away the rest of a beautiful point. No stone must be left unturned to find an alternative site for all the proposals and if one not available then the pros and cons of going ahead with the Point Bonython site must be weighed against the ecological losses which will occur.

Kept informed by BHP Billiton of their proposed desalination plant. Have not received any information about other development proposals except from SA Govt. Council ZERO. Last information about Point Lowly by council was an update of the Whyalla Development Park 12/4/1991 and Fitzgerald/False Bay management plan. Export of Iron Ore would ruin the surrounding area – RE: Whyalla before the Pellet plant. Salt brine from the diesel plants could ruin the marine life of the Gulf.

You should not further develop Point Lowly with a desalination plant, because it will ruin its beautiful landscape. I believe you should extend SANTOS a little, but not towards the beach area. Point Lowly is a family place where people create memories and have fun. People won't think its fun if there is a big ugly desalination plant.

Point Lowly is a good/quiet place to go with family and friends. It's a good place to go fishing and the lighthouse if fun to look at. Point lowly isn't such a good place for the desalination plant to develop. I think it should be done elsewhere.

I do not wish to see the Point Lowly developed any further with industry. The Peninsula is a unique ecosystem, which has made a name for itself globally. Visitors, divers speak fondly of Point Lowly and attract the tourist dollar. Why not develop Lowly as a sanctuary and haven, retreat, conference centre, a place for rest and well being centre. Somewhere to go to take time out from our busy lives. Think about alternative uses for this beautiful place on earth.

I dislike the way that people are wanting to destroy Point Lowly. I love Point Lowly beach but I understand that we need water but if we build some where else then we can still have water and Cuttlefish. I love the Lowly beach and I don't want it destroyed. I hope that when people read this that they will decide to move it some where else.

My concern is the effect on the marine life. It would be a tragedy to destroy the breeding grounds of the Cuttlefish which is a wonderful event and so unique and becoming known world wide. There is no doubt that we have to look at desalination due to the shortage of rainfall and increase in population but at the same time care has to be taken to preserve nature.

Reluctantly support refinery and fuel storage. Also desalination plant if proven environmentally safe. However Iron Ore export from Point Lowly is a definite No No.

From the first Point Lowly was a favourite spot. Friends I have taken there have called the view world class. Being an industrial town I think resident realise we need industry. However, that Whyalla should be used as a port should not impact further on the natural beauty and resource of Point Lowly. The lure of the Cuttlefish will attract visitors long after mineral exploiters have gone. I also believe that the west coast and southern ocean are the place for desalination. It's too risky in the Gulf. We need Point Lowly for recreation.

I don't like the idea of using Point Lowly for industrial development. As it is a family beach and it is a very important place in our eco-system as the Cuttlefish go there to breed. I understand that they need to put the desalination plant somewhere but why Point Lowly. Lowly already has enough industry.

I believe that there are very few areas in the immediate surroundings of Whyalla that are as attractive as Point Lowly where you can take the children a day of activities, e.g. beach, look at rock pools, walking, swimming, fishing etc. Despite lots of advertisement to the contrary, Whyalla is really an ugly place with little being done to beautify the place. I am very much in favour of development at Point Lowly but this is in terms of tourism. Why isn't there a much better playground, a restaurant with views on the water/surroundings or a nice tavern (family friendly) to be able to sit down and enjoy. I think to destroy all this for so called employment etc. is a crying shame

The long term preservation of our only beautiful pristine area, a fragile environment is more important than short term industrial site. Other alternative site should be seriously considered and explored.

Point Lowly is a beautiful area. It is a perfect place for a family picnic or a peaceful walk. The cottages are a great place to hold a getaway for a group or club. The sea life is amazing. The area around the lighthouse should be left as it is in its natural beauty. I don't think Point Lowly should be developed at all, I think it should stay exactly as it is.

Point Lowly is a poor choice for a desalination plant. Many have fond memories of the place, and I am no exception. A desalination plant would be a danger to the Cuttlefish breeding grounds and a threat to the eco-system. Do not get me wrong, a desalination plant is necessary; it just needs to be somewhere less threatening to the eco-system. Point Lowly should instead be developed as a tourist destination, harnessing its natural beauty. People camp, fish and enjoy themselves there all the time. A tourist area would be a better choice than desalination plant.

I think it would be a shame to see the natural environment developed especially involving industry. I can see reasons for both sides – pros and cons. We must be very careful regarding the possible environmental damage in the long term.

Disappointed this does not give an opportunity to express agreement/disagreement of Point Lowly area being industrialised at expense of tourism and relaxation.

I believe the fill extent of the proposal for a bulk commodities port has not been realised by Government or the community. The mining companies have expressed a strong desire to be provided with a port run by a third party, funded by others which they could use. Several assurances have been made regarding environmental protection by those with no information expertise or commitment on the matter. A much more professional approach is needed for this opportunity.

Please do not develop this beautiful area. We will lose so much for future generations. Thinking of my grandkids. Surely there must be an alternative – one being OneSteel Jetty.

I feel that any project that BHP Billiton and other industrial companies are involved in they ruin (purely for share holders only). They show no consideration to the general public or the environment. I do not mind progress but not the environments expense. Other avenues need to be explored e.g. Cowleds Landing, Arno Bay etc. Council needs to listen to the public and not the companies that profit from these projects.

The Cuttlefish breeding ground is one of only two in the world. It has been growing in international tourist popularity and world diving site as such this is a beautiful pristine piece of Australia that is too good to risk with industry. The desalination plant I'm OK with if all over burden super salinated water is pumped to the saltworks with none entering the Bay. Whyalla has voted against a refinery numerous times now and I'm still firmly against this. Natural beauty is a rare thing in this world and we should not risk this. We have Whiting, Snapper, salmon, cuttlefish, squid, pristine beaches, why are we risking this.

The Point Lowly Peninsula as a recreational area and with the unique Cuttlefish breeding grounds is too good as a Tourist attraction to just write it off as an industrial zoned area which ultimately would result in open slather for the mining companies to destroy and take away the only nearby beach and area with pristine views from Whyalla, Community and future generations. The Whyalla Council should do everything in its power to prevent such an atrocity especially when there is a viable alternative site for a deep sea port and desalination plant.

I would like to see the Cuttlefish area left open for recreation. A big attraction for visitor from all over the world. I think they have too many fish farms polluting the water. If big companies go in they should bitumenise a road for scenic purposes.

Who determines the outcome community? No Way!! The Government will!! The Council need to do their job protect our beautiful and unique coastline of Point Lowly and the fish etc. that will be affected forever. Just imagine the outcry of city Council if the proposal were to be sited at Glenelg, Semaphore etc. There would be an uprising. Eddie Hughes is the only councillor who seems to be on the ball. He has the interest of Whyalla and its people foremost in his mind. We residents have "Shacks where families relax". What a shame it would be to lose that simple value. Simple and intangible as the Mayor said and yet oh so valuable.

No further development at Point Lowly. Alternative sites given priority.

Why dose it have to be right at that spot where people call their bit of heaven and of course fish around there. When they could move further round – would it make that much difference. Some of these people come into Whyalla and it's not much to look at so they don't care where they put, what, where. We do, it's our home town. I know we have to have upgrades OK!

The whole Point Lowly area should have been protected as a natural and aboriginal heritage park/reserve long ago. Its geology, marine life and aboriginal heritage are far superior than any industrial benefits. It is ignorance of these issues that allowed by industrial developments and it is about time to do something about it.

I am not against industries, but I am strongly against the ore jetty and the mining group. Too many lies are being told! Once a jetty goes in, everyone will want to use it, e.g. copper concentrate, magnesium etc. (all highly deadly to marine and human life). The diesel plant has lied, stating it would produce drinking water once there foot was in the door, it stated it was producing industrial water. Come on Jim, Steward and Company what would you do Jim if they wanted Port Douglas!

Why bother sending this out, when you (the Council) have already made up your minds despite what we (the rate payers) say. You have sold your souls to big business to feather your own nests and profit at our expense (as you have done in the past). So don't insult my intelligence and stop wasting paper sending this crap out.

Whyalla doesn't stand to gain anything out of the mine and BHP except their dirty leftovers. They won't make us prosperous; it will have a negative impact on Whyalla. Point Lowly is well known by tourists now as a beautiful spot but the government keep taking more and more away from us. They don't care about the Cuttlefish or our Snapper and Whiting grounds. Just money which isn't coming our way it will go to Adelaide and other States and America who own 50% of BHP now.

This should not go ahead. I am unimpressed with the proposals that our City Council want the Whyalla residents to accept as development at Point Lowly. This area is the only remaining undamaged coastal area that the Whyalla residents have left to enjoy. I cannot believe that Council is trying to convince people that there will be little impact upon the area. What about the dust from the Iron Ore upon marine life. Our white sands will be red, black, will that increase the heavy metals in the area. I think so?

The only in depth information we have received is from the Whyalla News Letter. Our gravest concern is for the residents of Whyalla. The re-introduction of large ore trucks through Whyalla by road, even for a short period of time would be a dirty disaster for our city. We should learn from previous BHP shipments along Playford Avenue. Dust and noise does irreparable damage to Whyalla's reputation. Dust and noise has a detrimental effect on local resident's health. Playford Avenue. The traffic lanes are too narrow creating dangerous conditions for large vehicles. We will expect our Council to do everything in their power to divert all heavy regular traffic away from Whyalla.

I would be interested to know if Council has any understanding of how far government has researched the issue and is our Council able to match government pace? We in Whyalla have so few places of beauty and attraction, a visit to Point Lowly and the surrounding area is within the timeframe and budge available. It should remain as it is. Once gone – gone forever.

WPR, CM, IM, IMX and BHP's desalination plant could all be based in the same area OneSteel currently occupy. The above companies will only be creating a minimum of employment opportunities. Therefore, a minimum input. For this reason I do not agree with sacrificing such a beautiful environmentally valuable area. I suggest that the land currently occupied by OneSteel could be further developed to allow use by the above companies. Why can't OneSteel allow WPR, CM, IM, IMX and BHP desalination plant share their port and land? Why can't the existing port facilities be greatly expanded to allow use by the companies? Why can't Whyalla have a public port? Why can't the yacht basin be re-opened? I remember it as a deep water channel. Why can't Whyalla have a rail system for all the companies to use within the OneSteel site? I really think OneSteel should develop entrepreneurial skills and absorb the above companies in the OneSteel area.

I have discussed the issue one to one with Eddie Hughes and Jim Pollock. I have attended tow council meetings – 1st one when Eddie Hughes proposal was left on the table and 2nd a follow up meeting. Attended Cuttlefish Coalition and Shack owners meetings. Eddie Hughes prepared to be involved in sensible discussion which promoted reasonable long term outcome. Concerned that Council will take too long to get up to speed and have the guts and determination to stand up to Government and will fold for short term gains at the cost of long term losses. Once gone, it's gone.

I am most concerned with the desalination plant waste being returned into the Gulf. There is not enough tidal movement to disperse this saline water. Surely BHP Billiton can have the plant in Roxby Downs and discharge waste to ponds for salt collection and processing.

We are of the opinion the Point Lowly Peninsula should be left as it is and not be subjected to industrial development which could spoil the area and harm the Cuttlefish

We don't want any development at the Point Lowly Peninsula.

In these days of serious global warming and climate change and their devastating consequences, there is rapidly growing awareness and understanding of the need for urgent and responsible sustainable development, not just for our generation but for future generations. The Point Lowly Peninsula is no exception. Nothing must occur that can in any way damage the breeding processes and preservation of the world renowned Cuttlefish and other marine life. Our community is collectively the guardian of this breeding ground, which undoubtedly overseas visitor would agree. It is important to explore alternative viable sites to the proposed industrial expansion and deep water Port at Point Lowly that have significantly less impact on the marine and land environment. Community minded industrial organisation and all levels of government must absorb additional cost in order to help preserve our precious and irreplaceable environmental assets now and in the future.

Point Lowly should be left as is for the benefit of all Whyalla residents and not for the sole benefit of big companies.

We read articles in Whyalla News and after attending Public meeting at Buff Hall are no actively involved in Community awareness of this Council's need to look at alternative (and by all reports you are) for these things to go ahead but on another site. Please look at the area in regards to tourism and not industrialisation. Protect this for future generations.

Not many jobs for destroying the areas amenities. God knows we have very few places nearby to use for recreation. So why destroy the Point Lowly Peninsula any further. We are not anti-development – far from it, but we do want to see a win win situation and as proposed at the moment the people of Whyalla are definitely on the losing side.

It's too late for desalination plants anywhere. Why does everything in nature have to be destroyed for the sake of development? With the extra salt in the sea from the desalination plant and filtration of the sea water to run it anyone with an inch of nouse will realise that the environment cannot sustain these changes, let alone the flora, fauna and the sea creatures. Protect the Cuttlefish. Do you want Point Lowly to look like Whyalla?

Whyalla is short on scenic attractions with the tourist push it's very urgent we keep what we have. While I do agree with the need on the economic side – go ahead with the Cowled Landing area. When the first shipment of Ore left Iron Knob who would have thought we would have such a huge pollution problem in Whyalla. Think of the future and expansion in the industry side. We don't know how big this will get and its best to put industry away from towns.

The Cuttlefish aggregation at Point Lowly is of world significance and we must be very careful not to destroy this for the sake of a few dollars. The proposed developments will do very little for full time employment. Over the years Whyalla has had a lot of problems with dust. Do we want to create another desalination plant? These should be built on ocean shores, not Gulfs. The chemicals will destroy the fragile Lowly environment.

Please don't spoil Lowly like the two Whyalla beaches have been. I remember the Surf Life Savers picnics out there until SANTOS built their long jetty. "Please plan well!!"

No inappropriate development which further degrades the health of the environment. Dust, noise and emissions pollution all reduces the recreation/tourism potential of Point Lowly. This would rule out the following: Large industrial structures, shed and equipment which would visibly overwhelm recreation. Potential noisy, dirty, toxic in industry. Facilities which could process or handle toxic material in the future.

With all the industrial activity Port Lowly amenities will be lessened and restricted. If the Cuttlefish are affected it will be a loss to our future generations. There will be an impact on tourism which will then impact on our hotels/motels. We can say 'goodbye' to the snapper competition.

I feel the questions asked in this survey are designed to get minimum feedback. I am not against development of the Pt Lowly Peninsula but it should be appropriate development such as eco tourism, Cuttlefish sightseeing, walking and cycling trails and more recreational facilities. The Peninsula is too narrow for industrial development. Alternative sites can and should be sort not taking the cheapest option.

I believe it would be a terrible waste to damage the Point Lowly area. The area for the breeding of Cuttlefish is very important locally and internationally. It is a haven for them, the only place in the world. If another location is viable surely this could be used unless it is a great expense and inconvenience. Whyalla needs industry and jobs for people, also recreation and to be a popular holiday resort. I love going to Point Lowly to the cottages with friends to see the dolphins.

We don't want anymore poisoning of our environment, and we don't want our Cuttlefish to be extinct as the Dodo and the Tasmanian Tiger. This is what God has to say on the matter Revelation 11:18............and to bring to ruin those ruining the earth.

The uniqueness of the Cuttlefish aggregation and its tourism potential is too high a price to pay.

We all know Whyalla is an Industrial town, so why not keep all industry together and save the beautiful area of Point Lowly together with the unique Cuttlefish.

Point Lowly has been the home of the Cuttlefish for thousands of years. We should encourage tourism in this special area and keep it separate from industry.

We managed Cultana Station for 11 ½ years and we were disappointed to see any industrial development on such a lovely Peninsula. The army should not be in that area and the coast road should never have been closed.

Point Lowly should be left for tourists and nature. It is a unique place to be enjoyed by young and old through Council.

It is an evil plan to take over the world with industrialisation to the detriment of recreational fishing areas and Cuttlefish breeding areas.

The possible negative impact on the Cuttlefish aggregation and the spoiling of this jewel in the crown of Whyalla is inconceivable.

What about the homes of wildlife and marine life. We have our homes. The animals and marine life don't get a choice when it comes to their homes. You talk about environment being looked after then by doing these developments it is affecting the environments. Point Lowly is beautiful place to bring kids and teach them about the outdoors. If you go ahead then what is in store for our next generation.

When will Whyalla become a healthy city? According to the World Health Organisation, 1996 definition a healthy city is one that provides a clean, safe, physical environment meeting the needs of all its inhabitants. Has a diverse innovative economy, resting on a sustainable eco-system.

Leave Point Lowly alone. Do not endanger the environment and Cuttlefish in this area.

I believe that given the concerns that development at Point Lowly may have a detrimental effect upon the Cuttlefish aggregation coupled with the possible loss of recreational fishing. Whyalla seriously needs to consider if it is worth the relatively low number of jobs likely to be created both short and long term. Also it needs to be considered that the jobs created will not necessarily go to locally based people.

A better site is available south of the city and would be better for mines to the west and south of Whyalla. Costing this option needs to be a high priority. Point Lowly is an easily imagined project Council and Government need to show more long term thinking.

I think at all costs the Cuttlefish and their environment should be preserved. With this in mind I do not like the location of the proposed new jetty. I believe in future development and have no problems with industry being established on Point Lowly if it does not impact on the Cuttlefish and the white beaches between SANTOS and the lighthouse. The government could be pressured to change laws to get OneSteel to share facilities or allow an alternative jetty to be built.

I have lived in Whyalla for 36 years and the Point Lowly Peninsula has always been a great escape for me and my family. Having a beautiful safe beach only 20 minutes away. Once big industry gets set up, it will destroy the whole area. Why don't we learn from past mistakes e.g. Pellet plant being so close to town. We need to keep Industry far enough away from residential and recreational areas. We should be looking at other areas to set up, and the city council needs to have a big input into this. It can't be all about making short term money. Keep the environment clean.

Not knowing all the details but very concerned about the city of Whyalla. I would like to see the new jetty being built south of Whyalla where most of the action is. I'm very much against iron ore being transported through the city because when the trucks stop they drop a lot of iron dust from underneath the vehicles. The pellet plant should also be shifted to the same area south of the city - expensive to start with but more convenient in the end. If this doesn't happen from Playford Ave. to the sea it will be another RED DUST disaster.

I fully support finding an alternative to the proposed development at Point Lowly. I took some overseas guests to Point Lowly and they were blown away by the regions beauty. I appreciate the effort on Councils behalf to represent the community.

If there is another site south of Whyalla then that should be the place to go. I can understand the fuel refiner needs to be at SANTOS but the rest should not go ahead at Stony Point area ever.

The residents of this household are totally opposed to any further development of the Point Lowly area.

It would be a shame for the development of another jetty when there is a strong likelihood of a spillage which may cause an environmental disaster with the Cuttlefish breeding ground. With the extra shipping traffic I feel this may also cause some damage with the Cuttlefish. I liked the letter to the editor written by John Scott with an alternative site for a jetty – a very good idea.

I feel an area between Whyalla and Cowell would be a better proposition. We of Whyalla lost Weeroona Bay to SANTOS do we have to lose more.

Leave the total area untouched for all the right environmental and human recreational reasons –it's a place of unique beauty – to go on wrecking it would see you the council being charged with environmental vandalism of the worst kind! To think we put you there to keep things like this for our uses – not industrial abuses – whose side are you on anyway – take the warning or be charged and sued under the law.

Please do not destroy our coastline. Putting SANTOS out there was more than enough. We want a coast and fish for our future generations. Also for the poor shack owners some that live out there permanently don't destroy it for them. No building. Shame. Shame. Shame.

Whyalla City Council do your job and represent those who put you where you are. No industry at Point Lowly.

Whyalla City Council should listen to the people and understand they don't want the development at Pt Lowly. Please start doing what you were elected to do. Listen to the people.

I am not opposed to industrialisation in an appropriate place but Point Lowly is not where this proposal belongs. Today we tend to take too many unnecessary risks with our environment and recreational areas. Some people in Whyalla and surrounding areas are not able to afford a holiday to other parts of Australia or overseas. The only chance as a family to enjoy a vacation is in a place close to home like Point Lowly. What is here close to home is a lovely pristine place that everyone can enjoy. To the Council, you represent these people too. You should pay attention and represent those that elected you. Help us save Point Lowly.

Point Lowly is too significant to Whyalla's people and the Cuttlefish for any risks to be taken with industrialisation. We already have leaks at SANTOS which have been ongoing for some time which must eventually reach the sea but no-one seems to be worried about it. If it happens once it can happen again with more toxic material. There are always second options for building a new jetty. Even if it costs more. Whyalla should not have to kowtow to big business. They will be the ones making the big profits and can afford it. As usual Whyalla will be promised a lot until they get their way, then we get the crumbs.

I am opposed to any industrial development at Point Lowly. It should remain a recreation area for the people of Whyalla and tourists. Whyalla has few recreational areas close to the town and we need to keep it and retain its natural beauty. I do not want to drive out there and have the beautiful view spoilt by industrial development. Seeing SANTOS is bad enough. My family has enjoyed many happy holidays there and we all feel strongly that its sole use is for holidays and recreation. I do not want to see more life, particularly the Cuttlefish threatened. Alternative sites south of Whyalla (where the Gulf is wider) must be seriously investigated and not ruled out.

The whole thought of industrialising Point Lowly is beyond me. I have been going to the shacks and surrounding areas since I was 7 years old, 44 years on I still go there on a regular basis and consider myself to be Indigenous to this pristine environment (minus SANTOS). It would be another huge manmade disaster for this unique environment of our gorgeous country. Really all said and done what will the people of Whyalla have left to escape the working aura of the town. Just don't do it I say.

Whyalla being an industrial town has something beautiful and unique at Point Lowly. The Cuttlefish are one of the worlds' wonders and they are right on our door step for the entire world to see. I would hate to see their habitat invaded or destroyed. Hopefully somewhere else in the Gulf can be found.

The environmental risks are too great for a number of reasons. The more industry the more ships, roads and rail transport. More risk of pollutants – noise, dust, odours and spills. The beauty and generally unspoilt nature of Point Lowly is a positive image the many tourists take away with them and spread by word of mouth to other travellers. This in part off sets the perception of Whyalla as "that red city". The value to the Whyalla community as a recreational area away from industry and the urban environment should not be underestimated. Industrialisation on anything like the scale proposed is in my opinion a tragedy for the environment and the community.

As a lifelong Whyalla resident and shack owner I am in opposition to the development at Point Lowly. I believe that we need to keep Point Lowly the way it is for people to enjoy for generations to come. I believe increased pressure should be put on OneSteel to allow the use of its export wharf or an upgraded wharf to be built on the OneSteel site with a user-pay system.

Playford is not a suitable heavy vehicle road. Visibility is sometimes poor on this road. The increase in noise and pollution is already frustrating. The health impact would be serious for young children and we need to keep their wellbeing, health and safety in mind

I am worried about the environmental impact on the area. I am concerned about the cuttlefish, restriction to beaches, pollution and accidental spills

I do not agree with any development in this region other than a small tourist resort, restaurant, life-saving and water sport development

I do not believe that any further development should go ahead because of heavy traffic, loss of recreational areas and cuttlefish ground

If this had been a short term exercise them there would be little problem. But pumping brine into the gulf over a long term period will be a disaster. There are scientific reports available that indicate that this exercise will be detrimental to the gulf. The area is an icon. Don't mess around with it and oppose any further development

Government of South Australia
Primary Industries and Regions SA

Fisheries and Aquaculture

Level 14
25 Grenfell Street
Adelaide SA 5000

GPO Box 1671
Adelaide SA 5001

DX 667

Tel 08 8226 3994
Fax 08 8226 0330

www.pir.sa.gov.au

Our reference: A1817258
Telephone No: 8226 3994

21 November 2013

Ms Karen Ferguson
Chief Environmental Officer
Assessment Branch
Department of Planning, Transport and Infrastructure
GPO Box 1533
ADELAIDE SA 5001

Dear Ms Ferguson

Re: Port Bonython Bulk Export Port Facility EIS

Thank you for the opportunity to provide comment on this proposed development.

The EIS has been circulated to relevant groups within the Department of Primary Industries and Regions South Australia (PIRSA). Officers and their respective comments appear on the attachment.

PIRSA raises no fundamental concerns with the proposal and, subject to the comments in the attachment, regards the EIS as adequate and satisfactory.

If you have further questions regarding this matter please contact Andrew Manson, Manager Policy and Economic Analysis on 8226 0533.

Yours sincerely,

Mehdi Doroudi
EXECUTIVE DIRECTOR, FISHERIES AND AQUACULTURE

ATTACHMENT ONE

Comment from PIRSA Aquaculture

I can see no immediate issues relating to the EIS and aquaculture in the area.

The site (primarily the jetty) is located about 10 km from the Fitzgerald Bay aquaculture zone, although the water around the jetty and associated activities will flow north towards the zone. Currently there is little activity in this zone so I cannot see any impacts to aquaculture in the near future (particularly during the construction phase). Note this area will likely be utilised again sometime in the future (where on-going operations may have an impact). However, on-going impacts (water quality, noise, marine pests, oil spill etc.) are well considered in the EIS under various management and contingency plans. Specific marine issues are likely to be raised by EPA, DEWNR and SARDI and would cover any impact to aquaculture in the long-term.

Comment from Biosecurity SA (Marine)

Based on Biosecurity aspects (Chapters 1, 13, 14 and 19)

Pg 413 *“These studies indicate that there is likely to be rapid colonisation of the proposed jetty as part of the BCEF, resulting in a local increase in biodiversity.”* This is incorrect.

One cannot increase ‘biodiversity’ from the colonisation of local species. Biological diversity – or biodiversity – is the term given to the variety within and between all species of plants, animals and micro-organisms and the ecosystems within which they live and interact. By disturbing habitat the construction will undoubtedly <u>decrease</u> native biodiversity from the fatality of resident species and the potential genetic loss when infrastructure is installed. Any short term increase of overall biodiversity is likely to be from the colonisation of newly arriving pest species which will compete with the native species and further result in a negative long term effect on local biodiversity.

Artificial reef research supports the theory that marine infrastructure developments can be at best fish aggregation devices not biodiversity or fisheries resource volume increasing functions.

Pg 445 *“As mentioned earlier, these guidelines make reference to the Code of Practice for Antifouling and In-water Hull Cleaning and Maintenance (ANZECC 1997) which outlines appropriate preparation and application of antifouling, as well as protocols and occasions when in-water hull cleaning is appropriate.”*

These have been superseded by the 2013 National Antifouling and In-water Cleaning Guidelines. http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/marine-pests/anti-fouling-and-inwater-cleaning-guidelines

5.3.9 Describe the impact of increased shipping traffic and activities in the upper Spencer Gulf.	5.3.9 Describe the impact of increased shipping traffic and activities in the upper Spencer Gulf<u>, including impacts on commercial and recreational fishing and aquaculture, and the potential for increased marine pest transfer</u>.

The EIS does not adequately describe 5.3.9. Shipping data regarding vessel movements to the general area existing from SANTOS jetty....available from Lloyd's before and as proposed needs to be outlined. This should provide details about where the vessel traffic is currently coming from, predictions of where the new traffic will be coming from and volume. Are the vessels coming from new donor ports compared to those already incumbent to the SANTOS wharf ?

The potential for increased marine pest transfer is not adequately described.

Whilst the EIS mentions that ballast water discharges will be managed in accordance to the Ballast Water Management Arrangements (for pests) the potential for turbidity to be generated, difference in water quality of oceanic versus coastal ballast water discharged by incumbent vessels, potential for juvenile organisms to be entrained (sucked in to ballast tanks) and its effects on the cuttlefish population are not investigated by the current document.

A single cape sized vessel has the capacity for 32,000,000 litres of ballast water in a total of 9 tanks *(http://www.daff.gov.au/biosecurity/avm/vessels/quarantine_concerns/ballast/australian-ballast-water-management-requirements).* Several ballast water tanks would be exchanged or refilled when moving cargo into or out of port. There is a relatively small amount of available draft under a Cape Size vessel operating at the site. The effects of entrainment of organisms which could not swim against pumps that operate at 3.7 million litres per hour has not been discussed. Some mature motile organisms larger than a seachest grate aperture would likely perish with the shear stress of passing through or in the harsh conditions in a ballast tank (low light, oxygen deficient, lack of suitable habitat etc) or when discharged in the deep ocean / unsuitable habitat. If it is determined that the vessels in port could be in the migratory route of the cuttlefish this aspect could be assessed with regards to vessel traffic scheduling.

New point in section 5.3 Environmental Issues: Coastal and Marine	5.3.15 Describe the impacts of increased artificial substrate and shipping traffic on the occurrences of marine pests, and the response procedure that will be followed in the event of a new pest record.

There is no discussion regarding the impact of the increase in artificial substrate. Artificial substrate is a preferential habitat for marine pests. There is no mention of construction or biofouling mitigation techniques to prevent marine pests such as pylon wrapping to prevent colonisation. Likewise there is no discussion of site operator mitigation operations in the event of a new pest report. Table 13.6a: Summary of proposed mitigation measures could mention these aspects.

Section 19.5.13 Marine pests should mention the Antifouling and In-water Cleaning Guidelines.

Fish Kill aspects in response to operations such as mitigation and response are not covered in the document.

Comment from SARDI

The key issue relates to the giant Australian cuttlefish. In the EIS it is stated that inshore construction will only occur outside the aggregation season, but that offshore will continue during the season. However, as there is little known about cuttlefish movement to the breeding area, this could still interfere with the aggregation forming if the animals transit through that area. Without an understanding of the movement and migration pathways of cuttlefish on and off of the Point Lowly fringing reef we cannot ascertain the potential effect of either the process of construction or the resultant infrastructure/operation will have on the breeding population. Although the emphasis seems to focus on the aggregating adults during the spawning season there may be issues relating to the movement of the resultant hatchlings and juveniles throughout spring/summer.

There is some concern regarding the sedimentation of the reef structure west of the proposed jetty through propeller wash and construction/implementation of the jetty abutment (i.e. groyne). Although, this has been identified as a negligible impact, the loss of appropriate cuttlefish spawning habitat (i.e. rock crevices/dens) may reduce reproductive success. This has previously been seen at the OneSteel wall where back-filling has significantly compromised the availability of appropriate spawning habitat. The EIS indicates that further assessment will be undertaken during the design process, however, it is unclear what specific mitigation strategies (other than further sediment modelling) will be adopted if, in fact, sedimentation does pose a significant threat to cuttlefish in the area. The design of the jetty should consider the possibility of incorporating design features that assist the settlement and development of cuttlefish eggs. Specifically, the results from a study on artificial habitat based on suitable cuttlefish den design that is currently being conducted by SARDI and the University of Adelaide may be of use.

Pg. 381: Reference to Steer et al. (2009) is incorrect.

Pg 446: It is stated that propeller wash velocities will only be 0.7 m/sec compared to tidal velocities up to 1 m/sec, and so the former won't result in any significant increase in turbidity, but this ignores the fact that the former will be turbulent, while the latter is relatively laminar. Therefore, propeller wash has substantial potential to increase turbidity.

Pg 451: It is stated that they intend to consult with PIRSA Biosecurity on biological monitoring of a range of issues, none of which are marine pests.

Pg 451: It is indicated that water quality monitoring will occur during construction. However, it would also be important to monitor sedimentation on the cuttlefish breeding area. This is particularly important, as they have not convincingly demonstrated that turbidity plumes will not impinge on the cuttlefish breeding area. Confirming that this won't happen is probably more important for the turbidity associated with the propeller-wash of a fully-laden Cape size vessel than it is for construction.

Note, we have only reviewed Ch 13: Coastal processes and water quality, and Ch 14: Marine Ecology

Environment Protection Authority
www.epa.sa.gov.au

EPA South Australia

GPO Box 2607 Adelaide SA 5001
250 Victoria Square Adelaide SA
T (08) 8204 2000 **F** (08) 8204 2020
Country areas 1800 623 445

EPA 05 20204

Mr Robert Kleeman
General Manager Assessment Branch
Department of Planning, Transport and Infrastructure
Level 5, 136 North Terrace
ADELAIDE SA 5000

Dear Mr ~~Kleeman~~ Rob

Port Bonython Bulk Commodities export facility – Environmental Impact Statement

Thank you for the opportunity to comment on the *Spencer Gulf Port Link Port Bonython Bulk Commodities Export Facility Environmental Impact Statement (September 2013)* (the EIS).

In reviewing the EIS, the key interest of the Environment Protection Authority (EPA) is to ensure that all environmental issues (within the scope of the objects of the *Environment Protection Act 1993*) are identified and addressed. The EPA is interested in the potential environmental and human health impacts that could result from the proposed project.

To this end the EPA has examined the following environmental issues:

- Air quality
- Water quality (marine, surface)
- Site contamination and groundwater
- Noise
- Licensing requirements under the *Environment Protection Act 1993*

Numerous questions remain about many aspects of the proposal and further information is sought on those matters, as referred to in Attachments 1-6.

Of particular concern to the EPA is that there are a number of sections of the EIS where statements and data has been presented but no modelling has been undertaken to under pin these. Given this data has not be substantiated it is difficult for the EPA to provide comment to the Department of Planning, Transport and Infrastructure about the assessment of the environmental impacts. The EPA recommends the following is undertaken to confirm the adequacy of the EIS.

- Ambient air modelling needs to be undertaken in order to verify the likely extent of emissions from the proposed project. Refer to Attachment 2 for further detail.
- An assessment of the likely extent and duration of sediment plume generation and movement in order to verify the potential impacts on the inshore reef areas and whether sedimentation rates are likely to cause degradation of these habitats. Refer to Attachment 3 for further detail.
- Hydrogeological baseline assessment and modelling needs to focus on the Stuart Shelf groundwater flow system and the regional systems to address potential impacts on groundwater receptors. Refer to Attachment 4 for further detail.

For further information on this matter, please contact Ms Kym Pluck, Team Leader, Planning Policy and Projects, 8204 9289 or kym.pluck@epa.sa.gov.au.

Yours sincerely

Peter Dolan

OPERATIONS DIRECTOR

SCIENCE ASSESSMENT AND PLANNING

ENVIRONMENT PROTECTION AUTHORITY

22/11/2013

ATTACHMENT 1 – LICENSING REQUIREMENTS

General

It is understood that Spencer Gulf Port Link (SGPL) proposes to construct and operate the Bulk Commodities Export Facility (BCEF) at Port Bonython with an initial capacity of 25 million tonnes per annum (Mtpa) then expand up to 50Mtpa depending on the market demand. The BCEF will be mainly used to export iron ore (Haematite and Magnetite) with an estimated capital value $663 million.

The BCEF would consist of:

- a17.5 km railway spur from the existing Whyalla to Port Augusta rail link;
- a 6.1km rail loop to accommodate a minimum of 3 trains (1.8km in length);
- a train receiving and bottom dump facility;
- bulk storage areas;
- ancillary amenities;
- a 3km jetty to 20m of water depth;
- two ship loading wharves;
- two luffing ship loaders – 4000 tonnes per hour (tph) capacity each; and
- mooring facilities for up to 3 tug boats

It is noted on page 100 of the EIS that the proponent is aware the project will require an environmental authorisation in the form of a licence under the *SA Environment Protection Act 1993* (EP Act). However, the activities which require a licence were not specifically assessed or detailed. Thus, the EPA has provided the following assessment of potential licensable activities based on the available limited information.

Proposed activity

Bulk shipping

The proposed bulk storage facility includes the following components:

- Ore unloading facilities;
- Iron ore storage facilities including three sheds initially (two 270,000t capacity Haematite shed and one 225,000t capacity Magnetite shed). Further storage facilities may be required to meet the 50Mtpa capacity;
- Iron ore receival, storage and export operations;
- Conveying and material handling equipment suitable for exporting in excess of 50Mt of iron ore per annum;

A 3km jetty would support the material handling infrastructure and provide access to the berth wharves. Two berthing wharves would provide the interface for export of the ore to ships (one is required to support 25Mtpa export capacity with an additional wharf required to support the 50Mtpa export capacity). Each ship loading facility would be capable of exporting 4000tph of iron ore.

The proposed bulk material handling is considered to trigger activity *7(1) – Bulk shipping facilities (exceeding 100 tonnes per day)* in Schedule 1 of the Environment Protection Act 1993 (the EP Act) and would therefore require an authorisation from the EPA.

Railway operations

According to page 69 of the EIS, a new rail spur would branch from the existing Port Augusta to Whyalla railway line. The total length is approximately 23.6 km (2km of standard gauge track at the mainline turn outs and dual gauge track for a rail loop). A 6.1km rail loop would be required to accommodate three 1.8km trains.

The proposed railway construction activity is considered to trigger activity *7(2) – Railway Operations* in Schedule 1 of **the EP Act and would therefore require an authorisation from the Authority. In addition, any operator of rolling stock on the new line would require an authorisation under this activity.**

Wastewater Treatment

Page 72 and 77 of the EIS indicates that the construction workforce is anticipated to peak at approximately 200 persons. Portable self-contained units would be used, with the wastewater removed from site and disposed of at an authorised site during construction works.

During operation phase, peak workforce would be 48 persons (stage one) and increasing by 50 percent for stage two. A 5000L packaged sewer treatment plant is proposed to be used and treated water would be reticulated to landscaping.

As no sewage or treated wastewater would be discharged into marine environment, the BCEF is not in a water protection area, and the peak workforce is proposed to be less than 1000 persons per day, a licence would not be required under EP Act *Schedule 1, 3(2) – Sewage Treatment Works or Septic Tank Effluent Disposal Schemes.* However, the proponent is reminded of their duty to comply with Section 25 of the EP Act.

Concrete Batching

Page 113 the EIS indicates that, dependent on the water supply situation, concrete may be ready-mixed and supplied from Whyalla or a temporary concrete batching plant may be required. No other relevant information is provided.

The proponent should be aware that if a concrete baching plant is used with a total capacity exceeding 0.5 cubic metres per production cycle, an authorisation would be required under the EP Act, Schedule 1, 2(5).

In addition, the *EPA Guideline Concrete Batching (September 2009)* provides the basis of the EPA's expectations. A copy of the Guideline can be obtained from http://www.epa.sa.gov.au/xstd_files/Industry/Guideline/guide_concrete.pdf .

Chemical Storage and Fuel Storage

Fuel and chemical storage would be required on site during construction (up to 3 million litres of diesel is required – page 76 of the EIS). It is indicated throughout the document that the operation would be appropriately bunded to ensure adequate containment, however no detailed information of the fuel and chemical storage provisions has been included in the EIS. After consideration of the details provided, it is unclear whether the proposal would definitely trigger *Schedule 1, Activity 1(1) - Chemical Storage and Warehousing Facilities and Activity 1(5) - Petroleum Production, Storage or Processing Works or Facility.*

Fuel Burning

It is noted in page 76 of the EIS that portable diesel generator sets would be used to supply power for construction activities. Mainline power from the existing supply point on Port Bonython Road would be used for some construction activities once the power supply was connected. No detailed information has been provided regarding the fuel burning capacity generators. However, based on the quoted 3 million litre diesel consumption , EPA considers that the generators in aggregate may trigger the 5 megawatt threshold specified under *Schedule 1, activity 8(2) - Fuel Burning.*

Dredging; Earthworks Drainage or Blasting

It is understood that no dredging or blasting activity would be conducted (page 50 and 74 of the EIS), thus no authorisation would be required for these activities under the EP Act. However, if dredging was required during the construction and/or operation phase, the EPA would need to be consulted for further assessment.

Summary

Based on assessment of the largely limited information provided in the proposal relative to licensing, the proponent should be advised that EP Act authorisation(s) would be required for conduct of the following Schedule 1 activities

- 7(1) Bulk Shipping facilities
- 7(2) Railway Operations
- 2(5) Concrete Batching

An Authorisation may be required for conduct of the following Schedule 1 Activities

- 8(2)a Fuel Burning (if power generation triggers 5MW)
- 1(1) Chemical Storage and Warehousing Facilities
- 1(5)a Petroleum Storage

ATTACHMENT 2 – AIR QUALITY

EIS Reference	EIS Statement	EPA – Air Quality Comment
6.2.1 Methodology (Second paragraph)	*It is proposed to utilise a fully-enclosed materials handling system which, when operating in accordance with the proposed design, will result in no release of fugitive particulate (dust) into the surrounding environment.*	This appears contrary to the statement on page 161 (6.5 Potential Impacts) that says: *As a result of construction and operation of the BCEF, there exists the potential for the emission of particulates from activities associated with the Project, including land clearing and wind erosion during the construction stage and materials movements including the loading, unloading and transfer of ore during the operations stage.* If this potential exists, then the assumption that there is no release from loading, unloading and ore transfer that predicates the decision that there was no need to undertake modelling is flawed. The EPA requires modelling to be undertaken in order to be able to verify the likely extent of emissions from the proposed project.
6.3.2.3 Licence and Project-Specific Conditions; and	*Licence conditions specific to the proposed Project will be developed following approval of the Environmental Impact Statement (EIS) and in cooperation with the EPA. Recent SA EPA Sustainability Licences and/or Development Authorisation approval conditions for major facilities (EPA 2010, SA Government, 2011) have generally specified that the NEPM particulate criteria be complied with as an operational contribution, i.e., excluding the influence of background particulate concentrations, which is consistent with the criteria generally applied at other, similar port facilities (refer* ***Section 6.3.3****).*	The EPA has expressed dissatisfaction with the approach that PM_{10} criteria are applied as operationally contributed only, ignoring background. The EPA considers this to be a fundamentally flawed approach because the PM_{10} criteria in the Ambient Air NEPM are health based. Therefore, the EPA do not support these as the appropriate criteria for this project. The two recent projects referred to in the EIS are exceptions since most proposals in South Australia have the Ambient Air NEPM applied as a PM_{10} total, as intended. Furthermore, if the proponent expects the PM_{10} levels to be as insignificant as the EIS suggests, the application of PM_{10} as a total should not pose any concern. The EPA understands that the concern with this approach raises the potential for elevated background to misrepresent facility impact, but the EPA considers that an effective monitoring system can easily discern what the facility's contribution is during such times, since the EPA seeks to ensure that under high PM_{10} background days the facility does not raise PM_{10} levels above the NEPM criteria. Despite the application of the Ambient Air NEPM as a standard for

6.3.3 Benchmarked Air Quality Criteria (Second paragraph)	*This review indicates that the application of the NEPM air quality standards as an operational contribution is the most commonly applied (and best-practice) criteria for bulk commodities export ports…*	operational contribution from bulk export port facilities interstate, it has only been applied as such once in South Australia (the other occasion referred to in the EIS is at Olympic Dam). The EPA does not support this application because the Ambient Air NEPM is a health based standard and, as such, the EPA considers it is best practice as suggested.
6.3.4 Particulate Ground-Level Concentration Criteria	*The legislative environment around air quality is described in detail in **Section 6.3** of this Chapter, together with a summary of the air quality criteria as applied at a range of similar facilities across Australia. SGPL has committed to best-practice air quality criteria for the Project, resulting in a commitment to the air quality criteria for construction and operation as described in Table 6.3c, where operationally-contributed is defined as the ground level dust concentration at the sensitive receiver minus the regional background dust concentration.*	The application of the NEPM as an operationally contributed PM_{10} standard is not considered best practice by the EPA. The EPA considers that the application of the health based NEPM standard as total PM_{10} is current best practice in Australia.
6.4.2 Local and Regional Pollutant Sources (Second paragraph)	*Assuming the mass of particulate matter emitted from the Santos facility is released uniformly throughout the year and not as a result of isolated abnormal events, the 4,700kg of PM10 translates to an average emission rate of around 0.15 grams per second (g/s). The current gas flow rate for the Santos facility was not able to be determined, however even assuming a low flow rate of around 10,000 Normal cubic Metres per hour (Nm3/ hr), the source concentration of particulate would be around 60mg/Nm3, well within the 250mg/Nm3 particulate limitation specified within the Environment Protection (Air Quality) Policy 1994 and therefore unlikely to significantly*	Insignificant influence on local air quality cannot necessarily be concluded from stack concentration compliance at the Santos facility, let alone that the EIS is only assessing the rate quoted from several assumptions. It is imperative that this information is included in the model (as part of the background) to predict ground level impacts of PM_{10} and perhaps even $PM_{2.5}$. This was previously raised as a concern in the EPA comments on the draft EIS against the EIS Guidelines (5.1.69), and still remains a concern.

	influence local air quality.	
6.4.4 Sensitive Receptors (First paragraph) (Third paragraph)	*The nominated air quality criteria associated with emissions from the Project (refer to* ***Section 6.3.4****) must be met when measured (or modelled) at all nearby residences.* *A review of port operation-specific air quality criteria was undertaken, the results of which indicate that the application of the NEPM particulate criteria, as an operational-contribution (i.e. excluding background sources) is the most common and stringent criteria adopted at similar facilities throughout Australia.*	The EPA agrees, yet no modelling was carried out (and the EPA considers that it needs to be). Does this mean that modelling will be undertaken as well as the proposed monitoring? Whilst operationally contributed PM_{10} may be the most common criteria adopted for ports around Australia (although the EPA does not have evidence that this is the case beyond the handful of examples quoted in the EIS), only one port facility in South Australia has these criteria adopted and the EPA does not consider they are the most stringent criteria available since there are several other ports in South Australia where the total PM_{10} criteria are adopted.
6.4.5 Summary of the Existing Air Quality Environment	*Although there has been no specific ambient air monitoring at Port Bonython, there is evidence to suggest that the existing air quality is very good. Data from the EPA Whyalla background monitoring site suggests that PM10 concentrations are approximately 15-20µg/m3 as an annual average, with approximately three or so exceedances of the 24-hour average NEPM criteria expected per year, both values being within the NEPM criteria.*	Whilst this may be the case regarding Whyalla, the Santos and BCEF facilities are (and will be if this proposal is successful) contributors to the local air pollutants and the EPA does not consider the EIS has effectively addressed this issue.
6.5 Potential Impacts		See comment on 6.2.1 Methodology
6.6.2 Estimation of particulate emissions (Second paragraph)	*The average rate of particulate emission for the Project during normal operations, calculated using the NPI emission estimation techniques, is 0.07 g/s. This level of dust generation is virtually negligible and would not be expected to result in any change to*	Is this referring to total dust or PM_{10}? Also, the assumption that dust generated is virtually negligible needs to be supported with some evidence.

	existing air quality at the nearest sensitive receivers.	
6.6.4.1 Construction Stage; and 6.6.4.3 Operations Stage	List of proposed mitigation measures.	Whilst the list of mitigation measures is reasonable and appropriate, there does not seem to be a mechanism for contingency when immediate dust issues arise. A contingency plan should include clear lines of authority (who can call a cessation of work if required) and measures to assess and mitigate impacts. This also applies, more importantly, to the Operations Stage.
19.5.8.2 Operations	***Monitoring:*** • *Real time PM_{10} dust monitoring stations to be installed in accordance with Australian Standards until such time as the system has been established.*	The monitoring plan should also meet NEPM standards (and not just Australian Standards) to provide NEPM compliant monitoring for 24-hour average PM_{10} on a daily basis. The EPA expects that NEPM monitoring will also provide spatial information to allow operational contributions to be determined. The monitoring plan should also include real-time trigger-level monitoring that informs operational staff of potential NEPM exceedences, with a contingency mechanism for assessment and mitigation. This was raised by the EPA previously in the comments on the first draft EIS against the EIS Guidelines (5.10.11)

ATTACHMENT 3 – MARINE

EIS Reference	EIS Statement	EPA – Marine Comment
Section 2.6.4.2 Construction activities	*The EIS states that there will be three on-shore support facilities, which includes a load out wharf at Whyalla. This facility will comprise of 100 m of shipping berth backed by hardstand paved storage area.*	Clarification of the location of this is required? (ie: is this the Arrium wharf?).
Section 13.4.2.1 Sediment characteristics	*SGPL have undertaken sediment sampling to undertake an assessment of the likelihood of sediment resuspension due to shipping movement by the Cape vessels or from tugs and construction vessels.* *The inshore reef areas between Black Point and Point Lowly are dominated by plants and algae which require light to photosynthesize. Increased turbidity in the water column will reduce the amount of light available to these plants and algae and can result in reduction in health or loss. Some species of algae (eg: Ecklonia radiata) have been shown to be impacted by increased sedimentation due to the filling of crevices in the reef substrate by sediment which excludes recruitment of juvenile algae (Turner 2004; Turner et al 2007). Additionally turfing algae, which are seen to be an indicator of a degraded reef, can thrive on reefs in high sedimentation areas, these algae exclude the larger brown algae (Ecklonia radiata, Sargassum spp. & Cystophora spp.) further exacerbating the degraded condition (Gorgula and Connell 2004). In addition to the plants and algae, some animals can be sensitive to smothering by sediments including bivalves and sponges.* *The sediment particle size shows that the sediment is relatively fine at the tug berth (20% < 0.0625 mm) suggesting that this sediment will be likely to be mobile. The proposal suggests that the berth is likely to be in the*	The proponent must undertake an assessment of the likely extent and duration of plume generated and movement, under numerous tide and wind conditions, as a result of the activity (specifically including the tug berth and wharf areas). This investigation must include an assessment of the rate of sedimentation on the inshore reef areas and whether these sedimentation rates are likely to cause degradation of these habitats.

	order of 13 m deep and the sediment at this location is likely to be resuspended by the movement of the tugs and may result in prolonged periods of poor water clarity. This location is also the location of high turbidity in close proximity to the inshore rocky reef areas. *In addition to the tug berth, the wharf area is suggested to result in a resuspension of sediment (~63%) and have a settling time of 24 hours. The proposal suggests that there will be approximately 277 vessels a year which results in one vessel every 1.3 days resulting in no opportunity for the suspended material to settle between resuspension events. The remainder of the departure channel will resuspend sediment along its route with varying degrees of settling times.* *The EIS suggests that the high occasional natural turbidity of the area (particularly during strong southerly winds) will mean that the impact from the resuspension of sediment from this activity is likely to be minor or negligible. Additionally the proposal suggests that the frequent resuspension and movement of the fine sediments from these high use areas will result in eventual armouring of the sediments whereby the larger sediments will remain and the fine sediments will be moved resulting in lower turbidity generation over time.*	
Section 13.4.3 Marine Water Quality	*Table 13.4 displays a table reproduced from BHP Billiton (2009), however the units used to compare between the sample data and the ANZECC trigger values are incorrect.*	The units between the samples and the trigger values need to be consistent to allow for meaningful comparison. If there are occasions where the water quality is above the trigger value an assessment of the potential for impacts and/or sources needs to be undertaken. Additionally, many of the samples shown have detection limits which are far too high to enable comparison to the Guidelines and also to values which are likely to cause harm (eg: maximum values for Total N at A1, A10, B1 and B10).
Section 13.5.4.1	*The EIS states that a jetty abutment will be constructed*	The area of intertidal reef needs to be clarified. The construction of

Jetty Abutment	*which is likely to be 100 m wide and will extent 15-30 m into the intertidal reef. This will permanently destroy the intertidal reef and biota in this area. The EIS states (14.4.2.1) suggests that this area will only be 80 m^2, however calculation based on the figures above reveals an area more likely to be 1500-3000 m^2.* *During the construction of the jetty abutment a rock bund will be constructed on the outer slope including geo textile fabric to retain fill material. This process has the potential to increase turbidity in the nearshore zone.*	jetty abutment should not increase the turbidity in the nearshore environment above 10 NTU.
Section 14.4.3.6 Marine Water Quality - Nutrients & algal growth	*The EIS provides only a very small assessment of the potential for iron dust from the ship loading facilities or spillage from the wharf to contribute to algal growth in the waters.*	It is well understood that the waters at Stony Point through to Point Lowly are enriched by nutrients and it is possible that the addition of iron, even in miniscule amounts, may contribute to algal growth. See further discussion regarding EPA consultation regarding monitoring program.
Section 14.5.3 Marine Monitoring	*The EIS states that it is intended to undertake water quality and biological monitoring immediately prior to construction, during construction and post construction to enable comparison to the pre construction results. The scope, duration, methods and parameters will be defined in consultation with the relevant agencies.*	A marine monitoring program encompassing chemical and biological components, must be designed in consultation with, and approved by the EPA prior to construction.
Section 15.5.4 Underwater noise	*The EIS states that avoidance behaviour is expected for fish and cephalopods within 300-1200 m of the piling source (depending on seafloor conditions). However the proposal suggests that inshore piling will occur outside of the cuttlefish breeding season (May – October) which significantly reduces the potential for impact on cuttlefish. The EIS states that construction should be scheduled so that the piling rig is located greater than 550 m offshore for any construction during May – October.*	Piling any closer than 550 m offshore from lowest astronomical tide (LAT) must be undertaken outside of cuttlefish aggregation season (01 May – 01 October). Additionally, any piling undertaken within the cuttlefish breeding aggregation season must be accompanied by insitu underwater noise monitoring while piling is underway until predictions of underwater noise are validated and noise is observed to be compliant with the thresholds at the nearest cuttlefish breeding habitat.

BHP Billiton, 2009, Olympic Dam Expansion - Draft environmental impact stament. Main report volume 1 Adelaide, Prepared by Arup Pty Ltd and ENSR Australia Pty Ltd (Arup/ENSR) on behalf od BHP Billiton Olympic Dam Corporation Pty Ltd.

Gorgula, SK and SD Connell, 2004, 'Expansive covers of turf-forming algae on human-dominated coast: the relative effects of increasing nutrient and sediment loads', *Marine Biology*, 145: 613–619.

Turner, DJ, 2004, 'Effects of sedimentation of the structure of a phaeophycean dominated macroalgal community', PhD Thesis, University of Adelaide.348 pp

Turner, DJ, TN Kildea and G Westphalen, 2007, Examining the health of subtidal reef environments in South Australia Part 2: Status of selected South Australian reefs based on the results of the 2005 surveys, South Australian Research and Development Institute (Aquatic Sciences), Adelaide: 97.

ATTACHMENT 4 – SITE CONTAMINATION AND GROUNDWATER

EIS Reference	EIS Statement	EPA – Site Contamination and Groundwater Comment
Section 4.2		The EPA notes that, although mentioned in Section 3, Section 4.2 does not mention the *Natural Resources Management Act 2004*, which includes a number of water related requirements that the proponent would have to meet, e.g. groundwater well installation permits, water affecting activities, extraction of water etc.
4.3.1. Review of Existing Information	*The existing groundwater and surface water characteristics have been assessed by a review of available information both in terms of data collected and held by government agencies, as well as information previously discovered in background information relating to previous environmental assessments and studies.* ***Field investigations were not undertaken with respect to groundwater as the data and the characteristics of the environment indicate its occurrence is very limited in quantity.*** *This is supported by the area's low rainfall which limits recharge and the local geology and rock properties which indicate the likelihood of fractured rock aquifers of limited storage and yield. On this basis the existing data was considered to adequately assess the likely baseline condition and enable any impacts of the proposed development to be assessed*	The desktop investigations are not of a suitably comprehensive nature to determine the local geological and hydrogeological characteristics of the environment for the proposed development. The sedimentary rocks of the Stuart Shelf extend through a southern corridor to Port Bonython. A conceptual hydrogeological model would assist in the understanding of sedimentary lithologies in the vicinity of the proposed Port Bonython site. See recommendation below. Further to this, the EPA is unable to undertake an assessment as: ▪ there is no characterisation on the recharge into the groundwater from large rainfall events ▪ there are no details on probable occurrence intervals for probable maximum flood events ▪ there is no documentation on the hydrogeological characteristics of the fractured rock aquifers and how they are related to the sedimentary sequences documented in the area. Investigation may be required on the recharge capacity of aquifers on the Eyre Peninsula, which are believed to be unconfined and will recharge during large rainfall events. While the aquifers are believed to have no potable use, further investigation may be required for current and future irrigation use from pastoralist. The groundwater is understood to discharge to the marine environment or deeper aquifers. The potential for groundwater contamination and discharge into the marine environment has not been adequately investigated.

	In developing the Project, an objective has been and will be to avoid impacts where feasible. The assessment of any residual impacts the proposed BCEF activities may have on groundwater and surface water was carried out by identifying those activities, evaluating the potential impact on the environmental values described in ***Section 4.2.2.1****, considering the significance and likelihood of such impact, rating the risk and proposing the mitigation. Where appropriate, mitigation will include field work and appropriate actions which are defined in* ***Chapter 19, Environmental Management Plan.***	The assessment of any impacts cannot be effectively risk rated and mitigated if an adequate baseline investigation of local geology and hydrogeology has not been achieved.
4.3	*Information on groundwater in the study area is limited, and most of the following account is based on inference. There are no monitoring wells in the study area or the immediate hinterland, and limited records of bores in the vicinity with two active irrigation bores identified within the Santos facility.*	No relevant information has been sourced from the desktop study of groundwater from the Santos, Port Bonython site to the east of the proposed BCEF site, where there is detailed information (publicly available) on groundwater regimes in the area.
Section 4.4	*This section describes the existing environment provides limited detail and fails to recognise the impact of neighbouring Santos Port Bonython site.*	The neighbouring Santos Port Bonython site is a known contaminated site (soil and groundwater) with a number of groundwater wells installed at the site and a number of groundwater reports produced over time. The EPA holds a number of these reports on the Public Register, which the proponents can access. These reports would have provided a great deal of background information on groundwater conditions, site contamination which, if presented in the EIS, would improve the quality of the EIS.
4.4.2. Groundwater Conditions	***4.4.2.1. Occurrence*** *Information on groundwater in the study area is limited, and most of the following account is based on inference.* ***4.4.2.2. Recharge and Discharge*** *The Whyalla region is a dry area with an annual average rainfall at Whyalla of 278mm (1906 – 2001) and an estimated annual potential evaporation of about 2500mm. Sub-tropical high pressure systems dominate*	Investigating probable maximum flood events is more important than looking at an annual rainfall to evaporation balance. No hydrogeological investigation was made to determine the significance of the potentially unconfined to confined aquifers in the area to the environment.

	the weather and this causes dry continental air to blow over the area for most of the year, although monsoonal lows in summer can bring episodic, heavy rain. (Bureau of Meteorology, 2013a) *The high density of surface drainage on the Cultana Ridge is indicative of low permeability and therefore recharge to the underlying strata is likely to be very limited. The high density of drainage here contrasts with the flat, low-lying Long Sleep Plain which has an almost complete absence of obvious surface watercourses. Recharge here is potentially a little higher, but the high annual evaporation is likely to reduce actual recharge to negligible quantities.* *Due to the very low recharge to groundwater, discharge will be correspondingly small to insignificant. There is no evidence or record of any discharges such as springs or seeps in the area.*	
4.4.2.3. Quality and Utilisation	*Under the prevailing climatic conditions it is likely that groundwater will be saline, particularly beneath the plain.* *There is one record of a bore drilled in 1975….*	The EIS states that the natural salinity of the groundwater is too saline to have a beneficial use, however, the natural salinity of the water is significant for the receiving marine environment. Additional, more comprehensive, groundwater well information should have been utilised from the Santos site. What aquifer was the 1975 bore installed in?
Figure 4.4.a. Geology and Soils and dissolved salts.	*Shallow Groundwater Level and Salinity*	The data points on Figure 4.4a do not identify the aquifer in which they are placed nor do they correspond well with the salinity and groundwater levels. . The text of the documents indicates salinity is as high as 23,000mg/L, but the map represents the salinity one order of magnitude lower, which is deemed potable. What units are groundwater level and total dissolved solids (TDS)? Given there are only 3 data points shown on the map, how have the proponents contoured groundwater level and TDS on the basis of this limited number of data points?

Section 16. Sustainability	*For the EIS, reports were reviewed to understand the baseline conditions for the study area relating to surface water and groundwater. Detailed studies were also undertaken to understand the impacts of the Project on the existing water environment. While these studies provided significant understanding about the impact the Project will have on the water and groundwater environment, it was not considered necessary to conduct modelling given the low water availability on site.*	The conclusions of the baseline investigations are not acceptable to the EPA. The investigations are not comprehensive enough to give a representative conceptual hydrogeological baseline model at the proposed site.
Section 16 **Sustainability** **Water**	*Opportunities include harvesting stormwater or groundwater around the site for spray water use along with on-site storage.*	From all the previous baseline review, the water was deemed to have no beneficial use and of too low a recharge for use. If the proponent is planning to utilise the water the EPA requires a more rigorous investigation of the aquifer.
Section 19.5.1.1 Monitoring Section	*Performance Criteria - Contaminants are not to be conveyed off the site through groundwater as a result of operational activities*	The EPA recommends the proponent undertake baseline groundwater quality monitoring across the site to provide details on background groundwater quality conditions at the site. This will allow generation of site specific groundwater data/information and allow the determination of any impacts (or otherwise) from the Port Bonython operations.
Section 19.5.1.1 Reporting Section		Obligations under the EP Act, require that notification of site contamination is made to the EPA as soon as reasonably practicable. It is recommended that the reporting section of the Environmental Management Plan mentions that groundwater contamination needs to be reported to the EPA under Section 83A of the EP Act.

- The EPA recommends the need for a hydrogeological baseline assessment for the study areas, focussing on the Stuart Shelf groundwater flow system and the regional systems, to address potential impacts on groundwater receptors. This could include bounding groundwater systems, pastoralists and the marine environment.

- The EPA recommends that a conceptual hydrogeological model of the Stuart Shelf drainage corridor, from the baseline assessment, should include a summary of the interaction between the Stuart Shelf groundwater flow regimes and any recharge-discharge mechanisms.

The conceptual hydrogeological model should include all recharge parameters for all aquifers in the region, including the younger Tertiary and Quaternary sediments that overlie or incise the older rocks. Investigations into the aquifer bearing capacity of all lithologies should be summarised in the conceptual hydrogeological model.

- The EPA recommends that aquifer recharge is determined through probable reoccurrence intervals for significant rainfall events rather that a mass balance between annual rainfall and annual evaporation. This information should be summarised within the conceptual hydrogeological model.

- The EPA recommends that the information that forms the conceptual hydrogeological model should be accurately represented in the EIS figures.

ATTACHMENT 5 – SURFACE WATER

Surface water and Stormwater

The Port Bonython EIS proposes the construction of a 17.5km rail spur, three enclosed iron ore storage sheds, conveyor facilities to transport the ore and a 3km long jetty. The proposed site is located in an area of the state with limited rainfall, approximately 250mm rain per year. The surface drainage lines which exist in the area are ephemeral creeks which are usually dry and only hold water after rainfall events. Therefore, the risks to inland aquatic life from this development would likely be negligible. However, these drainage lines would allow movement of soil and pollutants from the construction site and proposed development to the marine environment during rain events. Therefore, consideration about how to minimise this runoff is important when considering the potential impacts to the marine environment.

It has been proposed that due to the large number of ephemeral drainage lines in the region, 49 culverts will need to be constructed along the 17.5km long rail spur. However, little information has been provided about how soil transport from this construction work will be minimised to prevent soil being transported down the drainage lines and into the marine environment during a rain event. Details of how soil transport will be avoided during construction of these culverts should be included in the Construction Environmental Management Plan (CEMP) which should be prepared in accordance with the *Code of Practice for the building and construction industry*. Debris resulting from the stone and concrete work required for the construction of the culverts could also potentially be washed downstream during a rain event and enter the marine environment. Means of avoiding this should also be detailed in the CEMP.

The main areas of concern for stormwater management are:

- the construction phase
    - minimising soil erosion and runoff from stockpiles, construction of culverts, land clearance
    - construction of a sedimentation basin (turkey's nest dam)
    - wastewater from wash down bays
- the post-construction phase:
    - possible requirement of wash down bays
    - separation of hard-stand runoff from roof runoff
    - storage of materials
    - runoff from the site
    - oil spills

Construction phase

Clause 17 of the Water Quality Policy states "a person must not discharge of deposit a pollutant listed in Schedule 4 of the Policy into any water or onto any land where it might enter any waters". Schedule 4 lists a range of pollutants which are likely to be associated with the development at Port Bonython, including soil.

It has been stated in the *Spencer Gulf Port Link – Port Bonython Bulk Commodities Export Facility: Environmental Impact Statement* that clearing activities will be staged in such a way as to minimise the exposure of earth and that mitigation measures for erosion prevention and water quality control during vegetation clearance will be detailed in the CEMP. Soil erosion control measures proposed for use during the construction phase include hay bales, sediment curtains, rock and concrete controls and natural vegetation. No soil will be removed from the site, instead being stockpiled on site as it is envisioned that all soil will be re-used. These stockpiles should be placed a suitable distance from drainage lines, as outlined in the EPA's *Guideline for stockpile management – waste and waste derived products for recycling and reuse*, and measures taken to minimise soil movement by water and wind from these stockpiles should be described in the CEMP.

A turkey's nest dam will be constructed prior to the commencement of the construction phase to capture runoff during construction with the captured water being re-used for dust suppression. It is proposed that this dam will act as a sedimentation basin during and post-construction at the site. The construction of this dam should consider the most appropriate sizing for the dam given the amount of rain and runoff expected for the region and minimise the risk of overflow from the dam. The EPA guideline *Wastewater and evaporation lagoon construction* provides recommendations for the suitable construction of wastewater (including contaminated stormwater) lagoons. This dam, or wastewater lagoon, will also need to be adequately maintained to ensure it does not infill with sediment associated with the runoff and thereby reduce the volume of runoff the dam can capture. The dam should be constructed in such as way as to allow easy access to the lagoon when it needs desludging. The dam will likely need to be cleaned out at the end of the construction phase to remove the sediment captured during that period and then on a regular basis during the post-construction phase depending on the degree on sedimentation. A figure in the Appendices suggests this dam will be constructed approximately 250 m from the coastline, however, as stated in the *Wastewater and evaporation lagoon construction* it is recommended that detention basins not be constructed within 500m from the high water mark. There is also no indication of a potential overflow path or if the pond has been sized appropriately to capture the runoff. The base of the lagoon should be no less than 2m from the seasonal water table and should be no closer than 50m from the nearest drainage line or ephemeral creek.

Washdown water from the concrete batching plant and equipment wash water are mentioned as potential sources of pollutants and designated wash down areas have been proposed as a means of mitigating the risks of this water entering the environment. The EPA guideline *Stormwater management for wash bays* provides information on how to protect the receiving environment from pollutants such as washwater, detergents, cleaning agents, grease, oil and general rubbish and applies to heavy vehicle or machinery washdown stations. It is recommended that the wash bays include bunding by humps, a graded floor surface, a roof, contain impervious surfaces and the wash bay should be appropriately sized and include drainage. The guideline *Stormwater management for wash bays* also includes possible options of disposing this washwater in unsewered areas, including the use of dedicated vegetated or landscaped areas but treatment will be required before disposal. The wastewater should not have an oil content greater than 10mg/L and disposal areas should be greater than 100m from drainage lines or the high water mark.

Post - construction phase

The use of wash down bays has been suggested for the construction phase but no mention of using these facilities has been mentioned for the post-construction phase. It is assumed that vehicles or equipment will need to be cleaned on occasions and this cleaning, particularly if detergents are to be used should occur in designated areas where the water can be captured and disposed of appropriately.

The *Spencer Gulf Port Link – Port Bonython Bulk Commodities Export Facility: Environmental Impact Statement* mentions two main sources of runoff; runoff from hard stand areas and roof runoff. Roof runoff is considered to be clean stormwater and therefore can be re-used on site without the need for treatment. Runoff from hard stand areas, however, would need to be treated to a level where it could be re-used on site. It is recommended that the roof runoff remain separate from the hard stand runoff. This will reduce the volume of water that would need to be captured by the turkey's nest dam before being re-used.

Three iron ore storage sheds have been proposed for the site, however, in section 19.5.1.2.Operation, it has been suggested that runoff from all iron ore storage areas will be collected and diverted through appropriate treatment. If the iron ore will be stored undercover, and minimal dust settles on the roofs, then runoff from the shed roofs can be considered clean stormwater and does not require detention or treatment. However, if the iron ore will be stored uncovered then runoff from the area will need to be captured and diverted to the proposed dam.

Liquids such as fuels, lubricants and herbicides must be stored in appropriately bunded enclosures The EPA guidelines for *Bunding and Spill Management* provides information on bunds and spill storage containers to minimise the risk of environmental harm from spills and prevent these substances from entering the stormwater, nearby creeks or drainage lines, or the marine environment. Herbicides should not be sprayed near or within drainage lines or in a manner contradictory to the instructions on the label as outlined in the EPAs *Guidelines for Responsible Pesticide Use.*

An ablution block has been proposed for the site with wastewater collected, treated and used for irrigation. The human and environmental health implications of re-using this wastewater should be considered and the *National Water Quality Management Strategy (NWQMS) guidelines for water recycling: managing health and environmental risks* should be referred to, to ensure the wastewater is re-used in a safe manner.

Use of the principles of water sensitive design assists in offsetting the effects of development through improving management of stormwater and is considered best practice stormwater management. Utilisation of best management practices demonstrates compliance with the *General Environmental Duty* as defined in Section 25 of the *Environment Protection Act 1993.* Best management practices is to not increase stormwater flows above pre-development flows and at the same time minimise the amount of pollutants in the stormwater that does flow. The use of water sensitive design principles has been proposed for this development include appropriate planting, rock protection, swale drains and detention ponds. However, details were not provided on the location or expected benefits of these elements.

Runoff occurring down the jetty access road between the dam and the coastline, a distance of approximately 400m appears to not be captured. A swale located near the end of that road may be required to capture that additional runoff to prevent it from entering the marine environment.

ATTACHMENT 6 – NOISE

Background Noise Investigations

Baseline noise measurements were undertaken to characterise the existing noise environment at the closest noise sensitive receptor locations to the proposed facility and associated (eg road, rail) infrastructure. There are two communities potentially affected by the proposed development; namely the False Bay shack community (1 property at Gilja Retreat and several shacks at Yorrel View), and the shack community at Point Lowly. It is not clear whether the potentially affected shacks are permanently inhabited, or are only inhabited seasonally.

Noise logging was undertaken over a one week period from 29/4/2013 to 6/5/2013 at two locations (one at Gilja Retreat and one representative of the shacks at Yorrel View). Conversely, attended noise measurements on one day only (29/4/2013) were undertaken at four locations (14 Sida Cove, Lighthouse Drive, Wilsonia Drive and Boobilla Retreat), covering day-time (7am to 10pm, 4 locations) and night-time (10pm to 7am, 3 locations) periods. The measurement locations at Point Lowly are not clear from the provided maps. It is stated that noise from the nearby Santos facility was generally not audible during the day, however; this conclusion is based on only one day of measurements at Point Lowly, and variable weather conditions, variable operating conditions at the Santos facility, and variable levels of community noise within the Point Lowly shack community may result in times where noise from the existing Santos facility is audible at Point Lowly.

It is not considered that the above methodology is sufficient to adequately categorise the existing noise environment as it is possible and highly likely that the ambient noise environment varies considerably dependent on the number of shacks which are inhabited at any given time. It is considered that this likely varies across different days of the week, and also increases during warmer months, school holidays, long weekends and other times which are likely to attract a higher shack occupancy rate. It is also considered that weather conditions are likely to vary considerably across the year, and consequently noise levels due to wind, waves and other natural sources are likely to vary significantly. It is therefore not clear how significantly the proposed development will modify the existing noise environment at noise affected premises, regardless of whether the proposed facility meets the Indicative Noise Level based criteria applicable under the Noise EPP.

In order to adequately characterise the existing noise environment at False Bay and Point Lowly, unattended noise logging should be undertaken for a substantial period at Point Lowly, Yorrel View and Gilja Retreat, concurrently with co-located weather monitoring to identify data affected by high local wind speeds and rain affected data. Ideally, such monitoring would be conducted over a period of 12 months (not necessarily continuously) to take into account variations in resident population and weather conditions throughout a year, however; shorter monitoring periods would be acceptable provided justification is provided which addresses variations in resident population and variations in weather conditions.

Furthermore, the 'Rating Background Level' parameter has been used in the EIS. This parameter is not used in South Australia. Typically, L_{A90} noise levels representing the 'background' noise would simply be averaged in a similar fashion to how L_{Aeq} noise levels have been presented in the EIS. However, as it is likely that the method presented in the EIS will under-estimate the background noise level as compared with the simple averaging method, this approach is considered satisfactory.

Noise and Vibration Criteria

The following table outlines the criteria and documents referenced by the EIS, and contains any comments regarding the use of the specified criteria/standard/document. Any detailed comments regarding specific criteria used in the EIS are outlined in the below sections.

Project Component:	***Document:***	***Comments:***
Construction Noise:	Noise EPP Part 6 Division 1 – Construction Noise Control Provisions	The requirements of the Noise EPP with regard to construction noise are well stated
	BS5228.1:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise	The EPA agrees with the use of this standard for noise source inputs to the prediction model, as it provides greater detail than the equivalent Australian Standard.
Construction Vibration:	NSW EPA Assessing Vibration: A Technical Guideline (2006)	There are no SA legislative requirements. The EPA is not familiar with the quoted standards (with the exception of the NSW Guideline), however the risk of adverse impact is determined to be low from the information presented and as such no further investigation into the validity of the quoted standards has been undertaken (which is not to say that there is any suspicion these standards would not be valid).
	AS2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites	
	BS5228.2:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration	
Operational Noise – Industrial:	Noise EPP Part 4 – General Noise Control Provisions	Noise criteria have been incorrectly derived. See the following section for details
	Noise EPP Part 5 – Development Authorisation Applications	
Operational Noise – Road:	SA EPA 52dB$L_{Aeq,15\ hour}$ criterion	The quoted criterion is intended for new sensitive developments encroaching upon an existing road (no upgrade taking place). For new/upgraded roads, DPTI Road Traffic Noise Guidelines should be used.
Operational Noise – Rail:	SA EPA Draft Guidelines for the Assessment of Noise from Rail Operations (2010)	Draft Guidelines have been superseded by the current version Guidelines for the Assessment of Noise from Rail Infrastructure (2013)

Noise Predictions	CONCAWE, The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, CJ Manning (1981)	This is EPA's preferred prediction methodology for industrial noise, however; predictions should be made for Cat 6 (night) and Cat 5 (day) weather conditions. See below sections for details
	Calculation of Road Traffic Noise (CoRTN), Dept. of Transport, Welsh Office (1988)	CoRTN is the preferred methodology for road traffic noise predictions. The methodology used to convert L10 to Leq for an appropriate time period (15/9 hour) appears fine
	Nordic Council of Ministers (1996) Railway Traffic Noise – The Nordic Prediction Model, TemaNord 1996:524	The Nordic Model is acceptable, however; it is unclear why the newer Nord2000 model was not used. Furthermore, the source height being at the 'railhead' may reduce predicted noise level for diesel locomotives due to a typical exhaust height of 4 metres (approx.). An appropriate source noise level (NR Class locomotive) has been input into the model.

Derivation of Noise EPP Criteria

The noise criteria for the False Bay and Point Lowly settlements have been incorrectly derived. The proposed development 'straddles' three zones, and as such, in accordance with the Noise EPP and the Noise EPP Guidelines, the Indicative Noise Factor (INF) for the 'source' is required to be the average of the INFs for each of the three zones straddled by the proposed development (Special Industry (Hydro), Coastal Conservation, and Land Not within a Council Area (Coastal Waters) zones). The resulting INF for the 'source' zone is then averaged with the INF for each of the 'receiver' zones to determine the applicable Indicative Noise Level (INL). It is important to note that the INL is based on what is 'principally promoted' by the relevant development plan (in this case the Whyalla Council Development Plan (consolidated 25 October 2012) and the Land Not Within a Council Area (Coastal Waters) Development Plan (consolidated 4 July 2013)), which may or may not reflect the land uses which have actually been developed in a specific locality. The tables below outline derivation of the operational noise criteria applicable to industrial aspects of the proposed project (ie excluding road or rail impacts) in accordance with the relevant development plans, the provisions of the Noise EPP, and guidance contained in the Noise EPP Guidelines:

Development Plan Zoning:	*Principally Promoted Land Uses:*	*Corresponding Noise EPP Land Use Categories:*	*Indicative Noise Factors:*
Source Zones:			
Special Industry (Hydro) Zone	Chemical industries requiring hydrocarbon feedstock	'Special Industry'	70dB(A), day 60dB(A), night
Coastal Conservation Zone	Conservation of the natural features of the coast	'Rural Living'	47dB(A), day 40dB(A), night
LNWCA Coastal Waters Zone	Coastal Rural Living Areas Retention of Environmentally significant areas Preservation/ enhancement of scenic areas	'Rural Living'	47dB(A), day 40dB(A), night
	Coastal Urban Settlements Housing Tourist Accommodation	'Residential'	52dB(A), day 45dB(A), night
	Tourism Public and Community Facilities	'Commercial'	62dB(A), day 55dB(A), night
	Aquaculture Farming	'Rural Industry'	57dB(A), day 50dB(A), night
	Mineral Exploitation	'General Industry'	65dB(A), day 55dB(A), night
	Port Facilities	'Special Industry'	70dB(A), day 60dB(A), night
Sensitive Receiver Zones:			
Settlement Zone	Mixed use village Low density dwellings Holiday accommodation	'Residential'	52dB(A), day 45dB(A), night
Coastal Settlement Zone	Protection of the natural coastal environment Existing dwellings	'Rural Living'	47dB(A), day 40dB(A), night

Constituent Zone:	*Indicative Noise Factors:*	*Indicative Noise Factor for Zone:*	*Indicative Noise Factor for Source:*
Special Industry (Hydro) Zone	70dB(A), day 60dB(A), night	70dB(A), day 60dB(A), night	59dB(A), day 50dB(A), night
Coastal Conservation Zone	47dB(A), day 40dB(A), night	47dB(A), day 40dB(A), night	
LNWCA Coastal Waters Zone	70dB(A), day 60dB(A), night	59dB(A), day 51dB(A), night	
	47dB(A), day 40dB(A), night		
	47dB(A), day 40dB(A), night		
	52dB(A), day 45dB(A), night		
	62dB(A), day 55dB(A), night		
	57dB(A), day 50dB(A), night		

	Indicative Noise Factor for Receiver Zone:	*Indicative Noise Level:*	*Criteria for Developments:*
Settlement Zone	52dB(A), day 45dB(A), night	56dB(A), day 48dB(A), night	51dB(A), day 43dB(A), night
Coastal Settlement Zone	47dB(A), day 40dB(A), night	53dB(A), day 45dB(A), night	48dB(A), day 40dB(A), night

Note that in the above table, the 'criteria for developments' column has had the 'minus 5' dB(A) adjustment for a new development applied to the Indicative Noise Level to give the noise criteria applicable to a new development.

Road Traffic Noise Criteria

Although it is not strictly necessary to address road traffic noise levels as part of the project assessment due to the fact that no new roads are being constructed, nor are any existing roads being upgraded, it is worth noting that the criterion quoted for road traffic noise by the EIS is incorrect. This criterion is intended for residential land developments encroaching upon an existing road and is not normally intended for projects where a new road is proposed, or where the impact of an existing road is predicted to increase by way of an upgrade or other means. In such situations, the criteria outlined in the *DPTI Road Traffic Noise Guidelines* are typically used. For situations where exposure to existing road traffic noise is low, the lower end of the target range should be targeted. As such, noise levels should not exceed 55dB$L_{Aeq,\ day}$ between the hours of 7am to 10pm and 50dB$L_{Aeq,\ night}$ between the hours of 10pm to 7am. It is notable that measurements made against this criteria should be undertaken 1 metre from the most exposed building façade and as such the criteria includes an adjustment of +2.5dB(A) to account for reflections from the building façade. As such, this criterion is largely equivalent to the criterion quoted by the EIS, however; as it is designed to be measured in the presence of existing buildings it is more appropriate than the criteria quoted which should be measured in free field conditions prior to the construction of a sensitive building.

Rail Noise Criteria

Operational rail noise has been compared with the draft EPA Guidelines for Assessment of Noise from Rail Operations (2010). This document has since been amended and published as the *Guideline for Assessment of Noise from Rail Infrastructure (GANRI) (2013)*. Notwithstanding, the criteria contained in both versions are largely the same, and as such it is not necessary to undertake any further investigation. It is notable that consideration of rail noise levels arising from additional traffic on existing railways (such as the ARTC operated Whyalla-Port Augusta Railway) is not necessary as part of this assessment.

Predicted Construction Impacts – Noise

Predictions of the construction noise impacts have been made under "Neutral" and "Adverse" weather conditions corresponding to CONCAWE category 4 and 5 respectively. However; in accordance with the Noise EPP Guidelines, only predictions for CONCAWE Category 6 (absolute worst case) are required for night-time operations, or CONCAWE Category 5 for day-time operations (it is not possible for category 6 conditions occur during the day-time). Notwithstanding, the EIS predicts exceedances of the 45dBL_{Aeq} level considered to represent an 'adverse impact on amenity' for several construction activities at several noise sensitive receiver locations, most notably short-term civil works associated with construction of the rail alignment for both Gilja Retreat and Yorrel View properties at False Bay. Furthermore, long-term impacts are predicted to arise from 'off shore marine plant' and 'marine piling' for properties at Point Lowly. For predictions made under CONCAWE category 6 (absolute night-time worst-case conditions), the impact is likely to be worse than predicted for 'adverse' conditions. As such, in accordance with the mandatory construction noise control provisions of Part 6 Division 1 of the Noise EPP, these activities must not be undertaken on a Sunday or other Public Holiday, or outside of the hours of 7am to 7pm on any other day, unless noise mitigation measures/strategies can be employed to reduce the noise impact to 45dBL_{Aeq}. However, as it is likely that some of the shacks are not permanently occupied, there may be some scope to undertake activities at times when the shacks are not occupied.

It is noted that in Section 5.8.1 of the EIS that 'construction works will be limited to the hours of 6am to 6pm Monday to Saturday'. It is not clear why these time limits have been chosen, and it is worth noting that these times conflict with the mandatory time limits for construction works having an 'adverse impact on amenity' described by the Noise EPP. It is recommended that the times be amended to reflect the mandatory times described by the Noise EPP.

Predicted Construction Impacts – Vibration

The nearest vibration sensitive receptor to any construction zone associated with the proposed project is Gilja Retreat, some 235 metres from the proposed rail alignment. All other sensitive receiver locations are in excess of 1 kilometre from any construction activity. Construction vibration impacts have been based on British Standard BS5228.2, which recommends that calculation of vibration impacts is only valid for the equipment proposed for distances up to 110 metres. At this point, vibration levels are predicted to be 0.08mm/s, which is below the most stringent criteria given in AS 2670.2-1990 for combined direction velocity and as such vibration levels are likely to be negligible at all sensitive receiver locations.

Predicted Operational Impacts – Noise

It is proposed that operation of the facility may occur at any time throughout the day-time or night-time, and as such noise predictions for day-time and night-time impacts are identical. In such situations, compliance with the 'night-time' criterion for an activity which has a constant noise level throughout the day and night will guarantee compliance with both the day-time and night-time criteria.

Predictions have been made for 'neutral' and 'adverse' weather conditions, however; again, only absolute 'worst case' predictions are required for assessment. In accordance with the Noise EPP Guidelines, 'worst case' conditions refer to CONCAWE Category 6 for night-time, and CONCAWE Category 5 during the day. Under 'adverse' weather conditions, an exceedance of 1dB(A) at night was predicted, however; this exceedance may be more significant if predicted under 'worst case' (CONCAWE Category 6) conditions. Furthermore, the impact is assessed to be 'negligible' by the EIS due to the magnitude of the exceedance and the fact that it is only predicted to occur under certain meteorological conditions, however; it is not stated how frequently the conditions used to justify this exceedance are predicted to occur. In accordance with the Noise EPP Guidelines, unless it can be shown that the default weather conditions occur less frequently than 10% of the year or 30% of any one season for either the day or night period then the default absolute worst case conditions should be used.

Mitigation is proposed to reduce the noise level in terms of enclosing the jetty conveyor in line with dust suppression requirements, however; it is not clear from the EIS whether this measure is required to reduce the noise impact to a 1dB(A) exceedance under 'adverse' conditions, or whether this mitigation measure would reduce the noise impact to achieve compliance with the Noise EPP.

The noise impact of increased traffic volumes on the existing public road network has also been assessed. As no significant new roads are proposed as part of the proposed project, a formal assessment against the relevant noise criteria outlined in the DPTI Road Traffic Noise Guidelines is not required. Notwithstanding, the EIS predicts that the most significant increase in road traffic noise is likely to arise during the construction phase of the project on Port Bonython Road, resulting in a 2.2dB increase in traffic noise levels arising from a 122 percent increase in traffic volumes. A 2dB increase is subjectively barely perceptible and as such the impact of the project on road traffic noise is considered negligible.

Noise impacts from operation of the proposed rail spur have been predicted in general accordance with the EPA Guidelines for the Assessment of Noise from Rail Infrastructure. Predictions show that the noise impact of operation of the railway will comfortably meet the Rail Noise Guidelines criteria (with Gilja Retreat being the most significantly affected) without any mitigation, and as such no further investigation is considered necessary.

Predicted Operational Impacts – Vibration

The nearest vibration sensitive receptor to any part of the operational infrastructure associated with the facility is Gilja Retreat, some 235 metres from the proposed rail alignment. It is noted that short-term construction vibration impacts are typically greater than operational impacts, particularly for projects such as railways, and that construction vibration impacts for any part of the project are predicted to be negligible at all sensitive receptors. As such, the conclusion presented by the EIS that none of the equipment proposed for operation as part of the project is likely to create vibration of a sufficient level to generate adverse comments at sensitive receptors is accepted as valid.

Hon Ian Hunter MLC

File No: 2013/03359/04

CORPORATE RECORDS
20 NOV 2013 3pm
DATE RECEIVED

Document No: 8139148

Government of South Australia

Minister for Sustainability, Environment and Conservation

Minister for Water and the River Murray

Minister for Aboriginal Affairs and Reconciliation

9th Floor, Chesser House
91-97 Grenfell Street
Adelaide SA 5000

GPO Box 1047
Adelaide SA 5001

DX 138

Tel 08 8463 5680
Fax 08 8463 5681

minister.hunter@sa.gov.au

Ref: 13SEC1604

Ms Karen Ferguson
Chief Environmental Officer
Assessment Branch
Department of Planning, Transport and Infrastructure
GPO Box 1533
ADELAIDE SA 5001

RECEIVED
25 NOV 2013
DPTI
PLANNING DIVISION

Dear Ms Ferguson

Thank you for your letter of 26 September 2013 referring the Port Bonython Bulk Commodities Export Facility Environmental Impact Statement to me for comment, as Minister responsible for marine parks, in accordance with section 46B(5)(a)(ic) of the *Development Act 1993*.

I am informed that the Department of Environment, Water and Natural Resources (DEWNR) will be submitting detailed comments on the Environmental Impact Statement, including matters relevant to the Upper Spencer Gulf Marine Park and my comments will be more general in nature.

The Environmental Impact Statement acknowledges the objects of the *Marine Parks Act 2007* and the zoning requirements in the Upper Spencer Gulf Marine Park. However, section 3.3.10.1 of the document does not accurately represent the situation regarding special purpose area zoning and changes to marine park boundaries.

As the existing special purpose areas fully support the proposed development, no further amendments to zoning are considered necessary. Any amendment to decrease the size of a marine park, such as an amendment to excise a port, is subject to disallowance by both Houses of Parliament, in accordance with section 10(11) of the *Marine Parks Act 2007* and such amendments cannot be finalised by any Government agency.

The large spawning aggregation of giant Australian cuttlefish (*Sepia apama*) in the vicinity of Point Lowly is known worldwide and is highly valued by many sectors of the community. There have been increasing concerns about the low numbers of cuttlefish observed in the area during the breeding season (March to September) in recent years.

I am advised that the Environmental Impact Statement is lacking in critical detail relating to the types of potential impacts to the giant Australian cuttlefish. I am further advised that consideration of cumulative impacts on the cuttlefish in relation to water quality, the potential loss of habitat incurred by the construction and operation of the jetty, impacts of noise during construction and operation and the effects of shading caused by the jetty structure itself should be more carefully considered.

In addition, I am advised that these same issues are also pertinent more broadly in relation to other species, such as marine mammals and sygnathids, which may be impacted by the development.

The Environmental Impact Assessment comprehensively covers a range of issues. However, the risk analyses and mitigation measures relating to the marine environment and marine parks should be more comprehensive. These should be backed by specific evidence and should more clearly describe the levels of risk and outcomes of the proposed mitigation measures.

I thank you for referring this matter to me for comment.

Yours sincerely

IAN HUNTER MLC
Minister for Sustainability, Environment and Conservation

18 / 11 / 2013

In reply please quote 2013/20844/01, *Process ID:* 244098
Enquiries to Mr Reece Loughron
Telephone (08) 8343 2569
Facsimile (08) 8343 2725
E-mail dpti.luc@sa.gov.au

Government of South Australia
Department of Planning, Transport and Infrastructure

TRANSPORT SERVICES DIVISION

77 Grenfell Street
Adelaide SA 5001

GPO Box 1533
Adelaide SA 5001

Telephone: 61 8 8343 2222
Facsimile: 61 8 8343 2585

25/11/2013

Development Assessment Commission
C/- Ms Karen Ferguson
Department for Planning and Local Government
GPO Box 1815
ADELAIDE SA 5001

Dear Karen,

ENVIRONMENTAL IMPACT STATEMENT – PORT BONYTHON BULK COMMODITIES EXPORT FACILITY

Applicant	Spencer Gulf Port Link
Location	Stony Point, Port Bonython
Proposal	Construction of Bulk Commodities Export Facility

The above report was referred to the Transport Services Division of the Department of Planning, Transport and Infrastructure (DPTI) by the Development Assessment Commission (DAC) for advice to assist the DAC in its report to the Minister for Urban Development and Planning. The following response is provided:

THE PROPOSAL

The Bulk Commodity Export Facility (BCEF) will allow for the export of up to 50 million tonnes of iron ore per annum. The key elements of the proposal consist of:

- A new 17.5 kilometres railway spur from the existing Whyalla to Port Augusta rail line
- A 6.1 kilometres railway loop at the terminal of the railway spur
- Train receiving and dump facility
- Iron ore storage areas
- Ancillary amenities and infrastructure
- A nominal three km jetty to 20 metres of water depth
- Two 250 metres ship loading wharves
- Two 4000 tonne /hour luffing ship loaders

CONSIDERATION

Ancillary Infrastructure

Road Access

TSD has reviewed Section 8.0 Transport and considers the traffic generation rates provided are acceptable and align with the projects construction phases. It is noted that the intersection assessment of the Lincoln Highway / Port Bonython Road junction, as detailed in section 8.6.1, has resulted in the recommendation to extend the Lincoln Highway right turn lane to 121.5 metres in length (an increase of 37.5 metres on the existing treatment).

Whilst it is acknowledged that the Austroads Guide to Road Design Part 4A specifies that the expected traffic volume generated from this development only requires a short channelised right turn lane (CHR(S)), as per the above recommendation, TSD is concerned that, given the largest vehicle expected to utilise the junction is a 36.5 metres road train, a CHR(S) will not provide sufficient length to allow vehicles to decelerate within it and safely out of the through lane. In order to fully mitigate this risk DPTI considers that a full CHR rather than CHR(S) for northbound right turn movement into Port Bonython Road is more appropriate, especially given that the Lincoln Highway and Port Bonython Road are gazetted road train routes.

Additionally, the level crossing on Port Bonython Road also has the potential to impact on the operation of the Lincoln Highway / Port Bonython Road junction as this crossing is only 65 metres east of the junction. The intersection assessment has not fully addressed the potential increase in train movements and the potential queuing from the level crossing towards the Lincoln Highway / Port Bonython Road junction.

TSD requests further analysis and review of the additional train movements and expected delays at the intersection along with the assessment of forecast increase in traffic volumes over 2017 and 2020 periods. Whilst it is noted that the 6 movements per day are likely (up to 12 with stage 2 – refer section 2.7.3.1), TSD considers that more detailed analysis needs to be undertaken regarding the likely origins/destinations of these trains and potential impacts on the Lincoln Highway / Port Bonython Road junction. This is considered critical as the spur line to the BCEF is being constructed north of the junction and this will result in additional trains crossing the Port Bonython Road and potentially delaying traffic movements at this junction.

In association with the rail movements adjacent to Port Bonython Road, the road crossing (ie. underpass) must be developed and designed to DPTI standards and requirements, with all costs being borne by the proponent.

Maritime Infrastructure

<u>Commercial Marine Operations</u>

- Currently under the Harbors and Navigation Regulations 2009 (Restricted Areas - Schedule 5) there is a restricted area around Port Bonython marked on navigation charts. Vessels loading at the new bulk loading facility will need to navigate over a small area of this restricted zone when approaching / leaving the new berth. Hence amendments will be required to be made to the regulations or an exemption granted by Santos to permit the vessels to traverse their restricted area.

- To ensure safe navigation and efficient traffic management between ships calling at Port Bonython and the new bulk terminal, an approved VTS System must be put in place prior to commencement of operations at the new terminal.

- The proponent is advised that the maximum draft of the Cape size vessels at the new berth would be around 18 metres. The maintained depth declared at the berth box is the responsibility of the proponent.

- Any future dredging of the berth box and the approach channels (if required) would also be the responsibility of the proponent.

- The terminal should have approved oil pollution equipment suitable to contain Tier 1 oil spills on the premises. Trained personnel must be made available to use of this equipment in an emergency.

- Some navigation aids currently in position for Port Bonython may have to be re-located. New navigation aids if determined necessary by DPTI (including lead lights) will have to be installed and maintained by the proponent. .

- A Risk Assessment Plan for this project must be prepared by the proponent and copy submitted to DPTI.

- A Port Operating Agreement and Port rules will need to be developed, and followed up with regular audits.

- In reference to 2.7.3.2, pilotage of loaded cape size vessels (drafts greater than 16 metres) similar to Project Magnet vessels on outward journey is compulsory.

- All expenses relating to Notices to Mariners, signage, tide boards, etc will be debited to the proponent.

Railway Infrastructure

<u>Rail Traffic</u>

TSD has reviewed the Transport Section and considers there to be insufficient analysis of the increase in rail traffic and the potential impacts to the adjacent Lincoln Highway / Port Bonython Road intersection and other level crossings along the potential road transportation route. Whilst it is noted that ARTC has provided in principle support (refer Appendix H5) further discussions with the proponent, ARTC and TSD are required. Subsequently, TSD request the following information to be investigated and additional assessment undertaken:

1. Whilst it is noted in section 2.7.3.1 that there will be six trains arriving at the BCEF per day (seven days per week), and this will increase to 12 per day when the site is expanded to process 50Mtpa, how many additional train movements are expected on the Pt Augusta - Whyalla line? ARTC have stated that there is sufficient capacity, but TSD is concerned that these movements could have implications on other level crossings. Subsequently, TSD request further discussion and investigation in potential impacts to other level crossings from the increased rail traffic to/from the site and surrounding rail network.

2. Whist it is noted that 2.6.4.2 – Onshore Construction – Rail, provides indicative cross sections (ie. 50m wide rail corridor) additional information and concept plans of the proposed location and design of the grade separation on Pt Bonython Road is required.

3. Additionally, the minimum treatments at any private level crossings created by the construction of the new rail line need to be identified and developed in consultation with TSD (Level Crossing Unit).

General

The following general comments are provided for clarification:

- Section 1.8.1, ARTC does not operate the line to Alice Springs. They own the line but it is operated by Genesee & Wyoming Australia under a concession deed expiring in 2047.

- Section 1.8.7, Darwin Port has a rail bottom discharge facility and is not restricted to containerised receival of bulk commodities.

- Section 5.4.2.1, the rail noise guidelines were published in final form in April 2013.

CONCLUSION

While no objections are raised the following above issues need to be addressed by the proponent and any further discussions need to be held with TSD to ensure agreement is reached on necessary upgrades/improvements to cater for the propsoed bulk export facility

Yours sincerely,

MANAGER, TRAFFIC AND ACCESS STANDARDS

for **COMMISSIONER OF HIGHWAYS**

Government of South Australia
Department of Environment, Water and Natural Resources

Document No. **01/13/0690**

Alan Holmes
CHIEF EXECUTIVE
DEPT OF ENVIRONMENT, WATER & NATURAL RESOURCES

TO: CHIEF EXECUTIVE

copy → Annie Lam. 8 27/11

FOR APPROVAL

RE: Draft Environmental Impact Statement for the Port Bonython Bulk Export Facility

---

THROUGH: Group Executive Director, Strategy & Advice 21/11.

PRIORITY URGENT

1. ISSUE:

That you:

1. Approve and forward to the Department of Planning, Transport and Infrastructure the attached DEWNR response to the draft Environmental Impact Statement (EIS) for the Port Bonython Bulk Export Facility.

2. PRIORITY:

Urgent – Response is due to DPTI by 5 pm Friday 22 November 2013.

3. BACKGROUND:

Due to concerns about a lack of suitable infrastructure to transport iron ore resources to markets, the state government selected Stony Point, near Port Bonython as the site for a new bulk export facility. Following a competitive tender process, Spencer Gulf Port Link, comprising Flinders Ports, Australian Rail Track Corporation, Leighton Contractors and Macquarie Capital, was awarded the tender to plan, build and operate the facility.

The proposal is to construct an onshore bulk ore handling and storage facility, a 3 km jetty and a 17.5 km railway spur to Port Bonython from the existing Whyalla to Port Augusta rail line.

The proposal is subject to environmental assessment and approvals under the SA *Development Act 1993* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act),

DEWNR's role and the issues raised to date in the respective processes are summarised as follows:

South Australian Development Act

On 1 March 2012, the Minister for Planning declared the Port Bonython Bulk Export Facility a 'major development' under section 46 of the *Development Act 1993*.

The Development Assessment Commission (DAC) determined that an Environmental Impact Statement (EIS) was required to evaluate the potential environmental, economic and social impacts and benefits of the project.

DEWNR has been consulted and provided comments at each stage of the process, as follows:

- Initial Draft Guidelines for the EIS – advocated that the proposal be subject to an EIS (as opposed to the proposed Public Environment Report) and highlighted the need to consider cumulative impacts (17 April 2012)
- Draft Guidelines - reiterated the need for an EIS and argued for greater emphasis on assessing the impacts on the Marine Park and the Giant Australian Cuttlefish (8 May 2012)
- Draft EIS (guidelines compliance check) - highlighted further detail required on impacts on native vegetation (including from weed impact) and the marine environment, from stormwater runoff, turbidity and waste (6h September 2013)
- Draft EIS (assessing the detail) this is the current stage) – see discussion below.

Commonwealth EPBC Act

On 24 May 2012, the Commonwealth deemed the project a 'controlled action' requiring assessment by Preliminary Documentation, due to the potential for the action to have a significant impact on the Slender-billed Thornbill and the Southern Right Whale.

The State Government provided comments to the proponent through the Department of Environment, Water and Natural Resources, which highlighted a lack of information regarding the impact of jetty piling installation on cetaceans.

Spencer Gulf Port Link has finalised its Preliminary Documentation in light of agency and public comments, and submitted it to the Commonwealth for approval. On 21 October 2013, the Commonwealth extended the period to make its decision on the action to 7 February 2014 in order to ensure consistency with any conditions imposed on the potential development approval under the SA Development Act.

Briefings

Additionally, the Planning and Assessment Team has provided the following briefings, PBNs and advice on the project/respective assessment and approvals processes:

- Briefing to the CE re DEWNR's comments on the Draft Guidelines, Minister for Marine Parks' role and next steps (14 May 2012)
- Briefing and PBN for Minister Hunter on the status of the environmental assessments (22 July 2013)
- Briefing to Executive Director, Conservation and Land Management on DEWNR's role in environmental assessments (3 September 2013)
- Briefing to Minister Hunter on the status of the environmental assessments (31 October 2013)
- Telephone enquiry from Minister Hunter's office about the major development assessment and approvals process 18 November 2013
- Updated PBN for Minister Hunter on the status of the environmental assessments (19 November 2013)

4. DISCUSSION:

As mentioned above, DPTI is currently seeking comments from DEWNR on the draft EIS (under the SA Development Act process).

Following internal DEWNR consultation (see Consultation below) it has been determined that the draft EIS is generally adequate with the following key exceptions:

- the assessment of the potential impacts on the Giant Cuttlefish/Marine Park Sanctuary Zone/marine environment generally lacks consideration of the impacts particularly from habitat loss from pile driving and shading, noise and vibration from on-going operations, iron ore spills, and turbidity;
- the assessment of the potential impacts on native vegetation lacks consideration of the long term impacts from increased traffic (human and vehicular), underestimates the potential weed impact and lacks information on how disturbed sites would be rehabilitated. The draft EIS also states that the SEB offset would be provided *post construction* whereas the *Native Vegetation Regulations 2003* requires it to be established *prior* to any clearance occurring.

Additionally, DEWNR seeks the opportunity to discuss the proposed marine monitoring methods and to review aspects of the proposed Environmental Management Plan.

Following the end of the EIS public consultation period, the proponent, Spencer Gulf Port Link, will prepare its response to the issues raised in the public and agencies submissions.

5. CONSULTATION:

The following areas of DEWNR were consulted on the draft EIS:

- Marine Parks
- Coast
- Native Vegetation Management
- Threatened Species
- Science Monitoring and Knowledge – Assessment and Advice
- Urban Water, Economics and Water Security
- Sustainability and Climate Change
- Heritage
- Crown Lands

? Region ?

6. FINANCIAL IMPLICATIONS:

Are there financial implications? No

ATTACHMENTS

- Draft CE letter and DEWNR comments on the draft EIS to the Department of Planning, Transport and Infrastructure

7. RECOMMENDATIONS:

It is recommended that you:

7.1 Approve and forward to the Department of Planning, Transport and Infrastructure the attached DEWNR response to the draft Environmental Impact Statement for the Port Bonython Bulk Export Facility.

APPROVED / NOT APPROVED

Brenton Grear **Executive Director** **Conservation and Land Management** **Department of Environment, Water and Natural Resources** Date: 19/11/13

Chief Executive Office use: Comments	
Comments:	------------------------------------ **Allan Holmes** 27 / 11 / 2013

Government of South Australia
Department of Environment, Water and Natural Resources

Chief Executive

Level 9 Chesser House
91-97 Grenfell Street
Adelaide SA 5000

GPO Box 1047
Adelaide SA 5001
Australia

Ph: +61 8 8204 9323
Fax: +61 8 8204 9321

www.environment.sa.gov.au

Your Ref:
Our Ref: 01/13/0690

27 November 2013

Karen Ferguson
Principal Environmental Officer
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5001

Dear Ms Ferguson

Re: Draft Environmental Impact Statement for the Port Bonython Bulk Export Facility

Thank you for inviting the Department of Environment, Water and Natural Resources (DEWNR) to comment on the draft Environmental Impact Statement (EIS) for the Port Bonython Bulk Export Facility.

It is considered that the draft EIS is generally adequate with the following key exceptions:

- the assessment of the potential impacts on the Australian Giant Cuttlefish/Marine Park Sanctuary Zone/marine environment generally lacks consideration of the impacts of habitat loss from pile driving and shading, noise and vibration from on-going operations, iron ore spills, and turbidity;
- the assessment of the potential impacts on native vegetation lacks consideration of the long term impacts from increased traffic (human and vehicular), underestimates the potential weed impact and lacks information on how disturbed sites would be rehabilitated. It also states that the SEB offset would be provided post construction whereas the Native Vegetation Regulations 2003 requires it to be established prior to any clearance occurring.

Additionally, DEWNR would also appreciate the opportunity to discuss the proposed marine monitoring methods and to review aspects of the proposed Environmental Management Plan.

For further information on this matter please contact Alex Ward on (08) 8124 4714 or alex.ward@sa.gov.au.

Yours faithfully

Allan Holmes
CHIEF EXECUTIVE

EIS Chapter / Section	*Page*	*Comments*
		growth of the filamentous *Hincksia sordida* blooms within the cuttlefish aggregation area and the marine park sanctuary zone. The draft EIS needs to clearly state what the total nutrient inputs would be.
		Paragraph 5 states *"overall, the current nutrient levels will meet the requirements for the protection of marine ecosystems…".* This appears to contradict the statement in paragraph 3 that there are already anthropogenic inputs that have caused degradation to seagrasses and the rocky sub-tidal area west of the proposed development. The draft EIS needs to address the additional inputs generated by the jetty construction and on-going operations.
	389	Paragraph 5 suggests that suspended sediment generated and carried by propeller-induced current is 'unlikely' to reach subtidal habitats to the northwest of the ship berthing area, located within the marine park sanctuary zone. The statement needs to be substantiated with more specific evidence regarding the likelihood of sediment transfer to the subtidal habitats occuring.
	391	Paragraph 3 – The statement needs confirmation with more specific evidence (as per pg. 389 above).
	392	The table of proposed mitigation measures should clearly define the terms, such as the likelihood and risk ratings. Some of the decisions made in the table may require review (for example the likelihood of waste and pollutants affecting marine water quality is more likely to be 'certain' than 'possible', when considering all of the other inputs, or cumulative effects.
14 Marine ecology		
14.3.5	418	This section uses a risk assessment matrix, based on mobility and distribution, to determine the credible risk to listed, threatened, or protected marine species to narrow more detailed assessment, and concludes that there is a credible risk to 19 of the 40 listed species. The Giant Cuttlefish is not a listed species and therefore was not subject to this first-pass risk assessment. However, if it were (subject the same first-pass risk assessment), the conclusion would likely be that it was at a (very high) credible risk due to its mobility and distribution. The jetty traverses critical habitat for the Giant Cuttlefish and they are regularly recorded in the Upper Spencer Gulf. The mitigation measures proposed to reduce the risk to marine mammals, sygnathids and cuttlefish are predicted to reduce impacts to negligible or low. However, the mitigation measures have not been tested or applied at this location so there would be residual risk of

EIS Chapter / Section	*Page*	*Comments*
		causing harm to these animals/the marine environment.
14.5.3.1	450	It is recommended that the proposed monitoring methods referred to in the document are discussed with the Department of Environment, Water and Natural Resources (DEWNR) and Primary Industries and Regions SA (PIRSA) in relation to the detection of changes to marine species with the marine park sanctuary zone.
	451	Specific details, such as frequency, location and timing, should be given in regards to determining the beginning of the cuttlefish breeding season. If the methods used are not comprehensive, undetected spawning cuttlefish would be at risk of being exposed to both construction noise and turbidity. Due the proximity of the sanctuary zone to the construction site, animals under high level protection may be exposed, which would not be consistent with the intentions of the zone. It is recommend that diver surveys to detect the commencement of the cuttlefish spawning season begin at the earliest recorded season start and occur weekly at multiple locations within the sanctuary zone.
15 Underwater noise		
15.6	531-538	Mitigation measures proposed during May to October should reduce the local impact on the cuttlefish. It is very important that there is strict adherence to the mitigation proposals for observance of marine mammals during the pile driving stages to minimise the impacts on marine mammals.
		The draft EIS does not give any indication of the expected noise or vibration that might be transferred from the jetty operations into the water (e.g. from conveyor belts or other machinery) and the impact that this might have on the marine environment.
17 Hazard and risk		
	508-527	This section makes very little reference to the marine environment, with more emphasis placed on hazards and risks to humans and terrestrial environments. More information should be provided regarding hazards and risks to marine environment that may be generated by the project.
18 Cumulative impacts		
18.4.8	537	The document acknowledges the potential for oil spills in the area, but does not consider the potential for iron ore spills into the marine environment from loading operations in relation to understanding the cumulative impacts of the project.

EIS Chapter / Section	*Page*	*Comments*
18.4.8.5	538	Noise and turbidity are identified as potential impacts to cuttlefish. However, habitat loss from pile driving and jetty construction generally (e.g. shading) should also be considered.
19 Environmental Management Plan		
19.5.11	562	The management action table for both the construction and operational phases should give more specific details of options to manage impacts on marine species other than cuttlefish and marine mammals. The draft EIS indicates that noise is the only impact on cuttlefish during the construction phase. The management of other impacts, such as turbidity, habitat loss, should also be addressed here.
		The sentences relating to marine fauna reporting during construction and operation (deaths and ship strikes) should be extended to include 'and any relevant Government agencies.' (e.g. DEWNR for marine mammals and PIRSA for fish species).

NATIVE VEGETATION

General comments

The draft EIS quantifies and details the extent, condition and significance of terrestrial native vegetation reasonably well.

DEWNR is satisfied that the information collected represents a thorough picture of the native vegetation present and that it also provides the relevant information needed to satisfy SEB offset requirements under the *Native Vegetation Regulations 2003.*

However, the draft EIS needs to look beyond the direct clearance impact of construction and address the potential long term impacts of the development on the surrounding native vegetation. The increased traffic of both people and vehicles in the area would present a constant low level of risk to the surrounding environment, managing this would require constant vigilance and monitoring to ensure that the remaining vegetation is not gradually undermined.

The Construction Environmental Management Plan (CEMP) addresses some of the issues and risks that may occur during the construction of the facility such as altered hydrology regimes; however, it does not require that any work occurring in drainage lines does not permanently alter the flow. The vegetation survey refers to sites along roadsides that are now favoured by weeds species due to the changes in surface hydrology from road runoff. Additionally, restricting water flow to certain areas may result in vegetation death.

DEWNR considers that the potential weed impact has been underestimated, not only in the ways in which weed invasion may occur, but also how significant weed invasion can be in undermining areas of native vegetation.

DEWNR considers that the rail corridor would be a major factor in both the spread and introduction of weeds. DEWNR is concerned that the continual disturbance to vegetation along the rail corridor and major transport routes, from dust and transportation of weeds has not been addressed adequately. The CEMP addresses weed management within the hub area, however, it does not indicated how the potential weed spread along the rail corridor would be managed or if the corridor would be regularly monitored.

Weed spread would need to be managed over the life of the project and for as long as the Port is in use.

The draft EIS states that disturbed sites would be rehabilitated immediately. DEWNR would like to see more information on how this would be achieved included in the draft EIS. Disturbed sites would need to be strategically and actively managed to avoid species colonisation (this can be by natives as well as weeds) and dominance by weed species. The remaining native vegetation is a primary concern; the concern being that these areas are not negatively impacted by ongoing activities associated with the development. DEWNR is concerned that once 'construction' is finished the monitoring and 'vigilance' to possible environmental impacts would be reduced.

The CEMP is reasonably thorough in addressing the monitoring measure, reporting regimes and audits for flora; however, DEWNR considers that the risk for weed spread is under estimated.

Specific comments

EIS Chapter / Section	***Page***	***Comment***
7.5.1.1	207	This section states: *"Options for SEB offset are currently being discussed with the NVC and will likely be finalised as part of EIS approval conditions."* Please note, SEB offset discussions with the Native Vegetation Council (NVC) have not occurred. The Native Vegetation Management Unit (as opposed to the NVC) has been asked to provide informal comments on the Native Vegetation Clearance Report; this report does not include SEB options.

		Note: clearance of seagrasses must be included in the SEB calculations.
19.5.2.1	546	This section states that vegetation offsets will be established *post construction*. The *Native Vegetation Act 1991* requires that an SEB offset is established prior to clearance occurring; staging the establishment of the vegetation offset after construction does not meet this legal requirement. Note: rehabilitation of disturbed areas within the project site may not satisfy the requirements for a SEB offset, especially where ongoing disturbance issues are likely to undermine the requirement to achieve a 'net gain', for example the rail corridor. Additionally, consideration must be given to the impacts from nearby developments and activities on any SEB area that is proposed within the vicinity of Point Lowly, this includes the proposed BHP Billiton desalination plant and the Cultana Defence expansion.

THREATENED SPECIES

Specific comments'

EIS Chapter / Section	*Page*	*Comment*
14.3.1.1	399	Recommend adding Subtropical and Temperate Coastal Saltmarsh under the Environmental values.
14.3.3	402-417	Recommend adding the Coastal Saltmarsh community as a Major Habitat, as per previous comments.
Appendix G3 Environmental Weeds		Recommend adding Carrion Flower Orbea variegata (Asclepiadaceae), Dune Onion Weed Trachyandra divaricata (Asphodelaceae) and Solar Fire Ursinia anthemoides (Compositae) to the list, as per previous comments. DEWNR consider that these weeds are more likely to be found here than many of the species on this list, e.g. English Ivy and Scotch Broom. All three are aggressive when established, in particular Carrion Flower, which is a major weed in the Whyalla area

COASTAL ISSUES

General comments

Coastal process/engineering

The key aspects of the draft EIS from a coastal process/ engineering perspective include:

- The construction methodology does not include any dredging (piles would be driven)
- The wave climate for the project location has been modelled (uncalibrated i.e. desk top only). The resulting description of the wave climate appears reasonable (low energy south west to south wave environment. Sheltered from long range swell, predominantly local short period wind waves).
- The area is a predominantly rocky shore line. The draft EIS concludes (based on actual measurement of tidal eddies and modelled predominant wave directions), that any shoreline sediment transport that may be occurring is eastwards along the rocky shore and around the headland to a sandy embayment.
- The proposed abutment does not extend beyond mean low water and therefore the draft EIS argues that there would be little impact on any sediment transport that is occurring.

The draft EIS has adequately described the coastal processes at the project site and has addressed coastal engineering issues, consistent with the Coast Protection Board Policy.

Coastal scenic amenity impact

Consistent with Coast Protection Board Policy, DEWNR seeks to protect coastal environments of high scenic value and in doing so ensure that development does not detract from the aesthetic appearance of the coast. In this regard, DEWNR seeks to ensure the siting and design of development on the coast minimises its impact on the visual amenity of the coast.

DEWNR opposes development that has 'significant' visual impact on coastlines with 'significant' landscape value (in doing so DEWNR has regard to both the visual impact from the land and from the sea).

DEWNR does not oppose this proposal on the grounds of coastal scenic amenity impacts, because this stretch of coast is not considered to have 'significant' landscape value (scenic quality rating discussed below).

Furthermore, the area is already developed, to an extent, for industrial uses (e.g. Santos refinery and jetty) and is identified as being strategically located for the export of bulk minerals and commodities; reducing pressure for ports on more scenic and undeveloped coastal sites along the Eyre Peninsula.

Scenic Amenity Rating

A report produced for DEWNR, 'Coastal Viewscapes of South Australia' by Dr Andrew Lothian 2005, measured and mapped the scenic quality of the South Australian coastline. This project assists in the development of planning policy and the assessment of development applications.

This project identified this area as having a value of 5.0 to 5.9, rated as 'moderate (low end) scenic quality', for land 100 metres inland from the coastline. Land further inland from the 100 metre setback is defined as having 4.0 to 4.9 'low scenic quality' landscape values.

'High' (7.0 -7.9) to 'very high' (8.0 – 8.9) ratings generally apply to iconic, undeveloped and dramatic landscapes (e.g. wide beaches and high cliffs backed by intact coastal vegetation).

Scenic Amenity Impact

The draft EIS visual amenity assessment (Section 9) identifies some 'moderate adverse' visual impacts on 'Local' sensitivities at 5 of the 15 viewpoints selected. For example, the view east from the Stony Point Cuttlefish diver's platform (Viewpoint 3, p274) is likely to be adversely affected by the jetty, notwithstanding the presence of the Santos refinery. However, no viewpoints with 'State' and 'National' significance were indentified and no adverse impacts are expected from the two viewpoints with 'Regional' significance.

There is no view point analysis from out to sea. DEWNR has regard to both the visual impact from the land and from the sea. Nonetheless, as discussed, DEWNR does not oppose this proposal on grounds of coastal scenic amenity impacts.

Further information

The Coast and River Murray Unit within DEWNR can assist with the coastal issues raised in this response. For further information please contact Arron Broom, A/Senior Planner, Coast and River Murray Unit on 8124 4929 or 0411110692.

GROUNDWATER MANAGEMENT

Specific comments

EIS Chapter / Section	*Page*	*Comment*
3.7	101	Permits may also be required for water affecting activities on the subject parcel as described by Volume 2, Caring for Our Resources of the Natural Resources Management Plan for the Eyre Peninsula Natural Resources Management Region, 2009. Section 127(6)(a) of the *Natural Resources Management Act 2004* (NRM Act) provides that it is an offence to undertake any water affecting activities without a permit.
4.6.2.2	116	Re the proposed detention basins, and the management thereof, consideration should be given to the impacts on the groundwater and surface systems of impervious vs. 'leaky' options.
19	540-570	DEWNR would appreciate the opportunity to review the following components of the Environmental Management Plan: 1. Earthworks and erosion and sediment control. 2. Protection of surface water and groundwater. 3. Waste management. 4. Requirements for reporting and auditing.
19.5.1.1	544, 545	This section states that: *"Should groundwater be sourced for construction water supply, appropriate licenses will be obtained prior to use"* It should be noted that a licence is not required to take groundwater. However, a well construction permit is required to construct a water well to then extract water. If a well is required for any purpose with respect to access to groundwater, a well construction permit is required from the DEWNR, as per Section 127 (3) of the NRM Act. Any wells, which are found to exist on the proposed subject land are to be maintained and or appropriately decommissioned as per Section 127 (3) of the NRM Act. The impact of short term and long term extraction of groundwater should be documented, as discussed in this section, for both the Construction and Operational phases. The specific management plan to be developed to protect surface water and groundwater resources should be in the form of a Water Management and Monitoring Plan. The Water Monitoring and Management Plan should consist of: 1. An understanding of the various site water balances.

2. Identification of all monitoring wells, including permit/unit numbers.
3. Identification of all surface water monitoring points.
4. Locality plan showing location of all wells and surface water monitoring points and infrastructure.
5. A comprehensive discussion regarding the risk assessment undertaken and the required actions associated with those potential risks and incorporation into the Monitoring and Management Plan, including adaptive management strategies.
6. List of all parameters monitored and frequency, including water levels and volumes, for all monitoring points.
7. Established trigger levels for all monitored parameters, including water levels and actions to be taken.
8. An outline of reporting and adaptive management for both the Construction phase and the Operational phase.

Spencer Gulf Port Link

Port Bonython EIS Project Team
c/o Arup
Level 7, 182 Victoria Square
Adelaide SA 5001

3 October 2013

Mr Allan Holmes
Chief Executive
Department of Environment, Water and Natural Resources
GPO Box 1047
Adelaide SA 5001

Dear Mr Holmes

Port Bonython Bulk Commodities Export Facility Environmental Impact Statement released for public comment

I am writing to advise that the Environmental Impact Statement (EIS) for the Port Bonython Bulk Commodities Export Facility was released for public comment by the South Australian Government's Department of Planning, Transport and Infrastructure (DPTI) on Thursday 3 October. The public comment period runs until Monday 18 November 2013.

During this time you have the opportunity to view the EIS and make formal comments regarding its content. Please see the enclosed fact sheet for information about where to view the EIS.

Submissions relating to the EIS are to be made to:

Minister for Planning
Attention: Robert Kleeman
General Manager, Assessment (Statutory Planning)
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

Or sent via email to: DPTI.PDPublicSubmissions@sa.gov.au

Written submissions commenting on the EIS are invited until 5pm on Monday 18 November 2013.

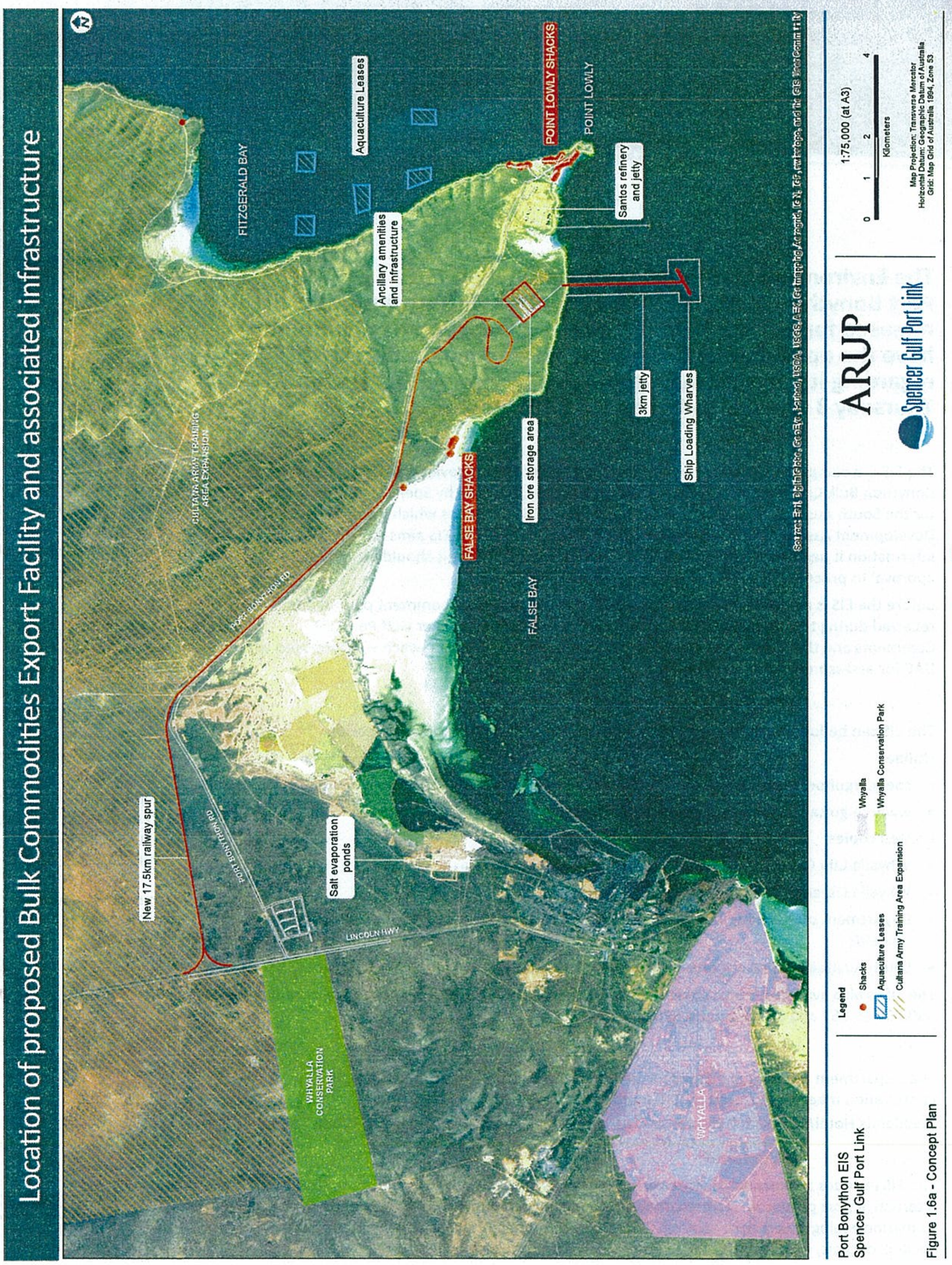
Thank you for your interest in the Port Bonython Bulk Commodities Export Facility.

Yours sincerely

Sean Reardon
General Manager Infrastructure

Encl.

Spencer Gulf Port Link



COPY

For further information

Phone
1800 657 248

Email
eis@spencergulfportlink.com.au

Web
www.spencergulfportlink.com.au

Spencer Gulf Port Link

Spencer Gulf Port Link is seeking environmental approval to progress with the Port Bonython Bulk Commodities Export Facility. This series of fact sheets provides information about the environmental assessment process for the project.

Fact Sheet 7
EIS public comment period

The Environmental Impact Statement (EIS) for the Port Bonython Bulk Commodities Export Facility has been released for public comment. Stakeholders and the community have the opportunity to view the EIS and make submissions regarding its content during the public comment period from Thursday 3 October to Monday 18 November 2013.

About the EIS

The EIS is a comprehensive environmental, social and economic review of the proposed Port Bonython Bulk Commodities Export Facility. It has been prepared by Spencer Gulf Port Link for the South Australian Government in line with the EIS Guidelines which were issued by the Development Assessment Commission (DAC) in August 2012. The EIS aims to give DAC the information it needs to assess the project and determine whether it should be granted approval to proceed.

Before the EIS is assessed by DAC it has been released for a public comment period. Comments received during this period will be reviewed and addressed by Spencer Gulf Port Link. Comments and their responses will be incorporated into the final EIS which will be lodged with DAC for assessment.

Where to view the EIS

The EIS can be found at the following locations during the public comment period:

Online

- spencergulfportlink.com.au
- www.sa.gov.au/planning/majordevelopments

Printed copies

- Whyalla City Council – Civic Building, Darling Terrace, Whyalla
- Whyalla Library – Elkhorn Street, Whyalla
- Department of Planning, Transport and Infrastructure (DPTI) – Level 5, 136 North Terrace, Adelaide
- South Australian State Library – Kintore Avenue, Adelaide

The EIS is also available for purchase from DPTI by contacting 08 8303 0724. Printed copies are $300.00 ex GST and CD copies are $10.00 ex GST.

Public meeting

The Department of Planning, Transport and Infrastructure will be conducting a public consultation meeting on Tuesday 29 October at the Oasis Board Room of the Westlands Hotel/Motel (100 McDouall Stuart Avenue, Whyalla Norrie) from 7.30pm.

What does the EIS contain?

The EIS includes a thorough description of the proposal, the justification for the project and alternative port proposals. It also contains the results of a number of technical studies such as marine ecology, terrestrial ecology, noise and vibration, air quality, visual, landscape, socio-economic, cultural heritage, Native Title, traffic and water quality.

Each technical chapter of the EIS includes:

- A description of the existing environmental conditions.
- An identification of the impacts of the project.
- An assessment of the significance of the identified impacts.
- Recommended actions to avoid, mitigate or manage any impacts.

Making an EIS submission

During the public comment period submissions about the Port Bonython Bulk Commodities Export Facility EIS can be made to the South Australian Government.

Submissions need to include the name, address and signature of the party making the submission, as well as the reasons for the submission.

All submissions should be made in writing and sent to:

Minister for Planning
Attention: Robert Kleeman
General Manager,
Assessment (Statutory Planning)
Department of Planning,
Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

Or sent via email to:
DPTI.PDPublicSubmissions@sa.gov.au

Flinders Port HOLDINGS

sacome
COMMITTED TO COMMUNITY PARTNERSHIPS
SA CHAMBER OF MINES & ENERGY

The quoted page numbers refer to the draft EIS on the Spencer Gulf Link website.

MARINE PARKS

General comments

DEWNR recommends the inclusion of a map showing the zoning in the Upper Spencer Gulf Marine Park in the vicinity of the proposed development.

Specific comments

EIS Chapter / Section	***Page***	***Comments***
3 Legislation and Planning		
3.3.10.1	86	The draft EIS acknowledges the objects of the *Marine Parks Act 2007* and the zoning requirements in the Upper Spencer Gulf Marine Park. However, statements in this section incorrectly suggest that additional special purpose areas might be necessary, even though the development is fully supported by the existing zoning arrangements and special purpose areas. Further, it is suggested that DEWNR has decided that port areas may be excised from marine parks. This is not correct as any boundary amendment that decreases the size of a marine park is subject to disallowance by both Houses of Parliament (s. 10(11) of the Marine Parks Act).
13 Coastal processes and water quality		
13.2.1	369	The National Water Quality Guidelines referred to in the document are considered outdated and in need of revision, particularly for South Australia as the nitrogen levels established for SA in this document have always been too high. It is recommended that the South Australian *Environment Protection (Water Quality) Policy 2003* is referenced instead.
13.3.3	370	The whole risk assessment criteria for the project could be included here (e.g. likelihood criteria as well as significance criteria).
13.4.3.3	380	This section does not account for the cumulative impacts of all the industries now operating in the Upper Spencer Gulf area. It is clear that there are already high nutrient inputs from anthropogenic sources that are contributing to degradation of seagrass in False Bay area and also to the growth of the filamentous *Hincksia sordida* blooms within the cuttlefish

EIS Chapter / Section	***Page***	***Comments***
		aggregation area and the marine park sanctuary zone. The draft EIS needs to clearly state what the total nutrient inputs would be.

Government of South Australia
Department of Further Education, Employment, Science and Technology

Ref: BRIEFC/13/2233

Level 4
City Central Tower One
11 Waymouth St
ADELAIDE SA 5000
GPO Box 320
Adelaide SA 5001
DX542
Tel 08 8226 3821
Fax 08 8226 9533

14 November 2013

Karen Ferguson
Chief Environmental Officer
Assessment Branch
Department of Planning, Transport and Infrastructure
5th Floor
136 North Terrace
ADELAIDE SA 5000

Dear Ms Ferguson

Thank you for your request in October 2013 seeking comment from the Department of Further Education, Employment, Science and Technology's (DFEEST) on the Draft Environmental Impact Statement (EIS) for the proposed Port Bonython Bulk Commodities Export Facility (the Project).

The DFEEST comment relates to Chapter 10 Socio-Economic impact which links with the Department's lead agency role in providing advice and supporting the achievement of targets for skills and employment in South Australia's Strategic Plan.

The draft EIS states from an economic perspective, the construction and operation of the Project is expected to provide economic benefits to the State (forecast to add around $10.2 billion to Gross State Product in the next 30 years, or around $340 million annually) and National (forecast to add around $9 billion to Gross Domestic Product in the next 30 years, or around $300 million annually). The Project would assist in addressing regional unemployment issues in Whyalla, through the creation of a maximum 270 Full Time Equivalent (FTE) jobs during construction and approximately 40 FTE jobs during operation. Additional jobs would be generated through flow on economic benefits in South Australia — 630 jobs during construction and 790 during operation. It is likely that the majority of these jobs will be located in the local Eyre and Northern Statistical Divisions of South Australia.

DFEEST has a critical role in ensuring the region has a labour force with the skills and qualifications to take up the new jobs. The Upper Spencer Gulf was identified as a priority region in the Government's recent Jobs and Skills Policy.

If the proposed Project goes ahead the Skills for Jobs in Regions Program would bring a strong focus on working with Spencer Gulf Port Link, allied industries and local employers to identify and support their skill needs; and helping people to get into jobs and training in their local area particularly the Whyalla Region, within which Port Bonython sits. The Adult

Community Education Program would help low-skilled people to re-engage in learning with pathways to training, further education and employment.

Yours sincerely

Raymond Garrand
CHIEF EXECUTIVE

An Independent Assessment of the EIS for a proposed

Bulk Commodities Export Facility at Port Bonython,

Upper Spencer Gulf, South Australia

[redacted]

This work is dedicated to those who care about environmental protection.

SUMMMARY

The construction of a major port facility at Port Bonython in the Upper Spencer Gulf poses a high pollution risk for the fragile and unique ecosystem of the region. The South Australian Government has the duty of care for this important ecosystem. In the view of the author, this development is not sustainable and in conflict with goals and targets set out in South Australia's Strategic Plan (2011).

With the approval of this project, the risk of future oil spills in the region will be high. This risk can only be mitigated via prevention; that is, the choice of an alternative port location. The author was surprised to see that the proponent has not yet developed specific plans for oil spills, vessel navigation & operations. In the view of the author, these important plans should have been publicly available for comment as part of the EIS process.

The proponent of this project fails to undertake the necessary modelling of possible oil spills in the region. This modelling is required to assess potential environmental risks under different tidal and wind conditions, in particular because of the imminent risk of oil spills directly interfering with the rocky shoreline of the cuttlefish aggregation. Given the high ecologic significance of the region, it is reasonable to demand the conduction of such oil-spill studies, in particular to scientifically evaluate possible levels of inference with coastal habitat (e.g. seabirds and waders), the cuttlefish aggregation, and the Upper Spencer Gulf marine park. This modelling is also essential for the development of a credible Oil Spill Plan.

Because of the reasons outlined above, <u>the author recommends that this proposal be rejected in full</u>. In addition, the author asks the South Australian Government to seriously consider alternative port options that do not bear the high risks of environmental damage to the precious Upper Spencer Gulf ecosystem.

A: Key Points of Criticism

Ecologic Significance of the Upper Spencer Gulf

The upper reaches of Spencer Gulf accommodate an ecologically valuable marine and wetland habitat in a region of extremely slow oceanic flushing (e.g. Kämpf, 2014). Pt. Lowly is outlined as one of four areas in Spencer Gulf that the South Australian Department of Environment and Heritage (DEH) has identified of 'high conservation value" for biodiversity and social values. A marine park has been recently established in the Upper Spencer Gulf for improved protection measures. The iconic and truly unique Giant Australian Cuttlefish mass aggregation in the Pt. Lowly region (**Figure 1**) has experienced a severe population decline in recent years. Specific reasons for this decline are still unknown, but human impacts (e.g. by-catches) cannot be excluded as a potential cause.

Figure 1: The iconic Giant Australian Cuttlefish. Photo credit: Dan Monceaux (danimations)

Lack of Oil-Spill Dispersal Modelling and Management Plans

The infamous 1992 *Era* oil-spill event of 300 tonnes of bunker fuel during berthing operations at Port Bonython during high winds resulted in significant loss of birdlife and mangroves (2.3 ha) (Duke and Burns, 1999). If this project goes ahead, there will be significant increases of the risk

of oil spills – in particular due to collision/grounding of vessels manoeuvring through the narrow "deep-water" channel of the region together with a small under keel clearance.
A major fundamental shortcoming of the EIS is the lack of oil-spill dispersal modelling, which should be a standard requirement for any professional port proposal. <u>The proposal should be rejected based on this fact alone.</u>

Figure 2: Oil spilled by barge Peck Slip after returning to port facility, eastern Puerto Rico, December 1978. Photo credit: M.O. Hayes/Oil-Spill-Info.com. For more information, see http://www.eoearth.org/view/article/159877/

It is made clear in the proposal that major oil spills can be of severe consequences for the ecology of the region. The proponents' EIS (17.4.8 Oil Spills) states that "*An oil or product spill may be considered a significant risk to the environment. The Port will develop an Oil Spill Plan to address this risk, and plans for Vessel Navigation and Operations will be implemented.*" Given the seriousness of this development, that author cannot understand why the proponent was not obliged to develop and publish these important plans as part of the EIS process. Such plans are relevant pieces of information being of high importance for the assessment of the viability of the proposed project. The author recommends that the proponent be asked to make the necessary amendments to the EIS.

In particular, the *Era* oil spill has taught us that oil spills in delicate mangrove systems are difficult to manage and that "doing nothing" could be the best mitigation approach. This approach, however, does not prevent oil-related environmental damage in the Pt. Lowly region, particularly not if oil is directly swept into the nearby rocky shorelines of the cuttlefish aggregation (see **Figure 2** as an example of an oil spill in close vicinity of a coast). The appropriate management decision would be one of risk prevention; that is, to choose an alternative location for the construction of a major port facility.

Non-compliance with South Australia's Strategic Plan?

South Australia's Strategic Plan (2011) includes the two important environmental targets:

- Target 69: Lose no species. Lose no native species as a result of human impacts *(baseline: 2004)*; and
- Target 71: Marine biodiversity. Maintain the health and diversity of South Australia's unique marine environments *(baseline: 2011)*

In the author's view, the construction of the proposed Bulk Commodities Export Facility in the Upper Spencer Gulf, which is an important ecological habitat, is in direct conflict with these targets. While the iconic Giant Australian Cuttlefish population in the Upper Spencer Gulf shows clear warning signals of becoming extinct, the Strategic Plan should oblige the SA Government to halt any industrial developments plans for the region until reasons for this species' decline are scientifically established. Given the massive industrial development plans for the Upper Spencer Gulf, the author has serious doubts about the genuineness of the Strategic Plan.

In the author's view and to protect important environmental resources for future South Australians resources (pristine nature is a key resource for human health), the SA Government's vision of an export corridor of mining products through the Spencer Gulf requires substantial revision. To the end and for the sake of environmental protection, the author recommends that the project be rejected in full and that alternative port options be considered. Alternative options are shipping of mining products from Darwin or the expansion of existing open-ocean ports such as the Port of Thevenard. While this may require dredging operations, such operations cannot be ruled out for the Pt. Lowly region in the long run, given the critically small under keel clearance of fully loaded vessels.

B: Why the Upper Spencer Gulf is so ecologically distinct

The proponents of this EIS extensively refer to BHP Billiton's "Olympic Dam Expansion" documentation, but not to previous serious concerns that were raised by independent scientists including the author (e.g. Kämpf et al., 2009, Kämpf, 2010). The approval of this project should not be taken for granted just because of BHP Billiton's apparent "success". Hence, it is reasonable to outline the key scientific reasons why the Upper Spencer Gulf is ecologically so different when compared with other estuaries and why this region deserves the highest possible environmental protection.

Spencer Gulf is one of the few large inverse estuaries that exist on Earth (e.g., Kämpf, 2014). The resultant hypersaline environment together with reduced exposure to ocean storm waves and the existence of intertidal zones in its upper reaches creates an ideal climate for the establishment of extensive seagrass beds and mangrove swamps, that, in turn, provide ideal breeding and feeding habitats of native birds and marine different marine life forms (see BHP Billion documentation).

Another important aspect for marine life cycles is the mean (non-tidal) water circulation in a region. This circulation, for instance, determines the spatial spread (dispersal) of marine species in their larval stage and, hence, the physical connectivity within a marine system. A sluggish mean circulation implies the formation of *stagnation zones* that are more vulnerable to pollution than other, more rapidly flushed regions.

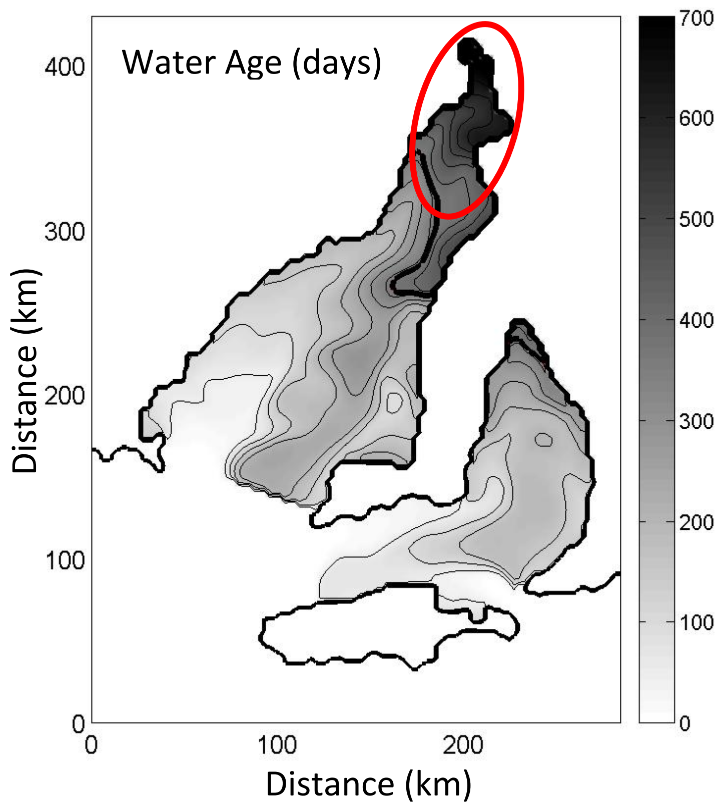


Figure 3: Simulated distribution of water age (days) for South Australian gulfs. Thick lines highlight the 1-year value. The ellipse indicates the slow-flushing zone of the Upper Spencer Gulf including Port Bonython. From Kämpf et al. (2009).

Water age is a scientific concept used to determine the locations of such stagnation zones. The age of water is predicted with reference to a region of zero age using a simple advection-diffusion equation with an additional ageing term (Deleersnijder *et al.*, 2001) coupled to a hydrodynamic circulation model. An equilibrium distribution of water ages can establish in a semi-enclosed sea reflecting a balance between ageing of water and entrainment of younger ambient water. Sandery and Kämpf (2007) and Kämpf *et al.* (2009) derived water-age distributions for Bass Strait (Victoria) and South Australian gulfs (**Figure 3**).

Owing to its vast length (~300km), Spencer Gulf displays two different flushing regimes (**Figure 3**). The lower portion of the gulf is flushed by ambient shelf water on an annual basis (i.e. resultant water ages are less than a year). In contrast, the Upper Spencer Gulf is flushed at a slower rate and displays water ages exceeding one year. To demonstrate the significance of these timescales it is worth to image an open channel of the same length as Spencer Gulf and being exposed to a uniform water flow of 10-20 cm/s (typical speed of mean ocean currents). The maximum water age at the exit of such a channel would range between 17 and 34 days. Water ages in Upper Spencer Gulf exceed this reference value by more than one order of magnitude!

Indeed and owing to negligible continental runoff, water salinity and water age are strongly correlated in South Australian gulfs (**Figure 4**), simply because rapidly flushed regions are more diluted with lower-salinity water of shelf origin. Hence, in Spencer Gulf, there is a strong connection between the location of hypersaline environments including their ecology and the mean oceanic circulation. On the other hand, it is the slow flushing of the Upper Spencer Gulf that helps the Giant Australian Cuttlefish population to stay in the same region without being washed away by mean currents (Kämpf et al., 2009).

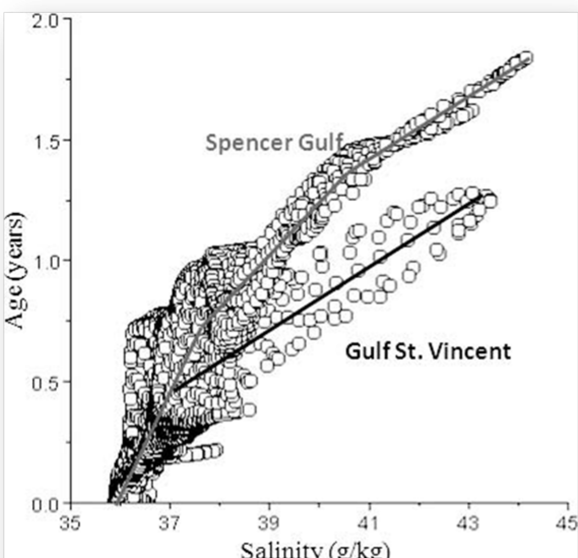


Figure 4: Relationship between water age (days) and salinity for South Australian gulfs. From Kämpf et al. (2010).

In terms of pollution risks, it is obvious that the <u>upper reaches of South Australian gulfs are considerably more vulnerable to (industrial and other) pollution than any other region within the</u>

gulfs. Shepherd (1983) concluded that the far northern section of the Spencer Gulf ecosystem is already under stress owing to the high salinity and temperature fluctuations, and explicitly states that “additional stress, such as effluent discharges, may have more serious consequences than in less stressed environments further to the south”.

Similar to BHP Billiton’s approach in the past, the proponent of this EIS has largely ignored this fundamental scientific knowledge. This is another and ultimate opportunity for decision makers to prevent natural destruction of important South Australian natural habitat of regional, national and international significance.

References*

Deleersnijder, E., J.M. Campin and E.J.M. Delhez, 2001. The concept of age in marine modelling I. Theory and preliminary modelling results. J. Marine Systems 28, 229-267.

Kämpf, J., C. Brokensha, and T. Bolton, 2009. Hindcasts of the fate of desalination brine in large inverse estuaries: Spencer Gulf and Gulf St. Vincent, South Australia. Desalination and Water Treatment, 2, 325-333.

Kämpf, J., J. Harris, P. Malthouse, 2009. An Independent Expert Assessment of BHP Billiton’s Draft Environmental Impact Statement Regarding Constructions and Operations of a Seawater Desalination Plant and a Landing Facility in Upper Spencer Gulf. Report prepared for Spencer Gulf and West Coast Prawn Fishermen's Association as part of their public consultation submission, 35 pp.

Kämpf, J., N. Payne and P. Malthouse, 2010. The marine connectivity in a large inverse estuary. Journal of Coastal Research, 26(6), 1047-1056, doi: 10.2112/JCOASTRES-D-10-00043.1

Kämpf, J. 2011. Expert assessment of marine impacts of the proposed Olympic Dam expansion with references to the draft and supplementary Environmental Impact Statements prepared by BHP Billiton. Report prepared for Spencer Gulf and West Coast Prawn Fishermen's Association, 9 pages.

Kämpf, J., 2014. South Australia’s Large Inverse Estuaries - On the Road to Ruin. Chapter 7 in “Australian Estuaries in 2050 and Beyond”, edited by E. Wolanski, Springer, Heidelberg.

Duke, N.C., and K.A. Burns, 1999. Fate and effects of oil and dispersed oil on mangrove ecosystems in Australia. Final report to the Australian Petroleum Production and Exploration Association, Australian Institute of Marine Science and CRC Reef Research Centre,

Sandery, P.A., and J. Kämpf, 2007. Transport timescales for identifying seasonal variation in Bass Strait, south-eastern Australia. Estuarine, Coastal Shelf Sci., 74 (4), 684-696.

Shepherd, S. A., 1983. The epifauna of megaripples: species' adaptations and population responses to disturbance SO: Austral Ecology, Vol. 8 (No. 1), p. 3-8. DOI: 10.1111/j.1442-9993.1983.tb01513.x

**Copies of the author’s papers/reports are available on request.*

Vision: We look after our natural environment

South Australia has a reputation as a clean and green destination and producer. To maintain our reputation and secure the enjoyment and far reaching benefits of these assets into the future, including for those whose livelihoods depend on them, we must adopt sustainable management practices and contribute to conservation activities.

[…]

We recognise and respect the beauty and fragility of our wildlife and natural surrounds. Our biological diversity sustains our state's natural resources. We need to maintain the health and diversity of both our land and water habitats so that we don't lose any more precious species through human impact.

[…]

Goal: We look after our land, rivers and wetlands.

Target 69: Lose no species
Lose no native species as a result of human impacts *(baseline: 2004)*

[…]

Goal: We care for our oceans, coasts and marine environments.

Target 71: Marine biodiversity
Maintain the health and diversity of South Australia's unique marine environments *(baseline: 2011)*

[redacted]

Response to Port Bonython Bulk Commodities Export Port Facility EIS

Prior to moving to Adelaide, I have lived in Whyalla for 37 years and during that time I have been a member of the Whyalla City Council and in 2008 was Citizen of the Year. For many years, I was either secretary or chairman of Council's False Bay/Fitzgerald Bay Management Committee. My profession is teaching, specializing in Senior High School Geography and Biology.

This whole process is flawed from the start, because there has not been a genuine attempt to consider all of the options for locating a new export related port on upper Eyre Peninsula. From the start, the government has focused on just one site and has absolutely refused to do the analysis required to select the best site. That blinkered approach has then limited the proponent to planning to use the Point Lowly site. Members of the Whyalla community, who are extremely experienced engineers and logistics professionals, have repeatedly tried to engage the government and Flinders Ports in dialogue on this issue, but have been largely rebuffed. I feel confident that in the long term that they will be proven to be right. Already we have three proposals for iron ore export ports on the eastern coast, when just one should be built to get the economies of scale required to keep the mining industry competitive. This is a failure on the part of government to recognize that more ports require more capital expenditure to be spread over the same export tonnage, thereby adding to the cost per tonne for every tonne exported.

People who have never lived in Whyalla for some time have ABSOLUTELY NO IDEA of how important the Point Lowly Peninsula is for recreation for Whyalla residents. They look at a map which shows coastline extending north and south of the city and assume that residents have access to beaches in a similar manner to people living in Adelaide. Nothing could be further from the truth. To the south for nearly 100 km the coast is mangroves and shallow water. To the north the coast is False Bay,a wide shallow bay, much of which is under the control of One Steel. The beaches at Point Lowly are without doubt the best beaches within 120 km of Whyalla. Add to that the rocky section of beach between Black Point and Stony Point is important for local Cuttlefish tourism and recreational snapper fishing and you might begin to understand why locals want to keep all of the area in public ownership. We lost a wonderful beach and recreation area at Weeroona Bay when the SANTOS plant was built and this has been keenly felt in the community. The industrialization of another section of that coast when there is a better option available to the south of the city is unforgivable.

The EIS conveniently glosses over the importance of the area to local residents, by failing to assess its importance to them.

I shall not pass this way again, any good thing I can do or any kindness that I can show, let me do it now, for I shall not pass this way again.

"While the number of people who use Point Lowly and surrounds to recreate has not been able to be quantified, it is expected that recreation in the area improves the health and wellbeing of people who use it." Pg 320
How can you have a socio-economic impact study which does not try to quantify and analyse the reasons that people visit Point Lowly? My Yer 12 students were able to get a snap shot of that back in the early 1980's by doing roadside interviews of visitors. If Year 12's can organize to do this, how is it that a professional consulting firm cannot do at least that much? Why, because they might actually find out how much locals actually value the area.

So far as shipping movements and their impact is concerned. I note the following from Chapter 13 Coastal Processes.

"The highest settling time was found to occur at the wharf with an estimated 12-24 hours required for the suspended material" pg 388
As the number of shipping movements is suggested to be 277 per year, ie 544 total movements it is reasonable to assume that there will be a shipping movement on almost every day of the year. As a result the suspended sediments will be re-suspended with every movement and there will be no effective settling out of sediment. How far this material will drift and what its impact will be seems to have been ignored. I also note that no attempt was made to actually observe the amount of sediment movement caused by a fully laden Cape vessel and that modeling is the basis of this report rather than empirical data. At minimum, observational data could have been obtained by following outgoing Cape vessels carrying ore for Arrium.
This points to an unwillingness to actually quantify the effect of many shipping movements in the shallow water sections of the gulf that the Cape vessels using the loading facility.

The most charitable conclusion that I can reach is that the decision making in this process has already been done and field work which might have come up with on-convenient answers has been avoided.

The saddest thing is that there is a better location south of town, with large amounts of low value flat land on which construction would be easier than at Point Lowly. That site would produce the same economic benefits for Whyalla, without impacting on the Point lowly Peninsula. It would have access to a large body of water more than 20 metres deep and is south of much of the shoal water. It also has the advantage of being closer to many of the existing and proposed mines and is only a small extra distance for ore coming from the north.

[redacted]

[redacted] 2013

PS the Map Figure 2 of the Executive Summary is wrong. The area of the Whyalla Conservation Park shown is that of pre 2001. I know because I negotiated a doubling in the size of the park in 2001. Simple errors like that cause me to have doubts about the whole EIS.

I shall not pass this way again, any good thing I can do or any kindness that I can show, let me do it now, for I shall not pass this way again.

SPENCER GULF & WEST COAST PRAWN FISHERMEN'S ASSOC. INC.

Harvesting with Care in the State of South Australia

15 November 2013

Minister for Planning
Attention: Robert Kleeman, General Manager,
Assessment (Statutory Planning)
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

Dear Hon. Rau,

I am writing on behalf of the Spencer Gulf and West Coast Prawn Fishermen's Association to provide a submission (attached) on the proposed Port Bonython Bulk Commodities Export Facility's Environmental Impact Statement. The Association supports economic development in the state that adhere to the principles of sustainability, responsibility and credibility. As with fisheries management; development should consider the values underpinning ecosystem based management practices.

In planning for South Australia's future the State Government needs to consider the balance between current and future resource uses of the Spencer Gulf. There are currently several formal and informal proposals for deep sea ports in the Spencer Gulf. The associated increase in infrastructure development and activity adjacent to and within the marine environment has the potential to impact significantly on current activities, including fishing.

The Association would like the State Government to develop an outline of a 'marine plan' that identifies ecological, industrial and social uses of the system which can be used to evaluate the balance between proposed alternative uses. It would be beneficial if the plan also identified the future transport requirements and appropriate location(s) options with due consideration given to the natural resource and natural resource users for developing one major port against multiple ports. The current publication of formal and informal proposals raises concern over the long term planning for infrastructure and transport in South Australia.

The Association, in the attached submission, has highlighted concerns that the EIS has a lack of supporting evidence and modeling of risks that were simply dismissed or described as minimal. As such it provides recommendations for monitoring to ensure impacts can be evaluated and modified if required.

Please contact me if you have any further questions.

[redacted]

A submission on the Port Bonython Bulk Commodities Export Facility (BCEF) Environmental Impact Statement (EIS) in relation to potential environmental impacts on the Spencer Gulf Prawn Fishery

This submission has been prepared by the Spencer Gulf & West Coast Prawn Fishermen's Association (the Association). The Association maintains a consistent position with regard to development in the Spencer Gulf. Like all businesses, and especially the fishing industry, the Association considers sustainability, responsibility and credibility to be important factors in business growth.

Following is our review of the EIS related to impacts from the proposal and its potential impact on the region's multimillion dollar fishing industry arising from the construction, operation and associated traffic from the proposal.

This document will provide a brief background on the Spencer Gulf fishery, followed by a review of the EIS document. The Association are of the opinion that the quality of the report is concerning given the inconsistent cross referencing, omissions and incorrect taxonomic references to species in the gulf. There also appears to be a lack of modelling to support the assessment of risks associated with the dispersal of sediment in the area through either construction or operations with shipping traffic.

Background

The upper Spencer Gulf supports a major fishery for the western king prawn. Specific concerns for the Spencer Gulf prawn industry the proposed BCEF include the following potential environmental impacts:

- Damage/loss of adult western king prawn habitat
- Damage/loss of juvenile western king prawn habitat
- Displacement of western king prawns from the area
- Introduction of diseases (and other pest species) to the western king prawn population and critical habitats
- Alteration of ecosystem processes in Upper Spencer Gulf that are relevant to the sustainability of the western king prawn fishery

From the perspective of the Spencer Gulf prawn fishery, the EIS fails to evaluate the potential risks on western king prawns population.

Location of the proposed BCEF and importance to western king prawns

The proposed BCEF will be constructed in an area that has a range of intertidal and subtidal habitats (P408-412, BCEF EIS), with some of these being of importance to western king prawns. The Spencer Gulf prawn fishery has a 46 year history of fishing in the region. For many years the grounds surrounding Point Lowly and further north encompassed the fishing grounds. Recently through technological improvements and improved practices the fishery has modified their fishing grounds and activity, moving south from Point Lowly. Although there has been little fishing directly in this region in recent history, the grounds are an important component of the stock assessment area.

The stock assessment surveys, which include the Point Lowly area, are a critical component of assessing and managing the fishery. The fishery has a long term program which involves surveying various established locations in the gulf to evaluate the stock available, which contributes towards its internationally recognised Real Time Management. The surveys are used to establishing the harvest and fishing strategies for this fleet.

There are established survey locations within the vicinity of the development with one site approximately 0.6 nm from the end of the proposed wharf. These survey shots indicate a high biomass of western king prawns in the region. The area is known to have a relatively high biomass of western prawns, which is demonstrated through the catch rates, which fall between 9 to 18 lb/min of prawns of mixed age classes, with a historic average of 10.8lb/min (of which approximately 4.5 lb/min is adult prawns), which ranks among the highest catch rates in the gulf. This demonstrates the importance of this area as grow out and recruitment grounds.

Additionally, the intertidal area in the adjacent False Bay is recognised as a major nursery area for juvenile western king prawns in Upper Spencer Gulf (Bryars 2003, Carrick 2003, Roberts et al. 2010). The significance as a nursery area of the sandy intertidal areas closer to the proposed BCEF (including Weeroona Bay) is unknown; however the size of this area is minor in comparison to False Bay (see Bryars 2003). However, the localised area of the proposed BCEF is an important habitat for western king prawns, and the intertidal habitats and functioning of the broader ecosystem in Upper Spencer Gulf are critical to western king prawns. The BCEF EIS fails to recognise the importance of the area to western king prawns and in turn the prawn fishery.

Construction phase risks

Activities occurring during construction of the jetty/wharf that could potentially impact the marine environment (and which are addressed in the BCEF EIS) are discussed here in relation to the western king prawn:

- **Pile driving causing disturbance of seabed and increased turbidity in the area:** The potential impact of increased turbidity on the ecosystem and local habitats is downplayed somewhat in the BCEF EIS and with a lack of data (and modelling) to enable accurate predictions, the real impacts will not be known until construction commences. If western king prawns in the area are negatively impacted by turbidity they could potentially be forced to move away during high turbidity events, thus displacing them from habitat and affecting their activity patterns, thus impacting on the fishery.

- **Boat movements and propeller wash causing disturbance of seabed and increased turbidity in the area:** As with pile driving, the BCEF EIS indicates that turbidity effects on the marine environment from boat movements and propeller wash will be minimal (without supporting evidence). If western king prawns in the area are negatively impacted by turbidity they could potentially be forced to move away during high turbidity events, thus displacing them from habitat and affecting their activity patterns.
- **Oil spills causing damage to intertidal juvenile western king prawn habitats away from the area:** While the risk of an oil spill was recognised as being a significant threat, it was considered in the BCEF EIS to be unlikely due to appropriate management and mitigation measures (e.g. P447, BCEF EIS). However, there are several issues around the proposed management and mitigation of oil spills (see section on Oil Spills later). The risk of a major spill may be lower during the construction phase than the operational phase (see below) due to the smaller vessel sizes and amount of traffic. If a major spill were to occur it could have a significant impact on the western king prawn population if it moved ashore in False Bay which is an important nursery area, or indeed other intertidal areas in Upper Spencer Gulf.
- **Increased noise affecting western king prawns:** Increased underwater noise levels will occur during piling operations (BCEF EIS) and could potentially affect western king prawns in the local area; if western king prawns are affected by noise they could potentially be forced to move away, thus displacing them from suitable habitat and affecting their normal activity patterns.

Operational phase risks

A number of activities or issues during the operational phase that could potentially impact the marine environment (and which is addressed in the BCEF EIS) are discussed here in relation to the western king prawn:

- **Oil spills causing damage to intertidal juvenile western king prawn habitat away from site:** While the risk of an oil spill was recognised as being a significant threat, it was considered to be unlikely due to appropriate management and mitigation measures (e.g. P447, BCEF EIS). If a major spill were to occur it could have a significant impact on the western king prawn population if it moved ashore in False Bay which is an important nursery area, or indeed other intertidal areas in Upper Spencer Gulf. It is anticipated that best practice procedures will reduce the likelihood of such an event occurring. However, there are several issues around the proposed management and mitigation of oil spills (see section on Oil Spills later).
- **Increased shipping traffic leading to introduction of marine pest species:** While the introduction of invasive pest species was recognised as a serious threat to the marine environment, the BCEF EIS argued that best practice procedures and guidelines would reduce the likelihood of such an event occurring. Importantly, there will be no dumping or exchange of ballast water at the BCEF site (P444, BCEF EIS). The most damaging invasive species for the western king prawn would most likely be some form of disease (see Roberts et al. 2010).

- While a monitoring program for marine pests was recommended (P450, BCEF EIS), it appears to be somewhat limited in scope (e.g. annual monitoring and only in the immediate vicinity of the proposed BCEF). There is merit in monitoring away from the proposed BCEF site and for testing the western king prawn for introduced diseases (see later section on proposed monitoring).
- In addition, it is unclear to what extent the expected increase in shipping traffic may increase the chance of a pest incursion; e.g. are there data available on this assumed correlation from elsewhere?
- **Increased noise affecting western king prawns:** Increased underwater noise will occur due to increased shipping traffic; however, the BCEF EIS argues that similar vessels already operate in the region and that the new traffic will not be introducing a new type of noise. Again, if western king prawns in the area are affected by the change in noise levels they could potentially be forced to move away during high noise events, thus displacing them from habitat and affecting their activity patterns.
- **Increased shipping traffic causing disturbance of seabed and increased turbidity in the shipping channel:** An increase in shipping activity will result in an increase in seabed disturbance and turbidity. However, while the BCEF EIS considered that the impact on subtidal habitats would be minimal, there are no references or scientific evidence provided to support this claim; is there evidence that can be provided to support this risk assessment? Again, if western king prawns in the area are affected by disturbance and turbidity they could potentially be forced to move away, thus displacing them from habitat and affecting their activity patterns.

Environmental Management Plan

The BCEF EIS outlines a draft Environmental Management Plan (EMP) that includes management actions related to various issues including marine fauna, marine water quality, marine pests and marine noise. While it is acknowledged that the EMP is a draft and that a more detailed EMP will be prepared by the appointed contractor (P541, BCEF EIS), there are issues of consistency with the EMP and the rest of the BCEF EIS, and in its current form the EMP is inadequate (e.g. see section later on oil spills).

The BCEF EIS also lists the following items under the Environmental Management System (EMS) for Flinders Ports who will operate the BCEF (P48, BCEF EIS):

- Ballast water management
- Emergency response plans
- Loading and unloading of ships
- Stormwater management
- Oil spill response
- Waste controls

If an adequate EMP and EMS are strictly adhered to then the risk of significant impacts on the marine environment (and thus on the western king prawn) should be substantially reduced. However, it is critical that the finalised EMP addresses all issues adequately and that the performance of the EMP is audited in some way; will there be auditing of the EMP and EMS?

Oil Spills

The dispersion of information across chapters, incorrect cross-referencing between chapters and inadequate or incorrect referencing of sources in the BCEF EIS makes it very difficult to understand how the risks associated with a major oil spill have been assessed and mitigated. It becomes even more concerning when there are also important discrepancies in the content between different sections.

Sections 13.5.4.4 and 14.4.3.6 (the latter referring to Chapter 17) state that oil spill contingency plans are in place for Port Bonython. Section 13.5.4.4 cites the plan as "AGC (1988a,b)", but the reference list contains only an (duplicated) entry for a report AGC (1989), *Whyalla Investment Park, Declaration of Environmental Factors*, which doesn't seem to be the right report. Section 14.2.1 refers to an Oil Spill Contingency Plan prepared for Santos in 1998 as an information source for the overall EIS but again this document is included in the reference list and does not appear to be readily available e.g. via a web search. It is hoped that the Santos oil spill contingency plan was developed in 1998 and not 1988 or 1989 (i.e. before the 'Era' spill). The 'Era' spill was 300 t which is 30 times greater than covered by a Tier 1 spill that Flinders Ports has the equipment to handle (Section 13.5.4.4). There is no mention of how the Santos plan or any other plan/approach would deal with Tier 2/3 spills such as the 'Era'. Section 14.4.3.6 states that certainly the lessons of the 'Era' spill have been taken on board and procedures improved to prevent a similar incident from occurring (there is a reference to Chapter 17 regarding the 'Era' but no such information in that Chapter) but there is little to inspire confidence in that statement.

Sections 13.5.4.4 and 14.4.3.6 state that the proposed BCEF will operate under the Santos plan but on redirection to Sections 17.4.8 and 17.5.5 it is indicated that an oil spill contingency plan has yet to be developed. Then there is a reference in Section 17.5.5 to cleanup in accordance with the "Flinders Ports oil spill management plan", which assumedly means the Flinders Ports Oil Spill Contingency Plan (FPOSCP). The reference list does not contain this or any other oil spill management plan.

The FPOSCP currently covers only the existing ports and confirms that it is geared to handle spills of up to 10 tonnes, with larger spills requiring the assistance of regional, state or national resources. The FPOSCP refers to the South Australian Marine Spill Contingency Action Plan (SAMSCAP), which according to the AMSA website is currently being revised. The plan is briefly mentioned in Section 13.5.4.4 but there is no indication of how it may contribute to oil spill response and no mention of this document or anything else of direct relevance to oil spills in Section 17.3 which purports to show the policy and legislative context for key risks.

Section 14.4.3.5 ("Aquaculture and Fisheries") acknowledges that aquaculture could be impacted by a large oil spill but makes no mention of western king prawns or any other fisheries. Carrick (1996) refers to the impact of oil spills having a significantly negative impact on prawn recruits.

Overall, the poorly referenced, widely dispersed, inconsistent and incomplete information provided by the BCEF EIS does little to inspire confidence in the statement about the lessons learnt from the 'Era' spill. The reader is redirected all over the document, with a number of dead ends, to be told both that an oil spill contingency plan is in place, but also that it is currently being developed. There are unreferenced or incorrectly referenced mentions of a Santos plan but the date is ambiguous (spanning a decade and bracketing the 'Era' spill). There is an unreferenced, misnamed mention of an existing plan that covers only existing ports and for spills only about 3% the size of the 'Era' spill. There is only a brief mention of the relevant SA policy context that is probably critical to the handling of spills greater than 10 tonnes. There is no specific mention of oil spills in the EMP.

Specific questions and issues that should be addressed by the Supplementary EIS include:

- Clarity over the status of the oil spill response/contingency plan for the new port
- Is the Santos oil spill contingency plan publicly available?
- How will Tier 2/3 spills be addressed?
- Does the plan provide for high wind situations such as the 25 knot winds that prevented containment booms from being used to manage the 'Era' spill (AMSA 2005)?
- How will the cleanup of relatively inaccessible and delicate areas such as mangroves be addressed, given the difficulties faced near Port Pirie after the 'Era' spill (AMSA 2005)?
- Is the oil spill response training audited? Are the reports, including historic reports, publicly available?
- Given that strong north-westerly winds pushed the 'Era' oil slick to Port Pirie, could easterlies push a slick into False Bay?

Additional monitoring

The tidal flats in Upper Spencer Gulf (including False Bay) are a key nursery area for juvenile western king prawns. The BCEF EIS indicates that the proposed development will have no negative impacts on commercial fisheries, including the western king prawn fishery. In order to help demonstrate that the development has no long-term impact on western king prawns (and the fishery) the following sampling is recommended for inclusion in a marine monitoring program:

- **Abundance of juvenile western king prawns at sites within False Bay and comparable sites away from the region:** Long-term data are available, including 2009 (Roberts et al. 2010), 2012 and 2013 (C. Noell, SARDI, pers.comm.). Further surveys should be conducted before, during and after construction of the Port Bonython BCEF.
- **Disease status of juvenile western king prawns at sites within False Bay and comparable sites away from the region:** A survey was conducted in 2009 and found western king prawns to be free of key pathogenic (and notifiable) viruses (Roberts et al. 2010). New surveys should be conducted before, during and after construction of the Port Bonython BCEF.
- **Presence of invasive pest species at juvenile western king prawn nursery sites within False Bay and at comparable sites away from the region:** A survey was conducted in 2009 and found no marine pest species (Roberts et al. 2010). Ongoing surveys should be conducted before, during and after construction of the Port Bonython BCEF.
- **Abundance of recruit and adult western king prawns within the vicinity of the proposed wharf and channel to landing:** There is a data set available that establishes the biomass of western king prawns in the area. There should be a monitoring program by the proponents during the construction of the facility and periodically through its operation, which should be implemented according to changes in shipping traffic volume or changes in vessel type, to evaluate impact on the areas biomass.

Other specific points requiring attention in the BCEF EIS

The following points should be addressed by the Supplementary EIS:

- P411-412: when discussing sandy or sand/silt subtidal habitats there is currently no mention of the western king prawn which is a critical component of this ecosystem.
- P413: the tropical affinities of the Upper Spencer Gulf are discussed yet there is no mention of the western king prawn, *Melicertus latisulcatus* (or indeed other relict tropical/sub-tropical species such as the blue swimmer crab, *Portunus armatus*, and the grey mangrove, *Avicennia marina*) (see Bryars and Adams 1999).
- P445: commercial fisheries are mentioned yet there is no mention of the loss of some subtidal soft sediment habitat that may be utilised by the regionally-important western king prawn.
- P445: While the risk may be low, there is no mention that a major oil spill could impact the intertidal sandy habitats of Upper Spencer Gulf (including False Bay) which are important juvenile nursery areas for the western king prawn (see Roberts et al. 2010). While mangroves and seagrass are mentioned (P445), it is the sandy intertidal habitat which is critical for juvenile western king prawns.
- A large social and resource allocation issue is not addressed in the EIS which is the increase in shipping traffic. It is evident that the amount of shipping traffic in the region will increase significantly once the BCEF is operational; currently there are around 25 vessel calls per annum to Port Bonython, but this may increase to around 277 if the proposed BCEF reaches full capacity (P383, BCEF EIS). This will be an issue for the Spencer Gulf prawn fleet in terms of a navigational hazard where the shipping channels and designated anchorages overlap with fishing grounds. While traffic hazards on land are covered in Chapter 8 (Transport) and Chapter 19 (Environmental Management Plan) of the BCEF EIS, traffic hazards at sea are not. How will this issue be addressed?

Quality of the report

Examples of inaccuracies and errors that lower confidence in the BCEF EIS and the ability of the proponents to undertake robust monitoring include the following:

- the list of dominant seagrasses in Northern Spencer Gulf does not include *Posidonia australis*, the dominant species in nearshore waters (14.3.3.1)
- The turfing algal species *Gigartina brachiata* that is dominant in shallow depths at Port Bonython hardly rating a mention
- a common species such as *Scaberia agardhii* is spelt in 3-4 different ways through the document
- An apparent unawareness of taxonomic changes, e.g with some very common fish species being referred to by names that are out of date by three decades, and an apparent unawareness that *Heterozostera tasmanica* and *H. nigricaulis* refer to the same species (14.4.2.3 (iii))
- Reference to a species that has never been recorded outside of a small area of north-west WA that looks a bit like a local species, and to *Haliotis rubra* which is not found in northern Spencer Gulf (Appendix K1)
- Many, many species names mispelt, misformatted, outdated or otherwise incorrect, e.g. at least half a dozen errors on the first page of Appendix K2 alone

- *Platysiphonia mutabilis* stated to occur only westward of the SA Gulfs but is widely distributed through the eastern states and New Zealand (14.4.3.9).

Conclusion

The BCEF EIS addressed a range of potential environmental impacts, with many of the marine based impacts relevant to the western king prawn. However, the BCEF EIS had a deliberate focus on listed protected/threatened species and the giant Australian cuttlefish aggregation at Point Lowly. The BCEF EIS made only brief mention of the western king prawn and the importance of the Spencer Gulf western king prawn fishery. The BCEF EIS indicates that impacts on the marine environment (and thus western king prawns) from the proposed BCEF will be minimal; however, this conclusion is mainly based on qualitative risk assessment and proposed mitigation measures.

The main ongoing risks to the western king prawn industry from the proposed BCEF appear to be from (1) potential major oil spills during shipping operations which could have negative impacts on intertidal juvenile western king prawn habitat, (2) introduction of invasive pest species and disease from shipping operations which could impact on the health of western king prawns or critical habitat, (3) potential displacement of prawns from habitat pre and post construction which may lead to poor recruitment or cost to the industry to modify its assessment practices, and (4) the impact of increased shipping traffic in the gulf. It is expected that the supplementary EIS and proposed EMP will address these concerns and questions (and other concerns raised in the current submission) with far greater clarity and assurance.

References

AMSA (2005) Major oil spills in Australia. Era, Port Bonython, South Australia, 30 August 1992. Australian Maritime Safety Authority, viewed 2013, http://www.amsa.gov.au/environment/major-historical-incidents/Era/index.asp

Bryars, S. (2013) Independent review of the Port Bonython Bulk Commodities Export Facility (BCEF) Environmental Impact Statement (EIS) in relation to negative environmental impacts on the Spencer Gulf Prawn Fishery. Confidential report prepared for the Spencer Gulf and West Coast Prawn Fishermen's Association. Dr Simon Richard Bryars, Adelaide.

Bryars, S. (2003) 'An Inventory of Important Coastal Fisheries Habitats in South Australia.' Fish Habitat Program, (Primary Industries and Resources South Australia: Adelaide)

Bryars, S.R. and Adams, M. (1999) An allozyme study of the blue swimmer crab, *Portunus pelagicus* (Crustacea: Portunidae), in Australia: stock delineation in southern Australia and evidence for a cryptic species in northern waters. *Marine and Freshwater Research*. 50(1): 15-26.

Carrick, N.A. (1996) Key factors which affect prawn recruitment and implications to harvesting prawn stocks. Final report FRDC 91/3.

Carrick, N. A. (2003) Spencer Gulf Prawn (*Melicertus latisulcatus*) Fishery, Fishery Assessment Report to Department of Primary Industries and Resources of South Australia (PIRSA), Adelaide. South Australian Research and Development Institute (SARDI) Aquatic Sciences, SARDI Publication No. RD03/0079-2, SARDI, Adelaide.

Currie, D.R., Dixon, C.D., Roberts, S.D., Hooper, G.E., Sorokin, S.J. and Ward, T.M. (2009) *Fishery-independent by-catch survey to inform risk assessment of the Spencer Gulf Prawn Trawl Fishery*. Report to PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2009/000369-1. SARDI Research Report Series No. 390

Port Bonython Bulk Commodities Export Facility Environmental Impact Statement (2013) Spencer Gulf Port Link Port Bonython EIS Project Team, Adelaide (http://www.spencergulfportlink.com.au).

Roberts, S.D., Deveney, M. and Sierp, M. (2010) Biosecurity and disease status of prawn nurseries in South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000593-1. SARDI Research Report Series No. 449. 35p.

[redacted]

15th November, 2013.

SUBMISSION-EIS on the PORT BONYTHONBULK EXPORT FACILITY PROPOSAL

Minister for Planning

Attention : Mr Robert Kleeman

General Manager, Assessment, Statutory Planning

Roma Mitchell House

GPO BOX 1815

ADELAIDE SA 5000. e mail : dpti.pdsubmissions@sa.gov.au

Dear Sir,

Submission - Port Bonython Bulk Commodity Export Facility

Draft Environmental Impact Statement- Sept 2013

I am a member of the Alternative Port Working Party (APWP), a group of concerned professional Whyalla residents. I am a retired engineer, having lived in Whyalla for 51 years with over 30 years experience in local process engineering and environmental control .

The APWP strongly supports industrial development at Whyalla, but believes it should be developed in areas where it has the best chance to be competitive and does not detract from the liveability of Whyalla region. Such areas exist at or in close proximity to the city and by conserving the Lowly Peninsula for recreation and tourism, we believe we can have the "Best of Both".

I have reviewed Chapters 1, 13, & 18. as well as Appendices D, J1 & J2. and I attach my submission in respect to these sections.

The review of this draft document reinforces my strong belief that a port located at a much less constrained site south of Whyalla would be a far more viable option.

In the limited time allowed detail review of the entire document was not possible.

Yours faithfully,

[redacted]

SUBMISSION –EIS on the BULK EXPORT FACILITY PROPOSAL

Review of Chapters 1, 13 &18 and Appendices D, J1 & J2

[redacted]

MAJOR ISSUES.

1. High probability for transport of massive amounts of seabed sediments to elsewhere in Upper Spencer Gulf with permanent alteration to seabed profiles, coastal processes and major change to regional marine ecology with loss of marine animals/vegetation.
2. No consideration given for transport of iron ore from Eyre Peninsula mines in main EIS (Refer App D, p46, Table 8) which says ore from EP would only be by rail and an estimated expenditure of $250million (Flinders Ports estimate) would be needed to provide this rail connection presumably by the rail network owners-refer also App D Cl 2.1.2 , p12 Table 1 "Narrow gauge between Kevin/Buckleboo and Port Lincoln-privately owned and operated by Transfield/Genessee Wyoming Australia)." Have T/GWA been consulted to ascertain their willingness to be involved? A more likely scenario would be that miners would apply to Govt for permission to use road transport. (This would need a separate study at that time according to Sean Reardon- but the Port would already be built!). Such road trains would significantly increase traffic on Port Bonython Road, the Lincoln Highway and around and through Whyalla.
3. Difficult to see how this proposal fits in with recommendations of the RESIC Infrastructure Demand Study 4/12/12, which recommended three deep sea ports , and the SA Government response which states " The State Government endorses the development of integrated transport infrastructure that will facilitate export of the State's commodities and is facilitating the development of a number of private sector port development proposals....... the private sector should be careful to ensure that the number, location and timing of port developments is based **on robust demand assessment and commitments by port users".** Such alternative developments, if they eventuate, could significantly change the environmental footprint of this proposal
4. No consideration given to potential increase in coastal living and recreation on the Lowly Peninsula. It has been assumed that this population is static at approx. 100 dwellings. With expected population growth of Whyalla this area could also see significant growth, being, as it is the only such area suitable for coastal home, recreation and tourist development within 100km of Whyalla. The fact that the Lowly Peninsula was zoned "industrial" 30 years ago does not mean it cannot be re-zoned.
5. Most of the environmental and operational issues that have been identified in the report (including many that have not been adequately quantified), as needing mitigation, would not exist if the port were to be located in a less environmentally sensitive area south of Yarraville Shoals. The terms of reference for this EIS excluded any such alternative site consideration, which has led to a sub-optimal planning process.
6. The whole assessment of environmental impact on coastal processes and seabed disturbance has been made without adequate data, and by the use of uncalibrated modelling in some cases. Few definite "mitigation measures" have been proposed, generally being only to resort to monitoring once the project is in operation.

7. Potential for turbidity generated at the jetty site during construction and operation to be transported to sensitive reef areas to the north and through the “Rip” into Upper Spencer Gulf.
8. Potential disruption of migration patterns of marine animals in Gulf waters. One unstudied aspect is that cuttlefish numbers have declined since about the time Cape-size ships started to regularly traverse Yarraville Shoals.

Errors and Inaccuracies;

- "Whyalla, approximately 18km east of the site location",
  should read 'west of the site location'. Chapt 2 Cl 2.2.3 p67
- Port Nonowie mentioned as on 'Northern Yorke Peninsula'.
  Should read 'Northern Eyre Peninsula'. Table 1a Chapt 1 cl1.8.9, p58
- "South-South-West" should read "West-South-West"
  to agree with wind rose. App J1 (sub) App-A cl 2.5.1 p2-7
- "depart from the berth within two hours prior Chapt 13 cl 13.4.4.2 p384
  to high tide.." should read "two hours before high tide"
  to agree with App. J2 cl 1.4.1 p12
- "Some visual impact on coastal homes to the south of the Chapt 18 Cl 18.3.2 p531
  proposed landing facility , which will impose an industrial
  element into the landscape.
  Exceedance of noise limits at approximately 13 coastal homes south of
  the landing facility during barge unloading activities."
  Statement: Does this relate to a temporary barge unloading facility near Point Lowly or does it relate to an unrelated activity, proposed by BHP-B in an area some 50km further up the coast?
- Appendix D p33
  - "Existing ports on the eastern side of Eyre Peninsula (e.g. Port Pirie)..."
  - "Export via Whyalla, on the north-western side of Eyre Peninsula..."
  - "Port Lincoln on the western side of Eyre Peninsula.."

  In each case the words "Eyre Peninsula" should be replaced by "Spencer Gulf".
- Coastal homes as well as Santos supplied from 132kV power Chapt 1 Cl 2.2.4.3 p 68
  line from Cultana sub-station.
  I believe coastal homes are supplied by a separate SWER line from Cultana sub-station.
- Arrium's narrow gauge rail line was extended from Iron Baron through Sinclair's Gap
  to Iron Duke in the 1980's. App D p 10, Table 1 p12.

Conflicting statements;

- Shallowest at Yarraville Shoals 19m
- Depth Chart shows departure channel from 4000m to 9000m
  as 18.4-19m. Fig 16 App J 2 Cl 1.5 p17
  (refer also Fig 13.5b, Chapt 13 p 389)
- Table 13.5a (Chapt 13 Cl 13.5.4.7 p 391) shows that for departing ships "3000-5000m, depth 18.5m engine power ½ ahead tug power none". This does not agree with Appendix J2 Cl 1.4.1 p12, Flinders Ports Rort Regulations which require departing vessels to be under tug power at 4knots as far as PB Port Limit 9000m.

Chapter 1 PROJECT INTRODUCTION

- This harbour facility will assist in the export of bulk commodities from a variety of **mines and other sources** in the Upper Spencer Gulf region. 1 cl1.3.1 p48
- "Port Bonython was selected as a **suitable location** for the development of a deep water bulk commodities export facility due to its **proximity to deep water, interstate rail, mineral resources** and sufficient workforce."
  This statement **is a popular and often repeated misconception.** *Firstly, whilst the water at the jetty location is more than 20mdeep,* **the 35km departure channel needed to be traversed to reach continuous deep water, is considerably shallower**. *Port Bonython* **is not suitable for use of the latest larger ore carriers in international use (VLOCs) of 400,000t capacity**.
  Secondly, the nearest mineral resources are the Middleback Ranges approximately 50 km away and ore from there will not be exported from PB. Next nearest is Wilcherry Hill some 120 km to the west, currently expected to be transported to and shipped from Lucky Bay.
  No consideration has been given for the transport of ore from elsewhere on EP as there is no rail connection. **That means the only mineral resources that can possibly utilise PB at present are those near Coober Pedy some 5-600km to the north., unless road transport is utilised**.
- "The primary objectives of SGPL for the Port Bonython BCEF are to 1 cl1.4 p48
  Construct and operate the BCEF in a manner that is **environmentally and socially responsible.**
  Maximise the volume of ore exported.
  Facilitate the development and expansion of users of the BCEF."
- "To recommend mitigation measures to avoid or minimise any significant impacts identified to acceptable levels." 1 cl 1.5 p48
  There has been little attempt to accurately identify potential impacts.
- "The project covers the design, procurement, construction and commissioning of the common user port infrastructure, **inbound transport links** to enable port users to access the port" 1 cl 1.6 p48
  Only one transport link has been considered, *namely rail from the north.*
- "Many SA deposits have relatively high logistics costs to market, but those costs are minimised by locating facilities at Port Bonython which has a number of financial advantages over other potential locations " cl 1.7 p52
  This is just not true, *since many of the higher cost deposits (EP) are not considered in this assessment, only the lower cost mines to the north.*
  Nor has a proper cost analysis been done on alternative locations south of Yarraville Shoals.
- "In terms of economic benefit, the proposed BCEF could potentially result in: ...." **So could a port in an alternative location.** cl 1.7 p52

- "The Project is estimated to result in an additional jobs(full time equivalent FTE) during construction and more the(sic)40 direct jobs during operation of the port." cl 1.7 p52

  So could a port in an alternative location to the south of Whyalla.
- "The purpose of this EIS is therefore not to explore the alternative port locations as the location **has already been already been chosen through the Expression of Interest Process.**;..." cl 1.8 p52

  More realistically **it was chosen by the Minister** *because it is Government owned land, and investigations of* **other locations were actively discouraged,** *as was the* **Whyalla City Council's attempts to re-zone land on the Lowly Peninsula (recreation)** *(refer Letter from Dept of Premier 21/7/2008)* **and south of Whyalla (industry)** *(refer letter Dept PTI 27/6/2012).*

  The **EOI process occurred after the location was chosen.**

  It is hoped that the DAC impartially reviews the shortcomings of this site in the light of this EIS and is then prepared to recommend investigation of a better alternative location.
- "When choosing a commercially and environmentally viable port location, a number of factors should be taken into consideration, including: cl 1.8 p52
  - A requirement to handle Cape-size vessels.

    Future requirement may be the ability to handle VLOC's (I believe some already service Port Hedland)
  - Elimination of the requirement for dredging, which substantially limits environmental impacts on water quality and the marine environment.

    However, **ship movements in shallow departure channel could displace far more sediments and cause far more environmental damage than dredging as the plume would be uncontrolled. Particularly since ships will be departing in a southerly direction against an incoming tide.**
  - Minimum periods of closure potentially resultant from currents, tides, high wave events and or adverse weather.
  - Land availability, tenure and suitable zoning.

    One suspects that this was really the **main** *consideration.*
  - Proximity to existing major transportation, particularly open access rail.

    Rail from north only transport considered, **no consideration given to transport of ore from EP even though project is supposedly to help get these mines into economic production.**

  - Proximity to existing services, e.g. employment sources, **electricity, water and sewer**.

    Few services exist at Port Bonython.

    Maybe some surplus electricity capacity; water for coastal homes is currently only available when Santos doesn't require; no sewer connections possible, other than septic tanks, so *development requires its own sewage treatment system.*

- Proximity to iron ore mines.

  Only mines considered are over 500km away.

- Integration with surrounding communities and recreational areas.

  Site selection will significantly degrade existing environment for recreation and coastal living.

- Capital and operating costs."

- "These include:
  - Eyre and Western Region- Eyre Peninsula mines (located in South Gawler, Central Eyre Peninsula and southern Eyre Peninsula) **have no commercially viable access to markets for their product. "** 1 Cl 1.8.2 p54

    And yet this EIS does not consider the impact of road transport vehicles to PB or any connection with the narrow gauge rail network!!

- "Locating the BCEF geographically close to existing and potential mines reduces environmental and other externality costs which increase with travel distance. Reducing logistics costs for marginal mines may make exports commercially more viable." 1 cl.1.8.2 p54

  How does this reduce environmental considerations **when there has been no consideration of the impact of road transport to PB?**

  The last statement is stating the obvious.

- "The central location of Port Bonython means that it is **accessible across all regions**." 1 cl.1.8.2 p54

  This also true of a location south of Yarraville Shoals.

- "The proposed solution at Port Bonython offers the highest capacity of any of three potential common-user options followed by Port Pirie (20mtpa) Port Spencer(5-10mtpa),Port Lincoln(up to 15mtpa) and Darwin (2-10mtpa)." 1 cl.1.8.4 p54

  This comparison is very selective as **it only compares those chosen**.

  A port south of Yarraville Shoals should have the potential for more capacity than PB, as would Cape Hardy (with the capability of permitting the future use of VLOCs) if the standard rail line was extended approx. 200km south (at a capital cost probably less than capital for PB).

- The 'Do Nothing' Option 1 cl.1.8.6 p54

  "If the site were to remain undeveloped, $24 billion in direct export revenue and up to 600 full employment positions will be lost to the region and state."

  This is **nonsense**, *as it assumes that without the port at PB no ore would be shipped from anywhere else. Obviously, ore* **WILL** *be shipped from alternative ports.* **A port at, say Nonowie, would provide equal or better opportunities.**

- "Should the BCEF Project not proceed, it is likely that an alternative industrial proposal would be put forward for development of the site." 1 cl.1.8.6 p55

  This assumes that re-zoning is not an option, *which* **of course it is**

(if common sense were to prevail). **Development proposals could be for recreation, tourism and coastal living, rather than industry**.

- "The existing site allows for both active and passive recreation purposes on the coast and marine areas; this access will be maintained with the exception of the storage areas, rail loop and a 50 m exclusion zone around the jetty." 1 cl.1.8.6 p55

  This assumes that there will be zero growth of coastal living, recreation and tourism in the area.
- Alternative Spencer Gulf Location 1 cl.1.8.8 p56

  A number of alternative new port locations have also been proposed either by mining companies or the public in addition to those explored by SKM in 2008. These include Port Nonowie (south of Whyalla), Point Lowly, Lucky Bay, Port Spencer, Myonie Point and a number of sites to its north.

  What do they mean by Point Lowly:-*Port Bonython* **is** *Point Lowly?*

  Another attempt to confuse!

  What ports were explored by SKM in 2008?
- Stony Point at Port Bonython was chosen as the best option due to the following reasons: 1 cl.1.8.8 p56

  (In actual fact it was chosen by the Govt **before the alternative sites were even considered,** *and I suspect for other than the reasons stated).*
  - Existing operating deep water port. *Actually only capable of handling Panamax size ships.*
  - Ability to access deepwater without the need for dredging. *This only applies to water depth at the berth, but ignores the shallower departure channel to Yarraville Shoals.*
  - In close proximity to rail, iron ore deposits and other services which benefit the financial viability of exporting iron ore to overseas markets.

    The only mines in relatively close proximity are those on EP and there is no mention of the $250+ million capital needed to connect to PB (Refer to Appendix D1). **This EIS only considers ore from near Coober Pedy, over 500km away. There are few available services at PB with sufficient surplus capacity.**
  - Availability of land in public ownership and appropriately zoned.

    One suspects this was the main reason.
  - Limited and manageable impact on surrounding communities in terms of amenity and recreation uses. **Only the existing situation considered, no allowance for future growth, ignores recreational use by Whyalla citizens.**

- Summary of Alternative Port Locations Table 1.8a 1 cl.1.8.8 p57,p58
  - Proposed BCEF at PB –

    Central location with close access to northern mines

    Again, **northern mines are over 500 km away and ignores EP**.

    Aligns with current land use planning.

    "Current" refers to a zoning decision that was made **30 years ago**

which is less applicable now.

- Port Lincoln-
  Current deepwater port on southern tip of EP
  Capable of only handling Panamax sized ships.
- Darwin-
  Advantage: Closer to market (ie china/india)
  Disadvantage: Long distance to Darwin results in high rail logistics cost. *No attempt to evaluate offsets.*
- Nonowie Port
  (Erroneously described as in the ***northern Yorke Peninsula****).*
  No admission that this was ***deliberately discouraged*** *by the Government.*
  Advantages; Access to land (subject to ownership) *Govt has* ***never attempted*** *to verify that land owner willing to sell. It is known here that he is. No mention of the advantage of* ***unrestricted deep water access to Southern Ocean****, and in* ***close proximity to Arrium mines in Middleback Ranges and closer to other EP mines*** *than is PB.*
  Disadvantages**: High capital cost.**
  This has been stated before based on ***the wrong assumption*** *that a jetty 6km long is twice the cost of a jetty 3 km long, ignoring the fact that the* ***first 3kms is in only 2m water depth*** *and therefore merely requires a trestle structure and the* ***remaining 3 km very similar to the jetty proposed at PB.***
  Land is in private ownership. *No attempt to find out if owner will sell. He already has sold the adjoining land to Uranium SA who are also willing to co-exist.*
  Will require significant new rail with construction restrictions around Whyalla.
  The word ***significant is misleading****, the extension of standard gauge line is* ***less than 20km longer*** *than the spur line to PB.*
  If routed west of the Conservation Park, it has ***no significant grades*** *(unlike the PB spur) This is offset to some extent by being* ***closer to the Arrium and EP mines.***
  Incompatible with current planning.
  The main reason it has been discouraged*, as was WCC's attempts to rezone Lowly Peninsula "recreation"and Nonowie "industrial".*
  (refer letters to WCC, from Dept Premier and Cabinet 21/7/2008, and from Dept Planning , Transport and Infrastructure 29/6/2012)
  May require transhipment depending on final solution.
  This seems a ***peculiar statement*** *as really one* ***<u>advantage</u>*** *is that transhipment could be an* ***interim possibility*** *whilst the jetty is extended for direct shiploading.*
  Likely to require an extremely long jetty to achieve depth requirements. *Ignores the fact that* ***50% of jetty length is in 2m***

depth *water and also the proximity of storage area means* **total conveyor belt length may be little different to PB**.

- o Cape Hardy.
  Minimal feasibility studies undertaken at this point.
  Nevertheless, we are led to believe **they are in progress**. *No mention of potential advantage of being able to handle VLOCs*. **If PB requires additional expenditure of $250+ million to connect EP mines, then a standard gauge rail connection from Whyalla to Cape Hardy would seem an option that would be of comparable cost.**

- Utilities Cl 2.2.4.3 p68
  - o Water.
    "Potable water is supplied to Port Bonython via a 200mm asbestos cement(AC) pipeline."
    This line is sized for Santos only and coastal homes can only have water when it is not required for Santos.
  - o Electricity
    "The transmission line feeds into the Stony Point substation which subsequently feeds electricity to the Santos Facility as well as to coastal homes and facilities at Point Lowly."
    As I understand it, the main transmission line is for Santos and the coastal homes are supplied separately via a SWER line from the Cultana Substation.
    In other words, this is just more of the **false "PB is fully serviced" waffle**.

- Project Description Cl 2.3.1 p68
  Overview
  "The project has been situated a distance from the jetty infrastructure to facilitate future expansion towards the shore."
  Initially the BCEF will be constructed to provide capacity for the export of up to 25 Mega Tonnes per Annum (Mtpa)of iron ore.........(including 3 sheds)."
  For **50 mtpa there will be 4 enlarged sheds**. **Extras not shown** *on the visual amenity view.*

- Should sufficient demand be generated, the BCEF will be upgraded to export 50Mtpa.... .....Additional infrastructure to b e built for this second phase will include additional site storage sheds, a second jetty conveyor and a second ship loader wharf.

- Supporting Infrastructure. Cl 2.4.4 p72
  - o Water Cl 2.4.4.4 p72.
    Depending on volume requirements , water is likely to be obtained utilising the existing 200mm pipe that extends to Port Bonython from the Morgan-Whyalla No.2 pipeline, or a new pipeline could be established that connects into the No. 2 pipeline.
    Existing supply to PB is so limited now that coastal homes can only get supply when it is not required by Santos.

- Project Staging. "Generally the expansion from 25 Mtpa (Stage One) Cl 2.5 p72 to 50Mtpa (Stage Two) will include construction of the following elements:

- Additional shipping wharf and ship loader.
- Additional storage sheds.
- Second jetty conveyor."

No mention of requirement of **$250+** *million* **for rail connection to EP,** *or to the* **need for ARTC to upgrade (duplicate?) rail line from Coober Pedy to Whyalla.***(ARTC advise currently spare capacity on Alice Springs/PA line* **is 3 train paths/week or 1.2Mtpa)***see App D Table 1.*

- Railways (Operations and Access)act 1997 Cl 3.3.16 p88
  - To provide a system of rail transport in South Australia that is efficient and responsive to the needs of industry and the public.
  - To provide for the operation of railways.
  - To facilitate competitive markets in the provision of railway services through the promotion of the economically efficient use and operation of, and investment in, those services.
  - To promote the efficient allocation of, and investment in, those services.

  How is all this to be achieved without any Government expenditure, and in particular as it applies to EP?

- South Australian Strategic Plan Cl 3.4.1 p88

  "....It focuses on six integrated objectives including:
  - Growing prosperity,
  - Improving wellbeing.

    Hard to see how this can apply to the citizens of Whyalla if their recreation area is despoiled.
  - Attaining sustainability

    Mining*, by its very nature, depletes the resource, so* **may not contribute to sustainability in the longer term**
  - Fostering creativity
  - Building communities

    If the liveability in Whyalla is degraded by the despoliation of breathing space, people will prefer to live elsewhere, *leading to a growth in FIFO workers and a difficulty in attracting specialist professions.*
  - Expanding opportunity.

    For Adelaide I presume!

- "69. Lose no species: Lose no native species as a result of human impacts. Table 3.4a Cl 3.4.1.1 p 89

  There appears to have been no work done to determine the possibility of **negative effects of frequent and regular Cape-size shipping movements through Yarraville Shoals** *and north to Port Bonython. It would seem there may be a correlation between depleted cuttlefish numbers aggregating at Stony Point in recent years and the introduction of Cape-size ships for transhipment operations north of Yarraville Shoals. It is worth a thorough investigation.*

- Road Transport. Table 3.4b Cl 3.4.2.1 p 90

  The Project is proposed to improve the efficiency of the iron ore transportation network in South Australia. This will improve international links and export opportunities by allowing for transportation of iron ore by rail, rather than by road, to the port.

"Minimise the impact of freight vehicle movement on the community and environment by appropriately locating and protecting freight routes.

Iron ore will be transported to site via the existing rail network, avoiding placing additional pressure on the road freight network. It does not interfere with any existing freight routes.

By assuming that all ore from EP mines (which has been used in the justification for the port) will be transported to PB by rail (that is after the miner/rail owners have provided capital of $250+ million for the construction of a rail line from EP to PB), ignores the strong possibility that to get these EP mines started they will request permission to road freight ore to the port. This contingency has not been explored in assessing environmental effects of increased traffic through and around Whyalla, and on the Port Bonython Road.

- " The project proposes a new port facility to improve the efficiency of exporting materials to the international markets."

  By proposing it in the **severely constrained location** *of Port Bonython there is a* **considerable loss of efficiency** *when compared to a location south of Yarraville Shoals.*
- Vessel traffic from the port will utilise existing shipping lanes, and does not interfere with the activities of any other nearby ports. e.g. Port Pirie or Whyalla.

  It would appear to be in reasonable proximity to Arrium's transhipment points (Refer Figure 13 App J 2 Cl 1.4.2 p14) and areas where Cape-size ships are currently anchored awaiting loading. This should be mentioned, as well as the number of ships needing to pass through Yarraville Shoals at high tide.
- The Project encourages the efficient use of rail infrastructure for freight transportation.

  How can it, when there is spare capacity on the Alice Springs/PA line for only **3 train paths per week** *(Refer App D Table 1 p12?) -1.2Mtpa?*
- The Project will be appropriately located, designed and managed to minimise adverse impacts on South Australia's coastal assets.

  How can this statement be true when there has been **no quantitative work done to assess propeller induced seabed disturbance and sediment dispersion?** *It may well be that sediment is spread far and wide with adverse effects on sensitive coastal areas.*
- Eyre and Western Region Plan Chapter 1 Cl 3.4.3 p90
  - Maximise the regions competitive advantages in renewable energy, mining tourism and aquaculture.
  - Manage natural resources and protect vulnerable environments and species.

Tourism potential of the Lowly Peninsula has been ignored *even though it is, in effect, the tourist gateway to EP, particularly for Motor Home tourists.*

Natural resources and **vulnerable species could be severely impacted by sediment dispersion.**

- The EP Natural Resources Management Plan Chapter 1 Cl 3.4.5. p91
    - Using and managing natural resources within environmental constraints.
    - Effective partnerships **based on sound knowledge** driving natural resource management.

      How can this project comply when the marine effects are really unknown?
- Eyre And Western Region Plan Table 3.4c Chapter 1 p93

  Recognise, protect and restore the region's environmental assets.

  There has been **little attempt to recognise and restore***.*
- The Project seeks to appropriately manage and protect the quality and function of
    - water dependent ecosystems
    - **coastal, estuarine and marine environments,**
    - Biodiversity, and
    - Scenic landscapes.

      How can this be true when **potential effects from shipping are not quantified?**
- Whyalla City Development Plan Chapter 1 Cl 3.6.2 p94
- "The general intent for each of these zones are:
    - Coastal Conservation Zone: This zone provides for the conservation of coastal features and scenic quality, whilst enabling appropriate public access and ensuring that development is not subject to coastal hazards. **Development within this zone is intended to be subservient to the conservation of the coastal environment in order to ensure that the fragile coastal environment is protected and biodiversity maintained."**

      Surely since the conveyor and jetty intrude on this zone the above must apply. (Refer Fig 3.6a p95).
- "To **enhance and conserve** the natural features of the coast including Table 3.6a p96 visual amenity, landforms, fauna and flora.
- **The onshore conveyor belt infrastructure will traverse this zone**.....

  It will be located such that it avoids areas that contain ecologically significant vegetation/communities..."
- "Low- intensity recreational and tourist accommodation located where environmental impacts on the coast will be minimal."
- "The project has no direct impact on existing tourist accommodation, however **there may be an indirect impact as a tourism facility could no longer be located on the subject site and amenity for recreational pursuits may be impacted."**

  This clearly assumes that there will be no expansion of tourism & recreation.
- "Industry designed and located so as **to practically eliminate impacts on the terrestrial and marine environment** of the locality."
- "The design and location of the proposed rail spur will aim to eliminate or minimise any impacts upon the environmental conditions within the zone."

  Nevertheless the passing of heavy long trains will be clearly audible, *especially as they pass the False Bay residential area on an uphill grade. Permanent residents will tend to get used to the rumblings but short stay residents will find it annoying, to say the least.*

- Port Bonython has been recognised by the Government of South Australia as a suitable location to develop a deep water bulk commodities export facility based on its access to deep water, proximity to rail, proximity to mineral resources and proximity to population centre...."

  That ***spin*** *again!!*
- "The main impact on the marine environment will be related to construction...." Table 3.6b p97

  Completely ignores probable dispersion from propeller wash induced turbidity and sea bed scouring.
- "A visual impact assessment.... concludes that the jetty and surrounding environment when viewed from publically accessible view points." p98

  View points selected do not include locations from which the sheds will be most visible and only the sheds for stage 1 are included.
- "The State Government have determined that **Point Lowly** is an appropriate place to locate a bulk commodities facility."

  A slip of the pen here; **they have called it Point Lowly not Port Bonython! They are the same, although rarely admitted by Govt.**

  Govt. decision based on a preconceived and biased notion with a probable hidden agenda.

Chapter 13. COASTAL PROCESSES AND WATER QUALITY

- Coastal Protection Act 1972
  "Develop any part of the coast aesthetically Chapt 13 cl. 13.2.2 p369
  or to improve it for those who use and enjoy it. "
  Issue: Coast Rd. (Cuttlefish Drive), diverted and crossed by overhead conveyor gantry, presumably supported on trestles.
  Question: How is overhead conveyor gantry, trestles and diverted coastal road seen to comply?
- "The description of the existing environmental and potential impacts is limited to information in existing reports. The description of existing water quality and sediment transport is qualitative due to **limited data**, but is sufficient for general characterisation of existing conditions. The wave model results presented here are **taken from an uncalibrated model**....Overall the data available is considered sufficient for the purposes of the assessment given that the **project does not involve dredging** and that water quality and sediment transport impacts are **expected to be minimal**." Chapt 13 cl. 13.3.2 p370 (Refer also App J1 cl 1.1.2 p1-2)
  Issue : Limited information and uncalibrated model.
  Question: How can the prediction "expected to be minimal" be made on the basis of such limited and possibly inaccurate data?
- As no dredging required, "**no numerical modelling** is considered necessary to understand **impacts on marine water quality and coastal processes** from construction and **operation (shipping) activities**." Chapt 13 cl.13.3 p369
  Issuse : Propeller induced sediment dispersion in the shipping channel is likely to have a similar but worse effect to dredging, since 100% of the sediments are dispersed to regions unknown.
  Question: How can the statement "no dredging" be seen to relate to operations (shipping activities) in the shallow departure channel, remote from the facility?
- "**Potential impacts** on water quality and coastal processes have been assessed through a **desktop qualitative assessment**, which is considered sufficient for the purposes of this assessment given the nature of the project and the proposed design and construction methodology." Chapt 13 cl.13.3.1 p370
  Issues : Potential impacts on water quality and coastal processes from shipping activities in the shallow departure channel are likely to be severe.
  Question: How can a desk top qualitative assessment cover potential damage to the marine ecology from shipping movements in the channel?
- "Wind generated waves are predicted to exceed one and a half metres significant wave height... around 0.5 percent of the time at the proposed development.... generated wave directions are between south and west-southwest." (wind rose included). cl.13.4.1.1 p371

- Table 13.4a Tidal Planes at Port Bonython — Cl 13.4.1.1 p372 (see also: AppJ1 cl 2.1.2.2 p2-5; App J2 cl 1.3.1 p5)

Tidal Plane	Relative to LAT	Relative to MSL
HAT	3.2	1.6
MHHW	2.7	1.1
MLHW	**1.8**	**0.2**
MSL	1.6	0
MHLW	1.4	-.02
MLLW	0.5	-1.1
L AT	0	- 1.6

- "**Periodic** amplification of the signal leads to **large discharges through 'The Rip'**." — cl. 13.4.1.1 p372
- Tidal eddies occur on the lee sides of Point Lowly. — cl. 13.4.1.1 p372
- "...even during a strong ebb tide the current flow in the vicinity of the proposed site at Stony Point is eastwards." — cl. 13.4.1.1 p372

  Issue : Potential sediment dispersion into environmentally sensitive areas of Upper Spencer Gulf.

  Question: Is it possible that tidal eddies in the lee of Point Lowly and discharges through "The Rip" may mean sediments find their way north of Point Lowly?

- Sediment Characteristics — cl. 13.4.2.1 p372 (see also - App J1 Cl 2.2.1 p2-14)

  Analysis of subsurface sediments (sedimentary profile) is not considered necessary for this study since no dredging work in the proposed development. Any project-related turbidity impacts will therefore be due to disturbance of surfaces sediments.

  The Map show point A3 as being close to departure point 4500m from berth.

- Table 13.4.b Sediment Sample Descriptions taken onsite — Cl 13.4.2.1 p372 (See also- App J1 Cl 2.2.1 p2-15)

Location	Echo Sounder Depth(m)	Sediment Description
A3	20	**Muddy silty sand with shell fragments**

- Table 13.4c: sediment sample PSD Results. — cl. 13.4.2.1 p375

	%silt/clay d<0.0625mm	%sand 0.0625mm <d<2mm	%gravel (shell) d>2mm	d50
Approach 3	**22%**	**43%**	35%	0.8mm

  Issue : Presence of muds and silty sand in shallow departure channel.

  Question: Since Approach 3 is close to Departure point 4500m which is the shallowest part of the departure channel (18.4m) will this not mean maximum turbidity from loaded ship movements? Refer also Fig 13.5b p390

  - The rocky nature of the coastline indicates that there is very — cl 13.4.2.2 p375 limited sediment supply. **Any sediment that is transported to the shoreline will tend to be subsequently transported by waves and current around Stony Point** and into the sandy embayment to the east(Weroona Bay).

Issue : Sediment transport to shore.

Question: This applies now, but will it not be influenced by the groyne at the start of the jetty? If this groyne intercepts the sediment transport, then such sediments may well settle within the cuttlefish aggregation zone. Also, such a statement does not apply to turbidity resulting from departing ships.

- The predominant littoral sand transport will be from west to cl.3.4.2.3 p375
- east... ... will tend to transport sediment to the east. (see also App J1 Cl 2.2.3 The tidal currents near the shoreline predominantly flow p 2-17) towards the east, even during ebb tides

Issues : Once again, no reliable data! Sediment transport predictions without prior coastal process monitoring.

Question: Shouldn't coastal process monitoring have been done before these predictions were made?

- The current near the seabed at the end of the proposed jetty **<u>may</u>** cl.3.4.2.3 p375 exhibit a bias towards the ebb tide direction (approximately 245^0 or westerly) which could generate a net sediment transport potential in this direction.

Issues : These are considered opinions, which may or may not be true as they are not backed up by hard evidence.

Question: Would not this put the sediments in an area from which they would be transported northwards to the shoreline?

- '"It is difficult to draw conclusions about ongoing geomorphological cl13.4.2.4 p375 changes in the study area **due to the lack of historical bathymetric data.** The turbidity and Total Suspended Solids (TSS) data(refer to Section 13.4.3.5) indicate that there are **active sediment transport processes occurring in this area, however, it is not possible to quantify net plumes or rates of bed level change."**

Issue : Again, no reliable data! This is nothing more than an educated guess.

Question: Should not test results be obtained before approval?

- ANZECC(2000) Environmental Values for the coastal waters cl 13.4.3.1 p 375 between Black Point and Point Lowly and around into Fitzgerald Bay are:

The protection of aquatic ecosystems

Amenity and recreation (passive and contact).

Issue : Negative impact on amenity.
Question: How can the establishment of the BCEF be seen as not having a negative effect on both of these, without any firm data?

- "It is apparent that suspended sediment levels are generally higher in summer months than in winter." cl13.4.3.5 p381
- "In 2009 groundwater contamination was reported at the Santos site(Steer et al, 2009) which had the possibility of intersecting with the intertidal zone. Subsequent monitoring of the intertidal zone found no evidence of hydrocarbons or ecological impact. cl13.4.3.7 p381

  Question: From which report are these conclusions drawn?
- "The existing shipping channel as recommended by Australian Admiralty Chart 778 is along a route with water depth of 20m at Lowest Astronomical Tide (LAT) with the exception of the **Yarraville Shoals where the water depth is slightly less than 20m (19.6m) at LAT,** and the vessel departure route (see Figure 13.4j) near navigation beacons 5 and 7 **where the water depth is approximately 18.5m at LAT.**" (refer also Figure 13.5b) cl13.4.4.1 p381

  Issue : This sediment disturbance in shallow channel .
  This is the first admission that there is a shallower point in the departure channel than Yarraville Shoals, and one that must be passed at least 1 hour before Yarraville Shoals.
- "The proposed development is expected to receive 277 vessel calls per annum." cl13.4.4.2 p383

  Figure 13.4i shows existing annual vessel calls at Port Bonython as 25-30, at Whyalla 60-100, Port Pirie approx 60 and Whyalla SPN approx 40. *p383* *The Section on "Cumulative Impacts" estimates Port Bonython Fuels as +12 ships pa and Expanded Whyalla Port as +22 ships* *cl18.3.3 p532* *cl18.3.4 p532* (also shown Figure1 App J2 cl 1.1 p 1)

  This means that there may be approximately 530 vessel calls per annum, or 1060 ship movements through Yarraville Shoals per annum or an average of 3 per day.
  Surely there is logic in having the BCEF south of Yarraville Shoals.
  Issue : Possible shipping bottleneck at Yarraville Shoals. *(refer also to App J2 Cl 1.4.1 p 11)*

  Question: **Why has a possible Nonowie Port been dismissed out of hand on flimsy excuses?**

- "The gross underkeel clearance for vessels manoeuvring in Spencer Gulf is 0.9 m or 10 per cent of the vessel draft (whichever is the greater).... For the fully laden Cape size vessel this corresponds to a required gross keel under clearance of 1.8m p384 (see also : App J 2 cl 1.3.3 p8) and **hence the Cape-size vessel requires a water depth of 20.1 m when manoeuvring or under way."** (refer also to Table 13.4). (App J 2 Table 4)

Why has the gross underkeel clearance required by Flinders Ports, recently been amended from 20% of vessel draft to 10% of vessel draft?

- "Flinders Ports require fully laden vessel to depart from the berth **within** two hours prior to high tide for safe navigation through the departure route and Yarraville Shoals."

- Drawing 60051283-SK-021 Rev C .... indicates that the structure will extend approximately 30m **below** the Mean Higher High Water mark (MHHW) contour. cl13.5.2.1 p385

  Presumably this means that the groyne will extend outwards 30m but be below the MHHW mark.

  "It is likely that the toe will be located approximately 2m below MHHW or around Mean Lower Low Water (MLLW) refer Table 13.4a) in this case the embankment will be located completely within the tidal range and allow any significant sand transport to occur past the toe of the structure." cl13.5.2.1 p385
- "There could however be an oil spill from a collision of a ship with the jetty structure or other ship, or grounding incident" cl13.5.4.4 p387
- Although a ship collision or grounding is unlikely, as the impact could be very high, it would have a high risk rating." cl13.5.4.4 p387

  Statement: **Less likely in less restricted waters.**

  Issue: **Surely with this amount of unknowns the "Precautionary Principle" should apply and attention be transferred to a location in a less environmentally sensitive area.**
- "The preliminary results of the propeller wash assessment are summarised in Table13.5a (refer to figure 13.5a for distances) metres from proposed jetty) and indicate that **propeller induced velocities are sufficient to mobilise a high percentage of sediments from the seabed. Between 28 percent and 100 percent of sediments could be suspended along the length of the departure channel with 63 percent being resuspended at the wharf.** The highest settling time was found to occur at the wharf with an estimated 12-24 hours required for the suspended material (depending on the assumption that the depth of water column involved) to settle out of the water column. cl13.5.4.7 p388

  (We understand there would be several man days of calculations necessary to make an assessment of propeller wash induced sediment resuspension for any particular ship, as it depends on ship's draft, water depth, depth of propeller, speed of the ship and engine setting and a knowledge of sediment composition. Surely, then, this must indicate that the passage of loaded Cape-size ships from Port Bonython through Yarraville Shoals is unacceptable and a port south of Yarraville Shoals is the only logical solution)

- The **study does not take into account possible " armouring" of the sea bed** after disturbance of the finer sediments. As demonstrated in Table 13.5a, **propeller wash velocities are sufficient to mobilise even coarse sediment fractions** into suspension. These particles rapidly settle back onto the sea bed, with the **finer sediments being carried away**, and may create a layer of coarse sediment trapping the finer material below, effectively armouring the sea bed. This may result in lower re-suspension and lower residence times over time. cl13.5.4.7 p389

  Issue : There has been no attempt to rate the Impact Significance of propeller wash induced turbidity.

  Question: **With the potential amount of material resuspended from the shipping channel and transported away by the turbidity plume, should this not be rated against Table 3-2 as "Very High"?**

Table 3-2 Impact Significance-Hydrodynamics and Seabed Profiles

Impact Significance/Consequence	*Description of Significance*
Very High	*Long term irreversible change in hydrodynamic regime and seabed profiles.*

Issue:

Question: **Does not this constitute " self-dredging" of the shipping channel with sediments dispersed to unknown locations?**

(My Guess: If we assume major disturbance of the sea bed as far as Yarraville Shoals (35km) and for a strip 100m wide and a depth of 0.5m with 50% of material carried away the amount of material transported over time, by the plume will be 35000x100x0.5x0.5 m^3 or *nearl y 900,000 cubic metres!!!)*

Question: **What happens to the benthic communities on the sea bed when covered by a layer of settled sediment?**

- "The primary receptor of the potential impact of the increased turbidity is the subtidal habitat 2.5km to the northwest of the ship berthing area which provides habitat for the Australian Giant Cuttlefish. Considering the predominant tidal current directions being northeast during flood and southwest during ebb tides, sediments can be carried by the propeller induced current, even if exerting in a northwest direction, is unlikely to reach the subtidal habitat..... It is considered that impacts on the subtidal habitat cl13.5.4.7 p389 are unlikely, although a **further assessment will be undertaken during detailed design to confirm this assessment**... the impact on the habitat is expected to be minor or negligible"

Statement: **The Cuttlefish aggregation zone actually extends to the jetty landward end location, and further east as far as the eastern Santos boundary, more north than northwest.** *(Refer Olympic Dam Expansion Draft Draft EIS –"Marine Ecological Surveys" -Appendix O1, Figure O1.2)*

Issue : Again, what is expressed is informed opinion, not fact based on actual known data.

Question: **What happens if the further assessment does not confirm this assessment?**

- Table 13.5a shows propeller wash results for departure channel 3000-5000m from berth, depth 18.5m, **engine power Half Ahead, tug power none,** max propeller wash induced velocity 3.7m/s, **max particle grain size suspended 45mm,100% particles re-suspended.** p391

  Issue :**This part of the departure channel is close to Approach 3 which had a high silt content in the sediments so there will be maximum turbidity generated and considerable damage to the sea floor with loss of benthic communities.**

- Similarly Table 13.5a shows propeller wash results for departure channel 5000-12000m from berth, **depth 19.5m, engine power Full Ahead, tug power none,** max propeller wash induced velocity 3.4m/s, **max particle grain size suspended 35mm, 100% particles re-suspended.**

  Issue : **Again maximum damage to sea floor.**

- *Reference to Appendix J2 cl 1.4.1 p12, Flinders Ports Regulations require that departing vessels will be under tug power to the Port Bonython Port Limit approx. 9000m from berth, max speed 4 knots, so presumably this is to overcome the above problems within Port Limits. However,* **significant problems will still occur 9000m-12000m***, and to a lesser extent all the way to Yarraville Shoals.*
  The tug assisted passage to Port Limits will take 1.1 hours to reach 9000m with another 26,000m to be traversed at 15 knots (29.2km/)-0.9 hours. There seems to be some discrepancy between a time of 2 hours required to depart Port Whyalla (presumably the transhipment point) and 2 hours required to depart Port Bonython Jetty.

- Table 13.6a p392

Jetty abutment -risk of interrupting sediment transport,
significance minor, ,unlikely, low risk rating.
Ship movements –risk of increased turbidity due to propeller wash, significance moderate, likelihood possible, risk rating medium.

Issues :

Question: How can these be more than considered opinions with **no reliable data?**

- Mitigation Measures- p393

  Design of the footprint of the abutment to be within the tidal zone.

  Sediment modelling to confirm if the sediment suspended by the propeller induced currents will travel to the subtidal reef to the northwest of the shipping berth area.

  Significance moderate, likelihood possible, risk rating medium.

  *Issue :***This modelling needs to be done first.** *Also cuttlefish aggregation zone extends to north of the loading berth.*

  The description as northwest is a convenient manmade definition.

Chapter 18. CUMULATIVE IMPACTS.

1. "It builds on earlier assessments undertaken as part of this Environmental Impact Statement... which **identified residual impacts** that remain significant after mitigation has been applied. These impacts related to **social, economic and environmental issues.** Section 18 Cl 18.1 p529

   Issue: ***Lack of data*** *in earlier assessments, and no genuine mitigation measures proposed.*

   Question: How can any conclusions be drawn?

2. The aim of this assessment is to: Section 18 Cl 18.1 p529

   Understand the potential impacts of these projects or proposals.

   Consider the combined effect of these impacts with the residual impacts identified for the BCEF.

   Issue : ***Lack of data*** *in earlier assessment.*

3. "An assessment should be based on **publicly available planning documents** that clearly identify impacts of the project. Recent information for the Santos facility and jetty, the Port Bonython diesel Fuel Storage facility (PBDFSF) and the Whyalla Port Facility (WPF) **were not publicly available**. For this reason**, cumulative impacts assessed in this EIS are limited** as the impacts of other projects are not able to be identified." **(By not even attempting an assessment it would seem this clause is being used as a "cop out".)** Section 18 Cl 18.2.3 p529

4. "Few of the projects considered for this assessment have been built, so **the real impact is unknown at this point**."

   Issue : ***Lack of documents****.*

   Question: What attempts were made to locate information?

   eg original PBF Development Application (10-12 ships/year), Recent information for the Santos facility, etc

5. "Given **the limited information available** to undertake this assessment, the **cumulative impacts have only been identified as beneficial or adverse and not assessed on a significance scale** from negligible to high." Section 18 Cl 18.2.4 p529

   Issue : This statement means this ***assessment is meaningless.***

6. "Some visual impact on coastal homes to the south of the **proposed landing facility** , which will impose an industrial element into the landscape. Section 18 Cl 18.3.2 p531

   Exceedance of noise limits at approximately 13 coastal homes south of the landing facility during barge unloading activities."

   Statement: Does this relate to a temporary barge unloading facility near Point Lowly or does it relate to an unrelated activity, proposed by BHP-B in an area *some 50km further up the coast.*

"Diesel will then be **trucked from the fuel terminal** to regional markets." Section 18 Cl 18.3.3 p532

Issue : This will be ***a considerable increase in traffic***

on the Port Bonython Road and the Lincoln Highway.

Question: Why hasn't this increased traffic been considered,

as without it, any traffic predictions are meaningless?

(Tanker truck numbers were stated by PBF at the public information session on10/6/2009 as being ***50 tankers/day each way****.)*

7. Whyalla Port Facility. Section 18 Cl 18.3.4 p532

" There is very limited data available on this facility....This is expected

to result in approximately 22 additional ship movements per annum ."

Issue : Additional ship movements through Yarraville Shoals.

Could be more if Arrium utilise a second self-propelled barge.

Question: have these additional ship movements been

taken into account when considering possible

congestion at Yarraville Shoals?

- "Any **environmental impacts** of this project **have not been identified**, therefore the expansion of the **Whyalla Port Facility is not considered further in this assessment."** Section 18 Cl 18.3.4 p532

  Issue : Arrium's ore trains from the North will require line space on the standard gauge rail system ,in addition to the 6 trains/day (stage 1) or 12 trains/ day(stage 2) of this proposal as well as regular National rail traffic.

  Question: ***How credible are ARTC assurances*** *that the existing single standard gauge line from the north can handle the total traffic?* Transport Chapter 18 Cl 18.4.3 p534 (Refer also App D) *ARTC* ***say currently spare capacity on Alice Springs line is 3 train paths per week.*** *ARTC also says in an undated letter (July 2013?) to Sean Reardon (Appendix H5) that they are working to improve the lines concerned to handle the proposed traffic.*

  "It is important to determine the cumulative impact of the BCEF along with traffic growth along with new and/or higher density development in the region. Guidelines from Ausroads Guide to Traffic Management Part 12(2009) recommend that the impact be assessed at **ten years after opening**, to identify whether the development will use up any space capacity in the surrounding transport network, bringing forward the need for improvements.

  As the exact traffic impact of other proposed developments in the region was not able to be ascertained, its effect was modelled through the use of a three percent per annum growth rate in background traffic on all roads in the area."

  Issue : Potential traffic associated with this project

e.g. ***although part of the justification for the BCEF,***
is to permit export ore from Eyre Peninsula, no allowance
has been included for road transport of ore from EP *to*
Port Bonython, neither has tanker truck traffic
from PBF been considered. (refer also App D which says all ore from EP mines will be delivered by rail **and miners /rail operators will have to find an additional $250million to fund this rail connection:- Note also that this figure of $250m is merely the lower of Deloitte's estimate range for a rail link from Central Eyre Peninsula to Kimba ($250-$400m) to which they add an additional estimate of $500-$750m for the rail extension Kimba to PB.** *Refer p58 "Regional Mining and Infrastructure Planning project-Eyre and Western Region" Interim Report 2013*

Question: **If a large part of the justification for the BCEF at Port Bonython is to allow export of ore from EP, why has no estimates been made on the quantity of ore from EP to be transported by road and/or by rail from EP mines?**

- "The combined effect of these projects on views to the proposal from Point Lowly will result in a reduction in the visual impacts identified for the proposal. This is due to the further industrialisation of the views from this area." Section 18 Cl 18.4.4.1 p536

  Issue : This statement is ambiguous.

  Question: Does this mean that the proposed development will be less visible because of the other developments?

  Note also, that this impact assessment only considers the sheds associated with Stage 1, expansion to Stage 2 will increase the impact.

- "The cumulative impact of these projects overall is a reduction in the quality of views from Point Lowly."

  Issue : The same could be said about views from Whyalla.

- "...**increased industry** in the local area **will result in more industrialised views** when accessing the coastal settlements which will **impact the amenity of the area for locals and visitors**." Section 18 Cl 18.4.5 p536

  Issue : **This will detract from the use of this area** *for coastal living and tourism.*

- ".... this change in land use is **consistent with zoning** for the area."

  Issue : This ignores the fact **that the current zoning of the area may not be the best option**.

- "Potential disruption to access and people's way of life has been highlighted as a residual impact associated with the construction of the BCEF. Should another project's construction period overlap with the BCEF's construction period there is the likelihood that these impacts could be exacerbated.... this is an issue that needs to be monitored."

  Issue : **It is not only the residents of Point Lowly that will be affected, as the area is also popular with Whyalla residents.**

- "Turbidity. Section 18 Cl 18.4.8.1 p537
  As sediment released during the construction phase of the BCEF will be minor and localised."

  *Issue : **This is not proven** in the body of the report (Section 13) since its effect will depend on whether the sediment is carried into environmental sensitive areas or not.*
- Ship Strike Section 18 Cl 18.4.8.2 p537

  Issue: Statistics are presented with regards to whales only, but no attempt has been made to identify if the deeper channels are used by other marine species to migrate to and from the area.

  Question: What investigations have been made as to whether other marine species (e.g. snapper, cuttlefish) use the approach/departure channel to migrate to/ from the area.

Appendix D ECONOMIC ANALYSIS

Executive Summary p iv

- "Port Bonython is the preferred location for SA iron Ore export facility. Its central location means it is accessible from all three geological provinces."
  Simply not true *as it cannot be accessed from South Gawler Craton Province without considerable capital required for rail upgrades and extensions-refer Deloitte "Regional Mining and Infrastructure Planning –Eyre and Western Region" p58.*
- "Direct impacts of the project were based on advice from Flinders Ports, p v including the assumption of a $250 million investment in rail From the Southern Gawler Craton mines to Port Bonython..."
  This is not compatible with the estimates suggested by Deloitte (the stated reference study) of **"Rail link from Kimba $500-$750m, rail link from Central Eyre Region to Kimba $250-$400m)**
- Narrow gauge network between Kevin/Buckleboo and Port Table 1 Cl? p 1? Lincoln-Privately owned and operated (Transfield/Genessee Wyoming Australia).
  Has been rated an open access line.
- Spare capacity of 1Mtpa in the absence of track upgrade works.
- Narrow gauge links between Iron Knob/Iron Baron and Whyalla.
  The line to Iron Baron was extended through Sinclair's Gap to Iron Duke in the 1980's which is closer to Kimba and puts it quite close to Nonowie.
- Standard gauge rail link between Port Augusta and Whyalla. ARTC advises there is spare capacity on this line (which will be made available for Port Bonython if it proceeds).
  This doesn't state how much spare capacity (elsewhere it is stated that it is much less than the proposed tonneages to be railed from the north. However, spare capacity on this section can only be utilised up to the spare capacity on the line from Alice Springs to Port Augusta.
- Standard gauge rail between Alice Springs, Kalgoorlie and Broken Hill. Spare capacity **for 3 train paths per week or 1.2Mtpa.**
  In the context of 25-50Mtpa proposed, this is nothing. ARTC have advised Flinders Ports in a separate letter 3/6/13 that they would upgrade as necessary (reference Appendix H)
- Table 5 ABS Census 2011 p20
  Whyalla LGA Unemployment rate (%) 8.1 %
- "Eyre Peninsula" should read "Spencer Gulf". p33
  Port Lincoln stated as being able to load large vessels.
  PL can only handle Panamax size vessels, not Cape-size.

Inefficiencies in the mine to export supply chain Cl 3.1.2 p33

- Far North Region-Capacity constraints on the existing standard gauge network limit its ability to meet the potential future freight demand of the Mount Woods cluster mines.
- Yorke and Mid-North /Braemar Region- There is some spare capacity on the existing standard gauge rail network in SA however, this is unlikely to be sufficient to meet forecast demand.

- It should be noted that, however, that more recent advice from ARTC is that there is spare capacity on the standard gauge rail link between Port Augusta and Whyalla, and this would be made available for Port Bonython if it proceeds.
  This appears to make no allowance for increased freight from the north by Arrium.

Options Considered Cl 3.3.1 p38

- "Port Spencer (formerly Sheep Hill)/ Cape Hardy- Private deep water port capable of accommodating up to 20Mtpa of additional capacity, but only accessible by road."
  Will not all proposed ports be private ports? I thought it was a Government requirement that they all had to be "common user". If it will be necessary to build a rail link to get ore from EP to Port Bonython why not a rail link to Cape Hardy?
- "Darwin- Increased port capacity and upgraded rail capacity providing up to 10Mtpa of additional capacity, but the longer mine transport distance increases costs."
  No offset included for cost savings and quicker delivery time from shorter shipping route to China/India.

Strategic options assessment Cl 3.3.2 p38

- "Based on the port analysis presented in the Draft SA Regional Mining and Infrastructure Plans, Port Bonython is the preferred location for a SA iron ore export facility because:
  This is nonsense because the decision was made years before the Draft SA Regional Mining and Infrastructure Plans were attempted and they are still inconclusive as all options were not fully considered.
  - "this central location means it is accessible from all three geological provinces in SA that contain iron ore (i.e. Northern Gawler Craton, Southern Gawler Craton, and Curnamona Province). ..." **This is a very deceptive statement as access from Northern GC and Curnamona restricted by rail line capacity, and no rail access at all from Southern GC.**
    "...Port Bonython is a common user facility which can be used by all mine owners, whereas the proposed solutions at Port Spencer and Cape Hardy will be private facilities where access may be restricted." **This is a play on words, as Port Bonython is to be privately owned. Is it not a Govt requiremens that all ports proposed must be "common user"?**
- "As discussed in Section 2.2.2 above , ... The unemployment rates in p 39
  SLAs in this area were estimated (December 2012) to be:
  - Whyalla : 7.0%"
    This is at odds with the figure quoted in Table 5 on p 20 (8.1%) Which figure has been used?
    Note **a port south of Yarraville Shoals would give the same employment opportunities.**
- <u>"Table 8 Definition of staged option including Port Bonython.</u> Cl ? p46
  - Mines included in analysis: As per base case:
    1. Northern Gawler Craton
    2. Southern Gawler Craton

3. Braemar Province."

Again, **ore from Southern GC used to justify project despite the absence of transport infrastructure.** *Presumably, Braemar = Curnamona.*

- Mine Development investments.....Flinders Ports indicate that the Southern Gawler Craton mine *(mines?)* would likely require investment in rail to Port Bonython ($250 million)

  This figure is obviously meant to deceive as it supposed to be taken from the Deloitte study "Regional Mining and Infrastructure Planning project – Eyre And Western Region" page 58, which gives estimates of capital costs of rail links required: Kimba to Port Bonython $500-$750 million, Central Eyre Region to Kimba $250-$400m. In other words Deloitte indicate it could be as high as $1150m!!!

  There is no corresponding estimate of capital investment by ARTC to upgrade/duplicate rail links from Northern GC or Braemar Provinces.

- "Table 11 Summary of direct expenditure..... Cl 4.5 p 52
  - Capital expenditure Port Bonython $663 million *(discounted)*

    Rail from Southern Gawler Craton Mine to PB $250 million"

  Again, **deceptive and incomplete figures (see above comments)**

Conclusions Section 5 p 59

- "Flinders Ports have been discussing the development of Port Bonython with the SA Government since 2007....."

  Whereas this is no doubt true, **it is at odds with the statement (Chapter 1 Cl 1.8 p52) that Port Bonython was chosen as a result of an EOI. It is also at odds with the statement that the choice emanated from the Deloitte study in 2013. The fact that the discussions and studies have extended from 2007 to 2013 indicates a very constrained location was selected by the Govt which resulted in a very flawed process. It is also difficult to see how this choice could continue as the favoured location without investigation of alternatives even after <u>the area was declared a Marine Park</u>. The Precautionary Principle should have been applied.**

Appendix J 1 PRELIMINARY HYDRODYNAMICS AND COASTAL PROCESSES

- "The description **of base line conditions and potential impacts is limited to information in existing reports**. The description of existing water quality and sediment transport is **qualitative due to limited data,** but is sufficient for general characterisation of existing conditions. The **wave model results presented here are taken from an uncalibrated model**....Overall the data available is considered sufficient for the purposes of the assessment given that the project does not involve dredging and that water quality and sediment transport impacts are **expected** to be minimal."
  App J1 cl 1.1.2 p1-2 (Refer also Chapter 13 cl. 13.3.2 p370)

  Issue : **Limited information and uncalibrated model.**

  Question: How can the prediction "expected to be minimal" be made on the basis of such limited and possibly inaccurate data?

- **As no wave data currently exists near the proposed facility the results presented in this report should be treated only as a first pass assessment. Should any such wave data become available BMT WBM are in position to calibrate and validate their wave models.**
  App J1 (sub)App-A cl 1 p1-1

  Issue : **Model validation should occur before the project is approved!**

  Question: Why hasn't wave data been obtained by an on-site measurement program

- The **findings of this report are derived from models yet to be calibrated and validated against real-time data**. Although every effort has been made to represent reality, **until the required data exists and the calibration/validation procedure has been performed, the results from this wave modelling exercise must only be considered as preliminary."**

  Issue5: **Surely, it would be irresponsible to approve a project on this basis!**

- "When modelling extreme events the inclusion of water levels and currents is warranted and **these two parameters should be explored in future, more detailed, assessments of wave conditions.**
  App J1 (Sub) App A p2-2

  Issue : **Water levels and currents should be explored before environmental approval**. *It will be a bit late if the project is already built!*

- Wind Conditions
  App J1 (Sub) App A p2-5

  "The most frequently occurring winds over this region are those from the West although the most severe, and those with the potential to generate the largest waves due to the available fetch, are from the South. The winter and early spring months are those which produce the strongest Southerly winds due to low pressure systems breaking away northward from the low pressure belt covering much of the Southern Ocean."

- The largest wind waves generally occur in the late winter to early spring, coinciding with windier conditions out in the middle of Spencer Gulf. Peak periods are unlikely to exceed 5 seconds with significant wave heights rarely exceeding 1-1.5m as outlined in Table 2-1 — App J1 cl.2.1.1.1 p2-1

Significant wind wave height(m)	Exceeded %
1	5.7
1.5	0.5

App J1 cl.2.1.1.1 p2-1

- Swell Waves –"For example , a 9 metre significant wave height in the Southern Ocean off the Spencer Gulf results in wave heights at the proposed facility below 0.25 metres. The wave period, which can exceed 20 seconds out in the Southern Ocean, undergoes only subtle transformations, and as a result, despite their small amplitude, **such waves can cause issues for large vessels when mooring."** — App J1 cl.2.1.1.2 p2-4
- Appreciable seasonal variability in the wave conditions is evident with the bigger events generally occurring in the late winter to early spring . **The influence of tidal currents and water levels could lead to increased wave heights and deserve attention in a more detailed assessment.** — App J1 cl 2.1.1.3 p2-4

  Issue **: Here is another qualification re accuracy of data.**

  Question: If this deserves attention in more detail, why has it not been done?

  This description of the wave climate is derived from models yet to be calibrated and validated against measured data. However, the model is considered adequate for the purposes of general characterisation of the likely wave climate in the project area. — App J1 cl 2.1.1.3 p2-4

  Issue : **Here is another qualification re accuracy of data.**

  Question: Why has the model not been validated against measured data?

- "The Earth's rotation has an influence on the broad scale circulation patterns in the Gulf, generating a clockwise gyre with saline discharge from the Gulf along the eastern shoreline balance by a fresher inflow along the western shoreline." — App J1 cl. 2.1.2.1 p2-4
-
- Table 2.2 Tidal Planes at Port Bonython — AppJ1 cl 2.1.2.2 p2-5; App J2 cl 1.3.1 p5 (see also Cl 13.4.1.1 p372)

Tidal Plane	Relative to LAT	Relative to MSL
HAT	3.2	1.6
MHHW	2.7	1.1
MLHW	**1.8**	**0.2**
MSL	1.6	0
MHLW	1.4	-.02
MLLW	0.5	-1.1
L AT	0	- 1.6

- Current Measurements
  Depth averaged currents up to 1m/s were recorded during spring tide periods and the direction of the current was predominantly 65^0 (flood) and 245^0 (ebb). AppJ1 cl 2.1.2.3 p2-7
  These **currents have the potential to transport sands and silts.** AppJ1 cl. 3.2.1 p3-2
- The current roses at Point C... clearly show AppJ1 cl 2.1.2.3 p2-7
  the effects of the tidal current eddy that forms in the lee of Point Lowly. At this location the current is predominantly towards the East with a magnitude of up to 0.7m/s. The current roses at Point D... show that at upper elevations in the water column the velocity is of almost equal magnitude on ebb and flood tides, with magnitudes up to 1.0m/s. The ebb tide direction is towards the West-South-West and the flood tide flows towards the North-East. At lower elevations in the water column the ebb tide magnitude is higher than during the flood tide.

  Issue : Transport of dust and spillage from berth by currents.

  Question: **Can we predict where dust and spillage at the berth may be carried, (perhaps into the Rip)?**
- Sediment Characteristics App J1 Cl 2.2.1 p2-14
  Analysis of subsurface sediments is not considered necessary for this project since **no dredging** is proposed. Any project-related turbidity impacts would be due to disturbance of surfaces sediments. cl. 13.4.2.1 p372

- Table 2-4 Sediment Sample Locations -5/3/2013)MGA94z53) App J1 Cl 2.2.1 p2-14

Point	Easting(m)	Northing(m)
A3	757,055	6,341,136

  The Map shows this close to departure point 4500m from berth.

- Table 2-5 Sediment Sample Descriptions-5/3/2013 App J1 Cl 2.2.1 p2-15

Location	Echo Sounder Depth(m)	Sediment Description
A3	20	**Muddy silty sand with shell fragments**

Table 2.6 Sediment PSD Results

Sample	%Silt/Clay d<0.0625	% Sand 0.0625<d<2mm	% Gravel (shell) d>2mm	d_{50}
A3	**22%**	**43%**	35%	0.8

  - The rocky nature of the coastline indicates that there is very limited sediment supply. **Any sediment that is transported to the shoreline will tend to be subsequently transported by waves and current around Stony Point** and into the sandy embayment to the east (Weroona Bay). cl 13.4.2.2 p375 App J1 cl 2.2.2 p215 (Also App J1 cl3.1 p3-10)

- The predominant littoral sand transport will be from west to east... ... will tend to transport sediment to the east. The tidal currents near the shoreline predominantly flow towards the east, even during ebb tides.(due to the ebb tidal eddy that forms in the lee of Point Lowly**. These currents also have the potential to transport sediments towards the East.** The relative **importance of wave and current transport is difficult to establish without coastal process monitoring.** App J1 cl2.2.3 p2-17 (see also - cl.3.4.2.3 p375

  Issues : Once again, **no reliable data***! Sediment transport predictions without prior coastal process monitoring.*
  Question: Shouldn't coastal process monitoring have been done before these predictions were made?

- The current near the seabed at the end of the proposed jetty **may** exhibit a bias towards the ebb tide direction (approximately 245^0 or westerly) which could generate a net sediment transport potential in this direction. App J1 cl2.2.3 p2-17 (see also - cl.3.4.2.3 p375)

  Issues : These are considered opinions, which may or may not be true as **they are not backed up by hard evidence***.*
  Question: Would not this put the sediments in an area from which they would be transported northwards to the shoreline?

- '"It is difficult to draw conclusions about ongoing geomorphological changes in the study area **due to the lack of historical bathymetric data**. The turbidity and Total Suspended Solids (TSS) data(refer to Section 13.4.3.5) indicate that **there are active sediment transport processes occurring in this area, however, it is not possible to quantify net plumes or rates of bed level change."** AppJ1 cl2.2.4 p2-18 (see also- cl13.4.2.4 p375)

  Issue : Again, **no reliable data***! This is nothing more than an educated guess.*

- Groyne AppJ1 cl 3.1 p3.1
  Any sediment that is transported to the shoreline will tend to be subsequently transported by waves and currents around Stony Point... The structure will extend approximately 30 m past the MHHW contour. There is **no indication of underwater profile** however if the

above water profile is maintained then it is likely that the toe would be located approximately 2m below MHHW or around MLLW. In this case the structure would be located completely within the tidal range and allow any significant sand transport to occur past the toe of the structure.

Issue : **No underwater profile available**.

Question: What happens if the underwater profile is not the same- will it be modified?

- Piling — AppJ1 cl 3.2.1 p3.2

  "These currents **have the potential to transport sand and silts**."
- "In terms of Impact Significance Criteria shown in Table 3-2 **the significance is expected to be "negligible."**

  Table 3-2 Impact Significance- Hydrodynamics and Seabed Profiles

Negligible	No or negligible change in hydrodynamic regime and seabed profiles.

- Ship Movement. — App J1 cl 3.3 p3-2

  A preliminary assessment of propeller wash induced turbidity at the proposed development was undertaken using empirical formulae to calculate sediment re-suspension threshold velocities and particle settling velocities. **This assessment is based on limited data relating to bed sediments,** tug and ship manoeuvring scenarios including the influence of adverse tides and **without the benefit of detailed hydrodynamics. Therefore it is recommended that the results be used with caution at this stage.**

  Issues : **Surely with this amount of unknowns the "Precautionary Principle" should apply** *and attention be transferred to a location in a less environmentally sensitive area.*
- "The preliminary results of the propeller wash assessment are summarised in Table 3-4 (refer to figure 13.1 for distances metres from proposed jetty) and **indicate that propeller induced velocities are sufficient to mobilise a high percentage of sediments from the seabed**. **Between 28 percent and 100 percent of sediments could be suspended along the length of the departure channel** with 63 percent being resuspended at the wharf. The highest settling time was found to occur at the wharf with an estimated 12-24 hours required for the suspended material (depending on the assumption that the depth of water column involved) to settle out of the water column. — App J1 cl 3.3 p3-2; App J1 Table 3-4 p3- 4 (Refer also - Table13.5a cl13.5.4.7 p388)

  (We understand there would be several man days of calculations necessary to make an assessment of propeller wash induced sediment resuspension for any particular

ship, as it depends on ship's draft, water depth, depth of propeller, speed of the ship and engine setting and a knowledge of sediment composition. **Surely, then, this must indicate that the passage of loaded Cape-size ships from Port Bonython through Yarraville Shoals is unacceptable and a port south of Yarraville Shoals is the only logical solution***)*

A lower percentage (**roughly 48% of sea bed material is resuspended at the channel bend by propeller wash velocities**. This is due to the relatively coarse material present at this location with an average D50 of 4mm However, **the fate of this resuspended material is unknown as it is initially directed to the north towards sensitive reefs"** — AppJ1 cl 3-3 p 3-3

- The **study does not take into account possible " armouring" of the sea bed after disturbance of the finer sediments**. As demonstrated in Table 13.5a, propeller wash velocities are sufficient to mobilise even coarse sediment fractions into suspension. These particles rapidly settle back onto the sea bed, with **the finer sediments being carried away**, and may create a layer of coarse sediment trapping the finer material below, effectively armouring the sea bed. This may result in lower re-suspension and lower residence times over time. — App J1 cl3-3 p 3-5 (see also - cl13.5.4.7 p389)

  Issue : **There has been no attempt to rate the Impact Significance of propeller wash induced turbidity.**
  Question: **With the potential amount of material resuspended from the shipping channel and transported away by the turbidity plume, should this not be rated against Table 3-2 as "Very High"?**

Table 3-2 Impact Significance-Hydrodynamics and Seabed Profiles

Impact Significance/Consequence	*Description of Significance*
Very High	*Long term irreversible change in hydrodynamic regime and seabed profiles.*

Question: Does not this constitute **" self-dredging"** *of the shipping channel with* **sediments dispersed to unknown locations***?*

(My Guess: If we assume major disturbance of the sea bed as far as Yarraville Shoals (35km) and for a strip 100m wide and a depth of 0.5m with 50% of material carried away the amount of material transported over time, by the plume will be 35000x100x0.5x0.5 m^3 or *nearly 900,000 cubic metres!!!)*

Question: **What happens to the benthic communities on the sea bed when covered by a layer of settled sediment?**

- Mitigation of Propeller Wash Turbidity Risk App J1 cl 3.3.1 -p3-6

  "At this stage **only preliminary assessments have been made** regarding possible propeller wash sediment resuspension and **no numerical modelling has been undertaken to estimate the fate once in the water column and subject to tidal influences**."

  In other words, **it is all an unknown- they do not know where it will go!**

  "The mitigation of this risk **could** take several forms. Firstly, it could include **better assessments of resuspension and transport based on numerical modelling,** including **extra information on the content of the bed sediments**. Secondly, it could include **armouring of the berth area with coarser material.** Thirdly, it could be based on a program of **monitoring turbidity at the wharf and several locations along the jetty towards the reef areas.** The main disadvantage of the last option would be that **potential impacts may not be known until after the facility is built.**"

  Issues : In reality only the first option has merit, and even this

suggests **an alternative, less sensitive, port location would be preferable**.

Appendix J 2   VESSEL NAVIGATION AND OPERATIONS

- "The proposed development is expected to receive approximately 277 vessel calls per year"   App J 2 p 1
- Figure 1 shows Annual Vessel Calls (2006 to 2012 Financial Year)
  "Reference source not found"
- Vessel Navigation and Operation.   App J2 Cl 1.1.2   p3
  Table 1
  Stages for Vessels Approaching and Departing Port Whyalla and Port Bonython.
  To what do these point locations refer?

- Table 13.4a   Tidal Planes for Port Bonython   App J2   cl 1.3.1   p5
  (see also: Cl 13.4.1.1 p372
  AppJ1 cl 2.1.2.2 p2-5)

Tidal Plane	Water Level Chart Datum(CD)
HAT	3.2
MHHW	2.7
MLHW	**1.8**
MSL	1.6
MHLW	1.4
MLLW	0.5
L AT	0

- Note that there are other effects on the actual water level observed at any given time, such as storm surge, atmospheric pressure, rain fall as well as future potential sea level rise.   App J2   cl 1.3.1   p5
- Design Vessel   Table 3: Key Vessel Details   App J2   cl 1.3.2   p6
  'Cape size' Bulk Carrier
  Laden Draft   **18.3m**
- Vessel Draft and Water Depth Terminology.   App J2   cl 1.3.3   p7
  Gross underkeel clearance
  = vertical ship movement due to squat , wave, trim and atmospheric pressure + **net** underkeel clearance.
  Note: Dredging not required in Spencer Gulf.
  Issue : Underkeel clearance in shallow departure channel, will be less than gross UKC for ships travelling at 15 knots.
  Question: What is the magnitude of the difference between gross underkeel clearance and net underkeel clearance?
  In other words, ***how close to the bottom can the keel actually come when vessel is underway?***
  - "The **gross underkeel clearance** for vessels manoeuvring in Spencer Gulf is **0.9 m or 10 per cent of the vessel draft** (whichever is the greater).... For the fully laden Cape size vessel this corresponds to a required gross keel under clearance of **1.8m** and hence the Cape-size vessel requires a water depth of **20.1 m**   App J2   cl 1.3.3   p8 (see also Chapt 13 p384

when manoeuvring or **under way**.” (refer also to Table4).

- “The data in Table 5 shows that **a laden Cape-size vessel at Lowest Astronomical Tide cannot safely navigate Yarraville Shoals.** However, at or above Mean Low Low Water sufficient clearance is provided. To allow for the highest possible clearance, Flinders Ports regulations require that laden cape-size vessels depart Port Whyalla and Port Bonython **two (2) hours before high tide.** The navigable distance from Port Bonython to Yarraville Shoals is approximately 19 nautical miles (35 km). The first 9km (approx) of navigation is tug assisted and **after this point the vessel will cruise at service speed.** App J2 cl 1.4.1 p12

  Table 6: Laden Cape-size Vessel manoeuvring Timing

Vessel Manoeuvring	Tug Assisted	Service
Distance	9km	26km
Average speed	**4knots (7.8km/h)**	**15 knots(29.2 km/h)**
Time	1.1 hr	0.9 hr
Total time required	2 hrs	

  There seems to be some discrepancy between a time of 2 hours required to depart Port Whyalla (presumably the transhipment point) and 2 hours required to depart Port Bonython Jetty.

- The tidal window is considered open from MSL halfway to low tide. This is considered conservative as it would take longer for the tide to drop below MLLW even in an extreme tide,... However, the tidal velocity slows down before reaching low tide and determining the exact window is difficult. App J2 cl 1.4.1 p13

  The conclusion is that when vessels depart two (2) hours before high tide, reasonable underkeel clearance is available. If delays should occur for tides below MLLW, the vessel has up to 4.5hrs extra before the tidal window closes. If such a delay happens the pilot will follow Flinders Ports procedures, refer Section 1.7

  Issue : One wonders what the effect of other ships trying to

  navigate Yarraville Shoals (3/day is likely to have).

  Surely a port south of Yarraville Shoals would be less difficult!

- Port of Whyalla. Figure 13 App J 2 Cl 1.4.2. p 14

  “ ..the dedicated Cape Transhipment Point (CTP) and Panamax Transhipment Point (PTP) is shown. The circle highlights the dedicated area which allows for a vessel being anchored and swinging 360 degrees..... **Flinders Ports have advised that an additional number of transhipment points have been implemented. The transhipment points are defined by DPTI and coordinates are available on the Admiralty Chart.”**

It would have been helpful if the updated Admiralty Chart had been included *in this EIS, since the CTP shown and new CTP's (how many?), are no doubt in an area relatively close to the PB departure channel.*

- "None of the barges has engines ..." App J 2 Cl 1.4.2 p 14

  Arrium now have an additional self propelled barge which permits loading 2 Cape-size ships simultaneously. It is conceivable that they could, in future, employ a second self-propelled barge thereby halving the time required to load the second Cape ship.

  This all adds to the potential shipping congestion in the area.

[redacted]

<u>Submission –EIS on the Port Bonython Export Facility Proposal</u>

Email : dpti.pdsubmissions@sa.gov.au
Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning
Roma Mitchell House,
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

Thank you for the opportunity to respond to the EIS re the proposed Port Bonython Bulk Export Facility. I attended the 2 hour meeting in Whyalla and was not convinced that this facility should be progressed due to the following issues:

Environmental concerns and value to the community and visitors to our region

Environmental concerns:

- The port is tide dependent and this leaves few opportunities to sail a fully loaded vessel especially when high winds and dodge tides are also calculated in the opportunities to sail. It will only take one mistake to create an environmental disaster.
- This gulf is an estuary where hundreds of marine species are hatched and grow. The risks of further damaging this fragile environment are too high. Already due to unexplained issues with current industry the Giant Australian Cuttlefish is nearing extinction. Surely in the 21st century this is not acceptable.
- The existing and future risks of the shallow shipping route are unquantified; propeller wash, seabed disturbance, marine environment turbidity, settlement of displaced seabed material onto adjacent sensitive reefs and shallow inverse estuary areas.

Value to the community and visitors to the region:

- Whyalla has very limited recreational land due to the current mines and land grab by the Defence Force. The Lowly Peninsula currently adds value to the economic, social well-being and livability of the Whyalla region.
- The visual amenity, access and appeal of the coast and land area (Lowly Peninsula) will be degraded by this facility, putting at risk the existing and increasing future jobs and income from tourism and recreational use of the area.
- Already the impact of the decline of the cuttlefish is seeing reduced tourist to the region. I owned a B & B and had many international visitors coming to Whyalla to swim and dive with the cuttlefish. Already that opportunity has been lost to our city and region and no doubt accidents in industry were the cause but not admitted to.
- Space for recreational activities is paramount to attracting new workers to this city. Reducing the options is not acceptable. It puts the viability of retaining current workers and attracting future workers in the mining industry at high risk.
- The drive from Santos along the coast road back to Whyalla is a very special place for residents in Whyalla. Access will be limited and reduced and this is not acceptable.

Yours faithfully

[redacted]

[redacted]

Submission –EIS on the Port Bonython Export Facility Proposal

Email : DPTI.PDPublicsubmissions@sa.gov.au
Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning
Roma Mitchell House,
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

This submission has been prepared by the Alternative Port Working Party (APWP). This is a group of Whyalla community members who believe that the bulk commodity facility, which is currently under investigation for the west coast of Spencer Gulf, should be located outside Marine Park 10 and south of Yarraville Shoal.

This would provide better functional, economic, social and environmental outcomes.

The Draft EIS for the Port Bonython Bulk Commodities Export Facility is promoting a facility which should not be progressed due to the following issues:

The Port Location is too highly compromised to be viable.

- It is tide dependent, confined, and shipping is operationally constrained.
- There are significant Coastal land implications/limitations for access corridors and expansion options.

Marine Environment Impact.

- The existing and future risks of the shallow shipping route are unquantified; propeller wash, seabed disturbance, marine environment turbidity, settlement of displaced seabed material onto adjacent sensitive reefs and shallow inverse estuary areas.

Degradation of valuable coastal assets.

- The Lowly Peninsula currently adds value to the economic, social well-being and liveability of the Whyalla region.
- The visual amenity, access and appeal of the coast and land area (Lowly Peninsula) will be degraded by this facility, putting at risk the existing and increasing future jobs and income from tourism and recreational use of the area.

Superior Alternative sites are available for the Facility:

- There are several alternative sites south of the shallow Lowly shipping departure channel and Yarraville Shoal which can be used for the Bulk Commodity facility.
- They would not have the limitations on availability, efficiency, flexibility and expandability that apply to the Port Bonython option due to it's tidal dependency and confined site.
- They would not activate environmental issues re Marine Park10 or degradation of a valuable coastal asset as they are far removed from these sensitive areas.

These alternative sites have not been given judicious consideration in the EIS report.

Process.
The whole process to pursue development of a commodity port in the Port Bonython area is flawed. This is due to the initial directive to provide a proposal for a commodity port on the Government land in the area, with the process and facility being force fitted to suit.

The process for reviewing the proposal and furthering involvement of the community, through to final recommendation to the Governor for approval, is unacceptable in that:

- The minimum time which has been allowed for the public Draft EIS review is clearly inadequate.
- There is no allowance for community input after the Spencer Gulf Port Link EIS response.
- There is no allowance for community input into SA Govt. review prior to the decision by the Governor.

Having tracked the journey of the Bulk Commodity Facility proposal at Port Bonython for over five years, including discussions with various developers, government departments, the community, various consultants including Deloitte, reviewing the Draft EIS, and considering other developments approved and proposed for the Lowly Peninsula, we are of the view that the Facility should be sited south of Yarraville Shoal.

Yours Faithfully

[redacted]

[redacted]

17th November, 2013.

Submission – EIS on the Port Bonython Bulk Export Facility Proposal.

Email : DPTI.PDPublicSubmissions@sa.gov.au

Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning
Roma Mitchell House
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

It is with some reluctance and scepticism that I participate in the EIS process for the Port Bonython Bulk Export Facility.

My specific interest in the proposal is that of a long term member of the Whyalla Community concerned for the integrity of the Point Lowly Peninsula, and its associated marine environment of Upper Spencer Gulf South Australia.

As one of thousands of Whyalla people who continue to visit the Point Lowly area with friends and visitors, I value its special environmental qualities, its history and heritage, recreational, lifestyle and tourism potential and its outstanding scenic views across the Gulf to the Flinders ranges. It is still a beautiful area although scarred by the Santos Fractionation Plant.

In 1981, along with many other concerned South Australians, I prepared a submission for the Draft EIS for the Port and Terminal Facilities at Stony Point (a deliberate misnomer for Weeroona Bay) then being proposed by SANTOS Ltd on behalf of Cooper Basin Producers. My submission was sent in before the deadline, yet at the same time I witnessed contractors clearing the bush in preparation for the sealed road and services corridor to the site.

In my submission I expressed concern for the loss of Weeroona Bay with its Aboriginal and European heritage, the destruction of fifty one holiday shacks and the Lions Club Youth Camp, and the plans to industrialise a section of the highly valued Point Lowly Peninsula. My articulated concerns were a factor in my being elected to the Whyalla City Council in 1983 seeking a fair rate ‘in compensation’ for the loss of amenity to the local community. We have of course never been truly compensated.

The concerns expressed above are relevant to this situation today as they relate to Chapter 18 “Cumulative Impacts.” This is described as “the cumulative impact of the Project in conjunction with the other projects that exist or are planned within the study area.”

I consider this chapter to be the most important in the EIS and also the most revealing in its limitations. It is the basis for my opposition to the continuing promotion of industrialisation of the Point Lowly Peninsula. It demonstrates the flaws in the EIS process in that the cumulative effects i.e. social and environmental, are not assessed adequately. It is a piecemeal process, not a holistic view of the Peninsula and Gulf and its wider potential. The following quotation confirms this assertion.

"An assessment should also be based on publically available planning documents that clearly identify impacts of the Project. Recent information for the Santos facility and jetty, the Port Bonython Diesel Fuels Storage Facility and the Arrium Whyalla Facility were not publically available. For this reason cumulative impacts assessed in this Environmental Impact Statement are limited as the impacts of other projects are not able to be identified."(Page 38 Executive summary Chapter 18)

There will be negative impacts (social, economic, and environmental) even after conditions are placed on the proponent as part of the authorisation by the relevant Minister to recommend to the Governor of South Australia that the Project be allowed to proceed.

The negative impacts will not be neutralised by the Mitigation Measures as proposed in Chapter 9 (Landscape and Visual Amenity), Chapter 10 (Socio-Economic Impact) and Chapter 11 (Cultural Heritage). Mitigation will not lessen the impact of Industrialisation of the Peninsula as acknowledged in the following statement.

"The Santos Hydrocarbon Processing Plant which commenced operation in 1984, intrinsically changed the character of the area by adding an Industrial influence." (Chapter 10 Socio-Economic Impact page 22)

Further Industrialisation, if approved, will have significant impacts. I consider that the long term effects of the Project have been 'airbrushed' from any real analysis. The EIS process for this proposal is fundamentally flawed as the State Government nominated this site only, without real consideration of other potential sites.

The process serves to justify the site on the basis that adverse effects will be mitigated. It is a form of implied 'legitimacy' lending weight towards a predicted outcome.

In conclusion, my submission has been compiled on the basis that it helps make a contribution to the Public Record of community concern for the loss and degradation of an area precious to a local community.

Future generations may be interested to know that over a 30-40 year span there was a concerted effort within the Whyalla community (and others interested in the health of the marine environment) to preserve and protect an important asset of great potential; to enable wise and sustainable usage of a beautiful unique area - Point Lowly Peninsula on Upper Spencer Gulf.

I fear that this proposal and any others that may follow, will not just change the character and integrity of the area, but destroy it.

Yours faithfully,

[redacted]

[redacted]

17th November, 2013.

Submission- EIS on the Port Bonython Export Facility Proposal

e mail : DPTI.PDPublicSubmissions@sa.gov.au

Minister for Planning

Attention : Mr Robert Kleeman

General Manager, Assessment, Statutory Planning

Roma Mitchell House

GPO BOX 1815

ADELAIDE SA 5000

Dear Sir,

Submission - Port Bonython Bulk Commodities Export Facility

Draft Environmental Impact Statement Sept 2013

I am a member of the Alternative Port Working Party (APWP), a group of concerned professional Whyalla residents. I am a retired engineer, have lived in Whyalla for 64 years with over 42 years experience in steelmaking and mining engineering and environmental control .

The APWP strongly supports industrial development in the Whyalla region, but believes it should be developed in areas where it has the best chance to be competitive and does not detract from the liveability of the Whyalla region. Such areas exist at or in close proximity to the city and by conserving the Lowly Peninsula for recreation and tourism, we believe we can have the "Best of Both".

I have reviewed the EIS and I attach my submission structured around the Executive Summary

In the limited time allowed by the process, detail review of the entire document was not possible.

Yours faithfully

[redacted]

Submission - SGPL Port Bonython Bulk Commodities Export Facility Draft Environmental Impact Statement Sept 2013

Introduction.

This submission has been prepared by Sid Wilson .I have lived in Whyalla for 64 years and spent my 42 years of working life as an engineer involved with the iron ore mines ,material handling, port and steelmaking operations owned by Arium /Onesteel

In the limited,30 working days allowed to respond to this EIS, I have reviewed volume 1 and 2 and many of the Appendices.
I have used the EIS Executive Summary as the basis of, structuring and referencing my review and preparation of this submission.

Summary

Having completed the review I have many concerns regarding the EIS report and the proposal and remain firmly of the view that the Bulk Commodity Export Facility proposed for the Lowly Peninsula should be located south of Whyalla.

The key concerns are:

The Port at Port Bonython is too highly compromised to be viable.
- It is tide dependent and shipping operation is constrained.
- Coastal land implications.

Marine Environment Impact-un-quantified risks
- seabed disturbance of cape size vessels in shallow shipping channels.

Degradation of valuable coastal assets.
- Current and future value of Lowly Peninsula to the economy, social well being and liveability of the region is under valued in the report.
- visual amenity ,access and appeal of the coast and area will be degraded by this facility.

Alternative port sites have not been given judicious consideration in the EIS.

Cumulative impacts of projects on the Lowly Peninsula have been virtually ignored.

The EIS draft report is skewed .
- The executive Summary presents a far more positive position regarding some critical issues than supported by the report and appendices. .
- the Strengths and Opportunity are accentuated and the Weaknesses and Threats are veiled - are not given due consideration.
- there is lack of balance in the considerations.

- Lack of empirical data [baseline ,on site monitoring] to support some of the conclusions and opinions documented in the report and summary.

Is the EIS process capable of delivering the right outcome?

- The process must deliver a judicious follow up and a cogent recommendation to cabinet .How will this be achieved?

Review of the EIS Executive Summary Document.

1 . Introduction

p1.para 3 “ The project is located at Stony Point…….. Land is undeveloped, “

Concerns- The project location description fails to recognize the value of Lowly Peninsula as a valuable coastal natural resource which contributes to the economy ,social well being and diverse environment in the Whyalla region. The description is big on why it is appropriate to degrade further with industrial development due to the existing Santos plant , government ownership and establishment of Cultana army training area.

Question – Why has the upside relating to the current and potential value of the Lowly Peninsula not been identified.?

Project Timing - p1 “Construction for the first stage……..subject to market conditions”

Concern-Construction may commence 2015, in operation 2018 subject to financial close.

Question.- For 8 years a key reason for the proposed port site being Port Bonython as promoted by the Government and SGPL, has been the urgent need to support the resource boom, so why is it still in the investigation stage without rigorous investigation of alternative sites?

Project Alternatives. p1 and p4
“The SA government has selected Port Bonython as the most suitable location for a new shipping terminal,,,,,,,,,,,,,,,,”

Concerns- The report[s] relating to the selection criteria , investigation, analysis and recommendation has never been made available to the public. The Bonython port option is tide dependent due to two choke points in the shipping channels ,one extending approx 20 km south from the port on departure and the other at Yarraville shoal.
Discussion relating to alternatives concentrate on the downside of the options which includes lack of deep water, rail proximity, iron ore availability, private ownership or an available work force, most of which are applicable to Port Bonython.

Question- 1. Why is the downside identified but the upside such as lower capital cost, less impact on environment, currently established as a port, potential for expansion not mentioned in order to provide a balanced view?

- 2. How extensive /detailed was the consideration of strengths, weaknesses opportunity and threats regarding the alternatives and Port Bonython?

EIS Process fig .3 p4

Issue.-Need to understand the opportunity for the community input going forward and availability of information being prepared and exchanged between SA Government and SGPL."

Concern- the review of submissions and recommendations/report to cabinet will be progressed with little or no input by the public/local community.

Question -1. How will the public submissions and SGPL responses to those submissions be made available to the public?

-2 What documents prepared by Govt for cabinet will be available to Public eg The Assessment Report ?

[Read only or read and comment or locked away under confidential ?]

-3 Will recommendation to the Governor be available to public?

-4 What is the time schedule for next steps ?

-5 What Government agencies will be involved in future steps?

-6 Which Minister has responsibility for delivering the process, presenting the recommendation to Cabinet?

Environmental Impact Statement Approach. p5

"the approach to assessing impacts has involved a description of the impacts using significance criteria,,,,,,,,,,,,,,,,,,, Where residual impacts have been identified the cumulative impact of the project and other existing projects as well as and proposed projects in the study area is considered . Identified impacts are assessed as either beneficial or adverse."

Concern- The cumulative impacts section of the EIS is weak. SGPL claim they could not access information and data on other projects in the area. This is surprising as most should be available from the Government records eg Port Bonython Fuel Development application.

Question.- What action will be taken by SGPL and Govt to ensure the information on existing, approved and proposed projects is made available and interrogated as part of the EIS process ?

" In order of preference, identified impacts have been;

a) Avoided if possible through appropriate location of the Project and related infrastructure.
b) ' Designed out ' thereby minimizing significant impacts.
c) Mitigated through the implementation of environmental plans to monitor and minimize impacts."

Concern- Many of the critical EIS impacts have been addressed by c) some by b) and few by a)

Question – 1 . If a) is the first preference how is it that the selection of another site has not been the preference to eliminate shallow port departure route/chokepoints ,visual amenity and access, environmental impacts etc.?
Question -2. If environmental mngt plans [based on inadequate EIS baseline ,real time and onsite investigation]or monitoring, operating procedures are used to minimize impacts[after facility is built], how can SGPL as part of the EIS ensure that the minimized effect is adequate, and that if not, adequate corrective measures can be implemented ie ship departure channel; seabed disturbance ,turbidity material displacement to sensitive reefs in Upper Spencer Gulf?

-Also does the impact/ consequence/outcome due to human error, monitoring equipment failure make the risks unacceptable?

-Why is the precautionary principle being ignored?

Public Comment Period Written Submissions p5.
"The EIS will be on public display for a six week period ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,making the submission"
.
Concern- inadequate time to review significant amount of information gathered over approximately 12 months and make submission.[600 page report +12 appendices of similar volume]

Question-What consideration was given re the amount time allowed for the EIS information to be reviewed and adequate time provided to prepare and lodge a submission ?

Why was the appendices folder not provided on line or hard copy? [only available in CD]. The appendices are critical in reviewing and understanding the story being presented.

Why was only one open public meeting, scheduled for a total of 2 hours [only 1 hour of questions] allowed for?

2. Project Description- p9

Concern- No mention of Port Bonython Fuels project or SA Government concept to industrialize a significant area of the Lowly Peninsula. The area identified for industrialization has a similar foot print to that of the city of Whyalla]

Question.- Why is a copy of SA Government concept plan /layout not provided anywhere in the EIS documentation?

Bulk Storage Facility.
"The bulk Storage Facility will include ore unloading facilities storage sheds ,,,,,,,, material handing equipment."
Concern- Bulk Storage facility description ,one sentence, is inadequate to give even a general feel/ impression of the scale of development. No attempt has been made to describe the number or size of the sheds or other facilities and the footprint of the project .
Question - Why has no attempt been made in the project description to provide the information;

25 million Tonnes per annum.- 3 sheds,190 to 250 metres long, 70 metres wide and 30 metres high taking up a footprint bigger than the new Adelaide oval and the height of a 10 story building.
50 million Tonnes per annum - 4 sheds approx 400metres long
(This info is buried as sketch in Appendix E)

Operational ,Workforce, Working Hours and Activities.p8

"Laden vessels will depart the berth two hours prior to the high tide, to allow for safe manoeuvring through the Yarraville Shoal, an area of reduced depth in the Gulf."

Concern.-There is no mention of the same issue regarding laden ship safety and seabed disturbance at the Port Bonython Jetty berth or ship departure route for approximately the first 20kms.

Question .-This is an important issue relating to ongoing long term management and impact of shipping in the Upper Spencer Gulf and risk to safety and environment so why has this been omitted from the executive summary?

3.Legislation and Planning.

"Approvals and Permits required will be largely dependent on the final agreed construction and operational methodology and agreements with the relevant Federal and State agencies."

Concern- Progressing of this EIS [and potentially the Project] is based on picking a site for the Port and then justifying and compromising the project implementation and operations to arrive at an expedient, non strategic, long term outcome, with unnecessary impacts and risks to the total economy, social wellbeing, liveability and environment[land and marine.] of the region and State. It is evident from reading the EIS documents that there are significant go forward issues that are based on limited information , no baseline or background ,current, real time onsite monitoring [some of these are qualified and result in cautionary references ,disclaimers in the body of the chapters and Appendices.]

Question-What action does SGPL and Government intend to undertake to ensure that alternative sites are thoroughly investigated? Also that the weaknesses and threats of the Port Bonython proposal are identified and rigorously investigated prior to preparing and making a recommendation to Cabinet about the decision on the project, that is not left open to how to make it work if the decision is made to progress to design ,construct and operate?

Question- Where does the decision to investigate and implement a Government indenture kick in, who would be responsible for the indenture and how robust are SGPL and Government systems to manage another indenture in this area?

4. Water Resources

Ground water p12.
"The proposed development does not include below ground structures or excessive deep excavations and there should be no requirement to carry out works below the water table"

Concerns – Piles not mentioned. One would assume that the piles required for the project could penetrate the water table. There is known significant hydrocarbon ground water contamination in the Santos area. The underground substrate of the area is known to be complex and consist of cracks and crevices
.
Question- What consideration has been given re this concern , some baseline monitoring should be done within the project footprint, could pile driving aggravate an existing condition?

5. Noise and Vibration

Existing Environment p13
"It was found that False Bay has a relatively constant ,low noise environment, dominated by natural sources The nearest potential affected noise sensitive receivers are the coastal settlements at False Bay and Point lowly."

Concern – The coastline from False Bay through to the Santos fence line is one of the most used areas for recreation and tourism, primarily due to the excellent snapper fishing , Cuttlefish diving access and windsurfing.
The noise generated by plant and railway activities will have an impact on the people accessing and enjoying this area.

Impact Assessment p14
"Noise modeling was undertaken to predict the impact of the project noise levels on sensitive receptors. These levels were then compared to legislative noise limits or criteria"

Concern –This is not about legislative noise levels and confined to False bay and Lowly dwellings. The impact should be considered with regard to degradation of the ambience and peacefulness associated with the natural environment in regards to recreation and tourism.

Question.- What will SGPL and Government do to address the concerns above prior to progressing the EIS process to decision step?

Mitigation Measures. p14

Concern – All mitigation measures, except enclosed conveyor belts are aimed at construction activities .The ongoing operational railway noise impact on the False Bay residents, recreational visitors and tourists along the Cuttlefish Coast road coastline[mentioned above] have no mitigation measures mentioned .

Question- Where does this concern get addressed in relation to economy, social and environmental impact in the EIS?

Summary p14.
"Some exceedence of acceptable levels is likely to be experienced at False Bay for a short period during construction of the rail line."

Concern- As per above, what about rail movement and shunting impacts on the peacefulness and ambience of the coastal area of False Bay through to Santos fence line 24 hours per day.

Question- What does SGPL and Government intend to do to address this in the EIS process.

6 Air Quality

Summary p15
"Without prompt mitigation, some local residents may notice short term minor decreases in air quality /amenity"

Concern-it is to be hoped that mitigation will be prompt .
The effects of short term failure of mitigation equipment will also degrade the amenity for recreation and tourism.

7.Terrestial Ecology

Impact Assessment. p17

Approximately 228hectares of vegetation will be cleared,,,,,,,,.This is an Upper Limit and is likely that vegetation clearance will be far less."

Concern- what does far less mean? Why nominate a figure and then discount it especially when most projects over clear or damage vegetation to gain equipment access, borrow pits etc. .

Question -. Does the vegetation clearance figure refer to the 25mtpa start up or the 50mtpa full picture. ie. allow for extended and more sheds, etc?

"Any birds displaced are expected to move to adjacent, good quality habitat"

Concern –It is easy to arrive at this statement but the Defence Forces , Santos, Port Bonython fuels ,BHP Billiton, already occupy or have reserved, significant areas of adjacent land and the State government has a large area of the Lowly Peninsula up for grabs for industrialization.

Question . How can the Developers be sure that the birds can cope with the the total picture, cumulative effects on loss of good quality habitat, both at the construction and operational stages?

Summary p17
"Whilst the Slender Billed Thornbill does occur within the Project area, the clearance of habitat and other indirect impacts (noise, dust) are not expected to have a significant impact on the viability of this species
With the control measures outlined above applied ,the potential impact to terrestrial plants and animals within the study area is considered to be low."

Question- How can these statements be supported given the project land and other land in the area will not be available as well as the quality habitat of the remaining land being degraded.[noise, vibration light from trains, guns, tanks, trucks, conveyors processing plant etc.]?

8.Transport

P18
"Traffic modeling was undertaken to quantify the likely extent of impact.
The level of background traffic at a given year was calculated as the sum of the existing surveyed traffic volumes and an allowance for traffic growth to allow for gradual development in the area."

Concern –An allowance for gradual development for road transport is a poor assumption considering the Port Bonython fuel project is approved and still in play.
The transport chapter of the EIS nominates a gradual increase of 3% based on historical growth of 2% .It significantly underestimates the traffic numbers and does not give adequate consideration to the traffic type and mix.

NOTE;-The Port Bonython Fuels Fuel Storage and Processing Facility Project, Crown Development Application (May 2009) ,which has been approved, Appendix K .Transport Impact Statement states on page10; Ref to Table 1 Traffic Generation.

" Based on table1 above, the ultimate traffic generated by the proposed development is approximately 128 trips per day and 21 trips at peak hour. The current traffic volume generated by Santos and point Lowly community is approximately380 trips per day and 45 trips per peak hour. The predicted traffic generated by this facility should lead to a 34%increase in daily traffic to 472 trips and a 47% increase in peak hour traffic to 66 trips" Note -102 trips per day will be 'B' double fuel tankers. .Santos also currently runs a significant number of LPG road tankers.

Any requirement to road freight iron ore to the port would add to the issue.

Question .

- How can the road traffic investigation, cumulative impacts and summary be accepted given the above.?
- How will this be addressed by SGPL and Government as part of the EIS review?

9. Landscape and Visual Amenity

Existing Environment - p20.

"Landform in the vicinity of Port Bonython rises from the coastline with a series of low cliffs, rocky headlands and small bays"

Concern –There is no acknowledgement that the Lowly Peninsula is a significant part of a small area of very valuable natural coastal asset in the Whyalla area.

Question-This is an important aspect in the decision making re the value to Lowly Peninsula to recreation, tourism, diversity of employment, sustainability of the region and State, why other alternatives should be considered for industrialization , so why is it not recognized as such?

" In this landscape there is an argument, particularly in Whyalla that the industrial landscapes are a visual feature, which is of interest to some viewers"

Concern .This statement is beyond belief. There may be some people that visit the region to look at the industrial landscape but they would be a very small minority.

I have lived in Whyalla for over sixty years, travelled extensively nationally and internationally and have not come across one person who has visited the Whyalla area to take in the industrial landscape. I have on the other hand faced many comments, ,particularly from city dwellers who comment on the ugly industrial image that Whyalla had prior to significant work by Onesteel to clean up our industrial landscape and impacts by moving large portions of ugly infrastructure to the Middleback Ranges mine site.

The inclusion of this statement adds to the point that developers and government do not "get the point" re the value of the Lowly Peninsula natural asset to the Whyalla region.

The comment is often made that Santos has blotted the landscape so why be concerned re further industrial development.

Question -How was this statement conceived and how will it be overcome/ revoked in the EIS review ?

Concern – the chapter of the report covering this topic shows current photographs from predetermined lookouts that do not do the area justice.
Also there is no attempt in the photographs to photo shop or provide artists impressions to give the reader an indication of the visual impact of the 4 off, 10 story high, 400metre long sheds railways ,tip pocket , conveyor gantry visual impact
.
Question-Why was the availability of a realistic indication of the impact on visual amenity omitted from the EIS and what will be done by SGPL and Government to get a better picture of it during the EIS review process?

Mitigation Measures p21
"Due to the nature of the site and surrounding landscape and potential impacts identified ,there are few mitigation options available that will be sympathetic with the low vegetation and natural character"

- Existing vegetation around the perimeter of the site will be retained to act as a visual screen
- The color of sheds
- jetty color
- etc."

Concern. All of these mitigation measures will be at best, weak in achieving an acceptable, low impact on the landscape and visual amenity. There has been no attempt in the executive summary or report chapter 9 to provide photo shopped or artist's impressions of the project's impact on landscape and visual amenity.

Question – What is the real impact of the project on the Landscape and Visual amenity and how will the real value of the Lowly Peninsula be impacted by it ? How, by whom and when is this issue to be given a real, honest position in the review, analysis and decision making going forward?

10 . Socio-Economic Impact

.
Summary p24
"Without the project during the next 30 years this could potentially result in the loss of up to $14.6billion in direct export as the existing ports become capacity constrained in the future".

Concern-The information discussion presented in this section of the Executive summary is a skewed, narrow and shallow view of the socio- economic impacts.
The section focuses on the upside of the project being implemented at Port Bonython. It is soft on the downside issues, loss of opportunities if the project is implemented at port Bonython.

It does not recognize that all the upsides could be achieved and negative impacts could be avoided in the region and State by selecting a better alternative for the port south of Whyalla.
A port south of Whyalla and the Lowly Peninsula developed for recreation, tourism, coastal living etc would result in:

- more jobs, Industry plus hospitality/ tourism
- more diverse range of jobs

-jobs and prosperity less reliant on mining.
Currently Whyalla surfs the peaks and troughs of the iron ore steel commodity cycle.
Recreational Vehicle tourism in Australia is a 5 billion dollar growth business. Grey power demographics will power this growth .It is somewhat recession proof .
-liveability in the region improved with the opportunity to attract and retain key human resources - a place for the local community to relax and enjoy
- no seabed damage ,a better environmental outcome, securing the local professional fishing, charter boat fishing, diving crabbing and other marine based activities.

The Port Bonython Port Bulk Commodities Export Facility could be a potential candidate for being constrained in the future.
It is shipping channel tidal dependent and suitable land area constrained .
How would it cope with expansion, a real mining boom of 100 million tones per annum, a pellet plant, sinter plant , magnetite pumped to site requiring a desal plant and dewatering plant ? These issues get raised by government and miners at conferences and in the media.

Question – when, by whom and how will a rigorous, big picture, strategic, balanced, triple bottom line Strength ,Weaknesses, Opportunity and Threats (SWOT) analysis for the Bulk Commodity Export Facility be undertaken in this EIS approval process ?

11. <u>Cultural Heritage</u>

Impact assessment p25

“The point Lowly Lighthouse and the likely location of the shipwrecks will not be directly or indirectly impacted by the Project.

Concern- .If the Commodity Port Facility, Port Bonython Fuels ,Desal plant and other concepts shown on the SA Governments Lowly Peninsula development plan are progressed then the ambience attraction of lighthouse will be degraded. There will be several kilometers of industry to drive through to reach the light house..
Also the seabed disturbance and the final deposition of displaced material , currently not addressed in this EIS could impact on the shipwreck sites.

Question- Is this a potential indirect impact and what risk should be applied ?

12. Climate Change and Greenhouse Gases

The issues covered in this section of the EIS are applicable to the project regardless of where it is implemented.

13. Coastal Process and Water Quality

Shipping Activities and Operations p28.
" The existing shipping channel is along a route with water depth of 20 metres at Lowest Astronomical Tide with the exception of the Yarraville Shoals where the water depth is slightly less than 20 metres (19.6 metres)."

Concern-No mention of similar or shallower depth of water issues in the laden ship departure route- channel Straight (shallow) extending 3000 to 5000 metres from departure point (ref EIS Appendix J1 Table 3-4 Preliminary Propeller Wash Results.

Question. Why is the Executive summary silent on this issue when there is significant discussion re the unknown propeller wash impact on the environment and part of the ship safety management procedure to clear this restriction ie. is a similar or more critical issue than Yarraville shoal.

Impact Assessment p28.

Marine Water Quality
" ~ Turbidity from propeller wash of tugs and cape size vessels which may stir up bed sediments during vessel manoeuving. Whilst some sediments will be distributed ,this is considered to have only a moderate impact on water quality and is unlikely to affect any sensitive habitats."
" It is therefore considered that there will be negligible change in the hydrodynamic regime and seabed profiles as a result of the Project"

Concern- These statements do not accurately represent, summarize the information presented in the EIS document, Chapter 13 sections 13.5.4 and 13.6 and Appendix J1,sections 3.3 and 3.3.1. for example :

- " This assessment is based on limited data relating to bed sediments, tug manoeuvreing scenarios including the influence of adverse tides and without the benefit of detailed local hydrodynamics. Therefore it is recommended that the results be used with caution at this stage ."
- " However the fate of this re-suspended material is unknown as it is initially directed north towards sensitive reefs."
- "At this stage only preliminary assessment has been made regarding possible propeller wash sediment re-suspension and no numerical modeling has been undertaken to estimate its fate once in the water column and subjected to tidal

influences"

- " The mitigation of this risk could take several forms. Firstly it could include better assessment of sediment re-suspension and transport based on numerical modeling including extra information on the contents of the bed sediments. Secondly, it could include armouring of the berth area with coarser material. Thirdly it could be based on a program of monitoring turbidity levels at the wharf and several locations along the Jetty towards the reef areas. The main disadvantage of the last option would be that potential impacts may not be known until after the facility is built"

Question - How come the executive summary is so soft and skewed on these issues ?

Question - What is the likely hood and consequence of the following due to propeller wash;

-seabed scouring?
- Hydro- blasting/ shot blasting type impact of marine life, finfish, shell fish etc, permanent and migratory species, plants,?
- settlement of displaced, suspended materials How much and where. Effect on marine ecology?

Question– What empirical investigations and further work will be undertaken, by whom and when, within the EIS process to address the critical issue eg visuals and monitoring of existing ship routes, seabed and adjacent areas traversed by Cape vessels .

Shipping Activities and Operations.p29

"The clearance for vessels manoeuvring in the Spencer Gulf is 0.9 metres or 10 percent of vessel draft[whichever is greater0as required by Flinders ports"

Concern- .For many years the clearance was nominated by Flinders Ports as 20percent Refer to FP 1623 a Flinders Port' s sketch .
Appendix J2 page 8 refers to" The gross under keel clearance for vessels manoeuvring in Spencer Gulf is .9 m or 10% of vessel draft (whichever is the greater)."
This is referenced with footnote 9 –" As per Flinders Ports Regulations .Revised by Flinders Ports to 10% from 20% as specified in the draft port rules "

Question .This appears to be a big step change in the under keel clearance allowance which should require rigorous investigation, risk assessment, change management prior to decision to implement. When was the change made and what documentation is available to demonstrate the change management , decision making.?

"At Yarraville Shoal where the water depth is slightly less than 20metres…….. a fully laden vessel will be required to depart the berth within two hours prior to high tides for safe navigation through Yarraville Shoal."

Concern –the same issue is relevant for a significant distance after departure from the berth and is described in chapter 13 of the report. That is, there are two shallow choke points in the laden ship departure route, the northern one being in Marine Park 10. adjacent to sanctuary zones SZ 6 and 7

Question-Why is the EIS executive summary silent on this issue?

14. <u>Marine Ecology</u>

Impact Assessment. p32
"Construction activities can impact on adjacent marine communities as a result of sediment disturbance, which when excessive, can resulting adverse impacts including:
- Increased turbidity in the water column affecting visibility for fauna and reducing light availability for flora.
- Increased suspended solids in the water column which maybe abrasive and cause clogging eg.of the gills
- Sedimentation through silt deposition smothering fauna and flora."

Concern- Considering information regarding sea bed disturbance by Cape ship propeller wash turbidity ,along the departure route, as presented in chapter 13 and Appendix J1, the cautions noted and the need for more information and investigation on material displacement and final settlement, the same statement as above should be made in this section of the EIS Executive summary to give a realistic holistic picture re the impacts, from ongoing shipping operations.

"Piling and propeller wash from construction vessels are the main activities which could have impacts.

Concern -Reinforces concern above

"Only a small area of reef habitat will be lost, and any turbidity caused by the Project will be localized and within natural background levels.""

Concern –Reinforces concern above.

Summary p33

“With the mitigation measures proposed ,impacts to marine environment will mostly be localized and short term in nature, and are not expected to have long term impact on the marine habitats or fauna within the vicinity Of the Project.”

Concern –This sounds like a disconnect /long call in comparison to the information presented in Chapter 13 and Appendix J1

Note; The Impact Assessment section under Marine Ecology in this executive summary is completely silent on the impact(s) on the marine ecology of operational Cape vessel- Propeller wash, seabed disturbance, turbidity. This is described in Chapter 13 and App J1 as occurring, charts and tables are supplied , the discussion is qualified with a caution and the need for further investigation.

Question - How has this important issue been omitted from this section of the executive summary and what actions will be undertaken to correct the omission and make sure that the above impacts are fully investigated and closed out as part of the EIS process, prior to decision making?

15. Underwater Noise

No comment on this section.

16.Sustainability

No comment on this section.

17.Hazard and Risk

No comment on this section.

18.Cumulative Impacts

Page 38.
“An assessment should be based on publically available planning document that clearly identified impacts of the project. Recent information for Santos ,Port Bonython Fuels …. and Arrium Whyalla Facility were not publically available. For this reason ,cumulative impacts assessed in this EIS are limited as impacts of other projects are not able to be identified.”

Concern –My impression on reading this comment is that it shows total lack of commitment to address this topic which is core to why the Facility is being proposed for installation in the wrong place.
The site was picked for the port by government on a convenience, expedient basis and not really suitable for a port and the industrialization surrounding it.

Government ,bureaucrats, developers most of whom live remote from the community and region, don't know the value of the Lowly Peninsula to the region ,don't listen to community views based on knowledge and experience and living in the community. They then go about picking off one project at a time, with low regard for the long term ,big picture strategic ,triple bottom line outcomes, saying our project is a good fit for the state. They show little or no regard for cumulative impact on the region or community.

To literally latch onto not publically available is a real low act(not sure where you would rate it on the sustainability matrix)

Sufficient information should be available from the Government Planning Dept and other agencies .With a commitment to access information a reasonable fist could be made to address Cumulative Impacts. Also there are groups and agencies for example ,Stony Point Environmental Consultative Group, Whyalla Major Projects Group, RESIC which should be able to assist with providing other project information .

Based on the information I have already in the public domain it is possible to build list of infrastructure relating to existing ,approved ,proposed ,project concepts currently being floated on the Lowly Peninsula

Santos Hydrocarbons processing and shipping---- In operation

- Ten large bunded storage tanks
- Processing plant and pipelines
- Admin and maintenance facility
- Car park and truck loading facilities
- 2.4 km jetty

Port Bonython Fuels ----------------------- approved

- Seven large hydrocarbon tanks
- Distribution and road tanker loading plant
- Diesel distillation plant
- Admin and car park

BHP Billiton Desal Plant ----------------- approved in principal

- Five large storage tanks
- Large desalination process shed
- Water processing cells and settling ponds
- Processing plant and pipelines
- Pumping stations
- Admin and car park

SGPL Bulk Commodity Facilities----------- EIS commenced

- Four super sized ore storage sheds
- 20 km of railway, turnout, unloading
- 3 km of conveyor gantry sampling tower and transfer tower
- 3 km jetty
- Admin. and Maintenance facilities.

Added to the above, all are or will be fenced with 3metre high fences and serviced by interconnecting service roads and other services.
Add to this the Governments concept plan to industrialize the area eg. a LNG plant . All still at concept stage but being aggressively promoted.
This is all located on 2500 hectares that the State government is promoting to be industrialized.
This is adjacent to the hundreds of Square kms. of Defence Force land .
None of this will not be available to the pubic.
All of these projects must have an individual impact on economy ,environment and social and also have a cumulative impact due to the construction and operations of the projects.
The construction phases are subject to further progressing of the projects but it could be envisaged that the Peninsula would be impacted by construction for many years .This would include civil work on sheds, railways, large pipelines and roads all quite invasive to the use and amenity of the area .This is further added to as visual impact ,noise, dust ,traffic and marine disturbance when in operations.

Information available in the public domain and via Government agencies including previous EIS and Development Application documentation could surely provide information to carry out a cumulative impact assessment.
Cumulative impact assessment should be a core issue to be fully addressed in the EIS process **prior** to recommendation decision making of the Commodity port Project.

Question- When will SGPL show some genuine commitment and step up to the mark on the issue of Cumulative Impacts and what will Government do to provide assistance leadership and carry out due diligence on Cumulative Impacts regarding the Port Facilities proposal and their concept to industrialize the Lowly Peninsula?

Impact Assessment p38.

"- There is insufficient information on the amount of vegetation to be cleared for other projects ; however it is not believed this will have a significant impact on the survival of any species that uses the Port Bonython area."

Concern.- this statement is formed on insufficient data and one could equally "believe" that the Santos , PBFuels , Defence Force occupying land with associated impacts will have significant impact.

Question- How can this belief be formed on insufficient information and data being available?

"- Traffic Growth along the Port Bonython Road should multiple projects be constructed simultaneously ,and when all projects are operational.

- Modelling indicates that such growth can be accommodated with out any Further infrastructure upgrade."

Concern.- I believe that the modeling is based on a flawed growth assumption of 3%,see the comments under Transport in this submission.(34% increase for Port Bonython Fuels, significant part of increase is Double B's).
Port Bonython road may cope but the intersection at the Lincoln Hwy will need upgrading and based on current travel on the Lincoln Hwy to Port Augusta passing lanes will be required on that road.

Question- see section 8 of this submission.

An increase in ships in the Upper Spencer Gulf - P39

"The cumulative amount of ships will be approximately 309 a year which is a significant increase on the current number of approximately170 per year "

Concern .- The cumulative number of ship is significantly understated by approx **140-160 Cape vessels per annum. This understatement gives a false impression of the shipping movement in a port which has retrained capacity due to water depth.**
The project will call for approx 277 ships per annum ,current shipping is approx 170, which gives a total of 447 ships per year
Port Bonython fuels will require approximately 20 ships per year to give a total of approx 467 ships per year. The increase approx 300, is predominantly Cape Vessels. Should there be any operational or environmental risks relating to ships operating in the Upper Spencer Gulf this significant increase would have a magnifying effect on the impact.

Question- what will be done to correct the statement ,ensure that the risk reviews are carried out with the correct numbers?

19. Draft Environmental Management Plan

P40
Concern-The plan is the easy part of Environmental Mangement.
The challenge is to put the plan into action and keep it alive.
All of the plan relies on significant human input and attention to detail.
There are key issues relating to the Marine and Coastal environment for the Commodities Port Facility and the cumulative environment impacts if the area is developed as per the Governments concept for an extensive industrial precinct on the Lowly Peninsula.
Should the commodity port development and other existing approved and proposed developments proceed the individual and overall environmental plans and management will be put to the test. It then comes down to what is the RISK, what is the likelihood of an environmental excursion /incident /accident and what is the consequence/outcome /impact of an environmental incident .
Considering the increased industrial /port activity 'on the horizon' this issue must be seen as pivotal in the decisions to be made.

.
Questions. Who is responsible for identifying the big picture /cumulative impact Environmental Plan including Risk assessment.?
Who is responsible for the management of the big picture cumulative plan?
Is it likely that further indentures will be required to manage the port and other developments on the Lowly Peninsula?
Where does the Stony Point Environmental Consultative Group(SPECG) , EPA,Sardi fit into this big picture, cumulative, environmental plan development and its delivery?

20 . Summary of Benefits ,Impacts and Commitments

P 41 -"Spencer Gulf Port Link will continue to engage with Government and community to help ensure that environmental values are protected and managed. Overall the combination of management measures and ongoing monitoring that has been proposed demonstrates that the Port Bonython Bulk Commodities Export Facility can be developed without posing significant environmental impacts ,whilst generating jobs and revenue for the local community."

Table 7: Summary table.p42- Residual Impact Risk rating.

"Visual Amenity
Medium.
Views from Stony and Black Point. Views from Port Bonython Road."

Concern . Sheds are the only items mentioned. Residual Impact Risk should be rated unacceptable (high, extreme) . Four adjacent sheds 400 metres long , as high as a 10 story building and an area greater that Adelaide Oval will significantly degrade the amenity regardless of the color. Add to this a railway, sampling tower, conveyor gantry, transfer tower and a jetty. Add to this the cumulative effects of other industries.

Socio- economic.
"Low
" Disruption to way of life (during operations and construction),reduction in amenity ,disruption to property access, community facilities ,marine access"

Concern- should be rated higher than this:
- amenity -see above,
-disruption to property access-consider cumulative losses ;
  Santos
  Defence Force
  Proposed port .

Port Bonython Fuels
Government concept for further industrial development

- community facilities

loss of opportunity in investment in community
Investment is continually held back by the likelihood of industrial development degrading their value.

" High Beneficial"

" Economic contribution"

Concern -The economic contribution would be higher if the port was south of Yarraville Shoal

A commodity port will bring an economic contribution to the consortium, the region and State. However by positioning the port on the Lowly Peninsula there would be a consequential loss to existing jobs and revenue ,future job growth opportunity, diversity of employment ,sustainability of employment ie less jobs and revenue.
A port sited south of Yarraville Shoal would eliminate the downside to jobs and revenue, open up the opportunities. A southern port would allow mining resources, tourism and recreation to develop in parallel, multiplying the economic returns and adding resilience to the local economy by lowering the impact of iron and steel commodity peaks and troughs. A southern port would have room to grow. .

Concerns- This summary paragraph and Table 7 is skewed /out of balance to the positive of the project as seen by the individual developer. It misses the points that there may be significant impact on the marine environment by the increased cape ships, unacceptable visual and general amenity impacts on the Lowly Peninsula which would result in loss of opportunity to expand, diversify , and make resilient the region's and state's job numbers and prosperity short and long term.
These concerns could be addressed/avoided by looking at the long term ,strategic and cumulative impacts and investigating/building the port south of Yarraville Shoal.

Question.
What actions will be taken during the EIS process by SGPL and the Government to address the concerns raised above ?

Coastal Processes and Water Quality and Marine Ecology

"Low "

“Sediment transport ,changes to hydro-graphics ,release of sediment from piling or propeller wash ,release of contaminates eg waste”

“Low “
“ Loss of habitat from jetty construction ,habitat fragmentation ship strike noise &light turbidity ………”

Concern-The issues relating to sea bed disturbance by Laden Cape vessel propellers in the departure route are not reflected in these rating .The unknowns re mass of material disturbed ,possible seabed scouring ,where the material is finally deposited and impact on marine ecology does not support the low residual Impact Risk Rating.
(refer concerns and questions re EIS chapters 13 and 14 earlier in this submission .

Question. ”What is the impact of current shipping on Upper Spencer Gulf and potential impact of the approx 300 increase in Cape Size vessels travelling in the northern restricted channel. What will be done by SGPL and Government to address the concerns raised above during the EIS process?

Having closely tracked the proposal for the Bulk Commodity Facility on the Lowly Peninsula in parallel with the proposals for various other industrial projects on adjacent land and now reviewing the Draft EIS I am still firmly of the view that the Bulk Commodity Export Facility should be sited south of
Whyalla.

[redacted]

.

[redacted]

Minister for Planning

Attention: Robert Kleeman

General Manager, Assessment (Statutory Planning)

Department of Planning, Transport and Infrastructure

GPO Box 1815 ADELAIDE SA 5000

DPTI.PDPublicSubmissions@sa.gov.au

To whom it may concern,

The purpose of this submission is to bring to the attention of the proponent and the Minister for Planning some deficiencies in the Port Bonython Bulk Commodities Export Facility EIS that should be addressed prior to approval.

The author of this submission has experience in impact assessment and ecological studies in the Port Bonython area. This submission represents the views of the author alone and does not purport to represent the views of any organisation with which the author is currently or has previously been associated.

This submission does not constitute an exhaustive review of the EIS but focuses on five particular areas, namely sediment deposition, impact of construction noise on cuttlefish, oil spill response, introduced marine pests, and ecological monitoring programs.

Please do not hesitate to contact the author if any further information is required.

Regards

[redacted]

1 Sediment deposition

The EIS states that:

> *it is considered that impacts on the subtidal habitat are unlikely, although a further assessment will be undertaken during detailed design to confirm this assessment* (Section 13.5.4.7); and
>
> *For the ship movements, at this stage only preliminary assessments have been made regarding possible propeller wash sediment re-suspension and no numerical modelling has been undertaken to confirm its fate once in the water column and subjected to tidal influences. Further assessment will be undertaken during detailed design to confirm the risk of sediment suspended by propeller induced currents travelling to the subtidal habitat, although qualitatively it is considered unlikely based on the known current data (Section 13.6).*

The second statement in particular highlights that some uncertainty remains, even if the interpretation of the current data and other assumptions were correct. It is understood that in some circumstances it is reasonable to delay further assessment to the detailed design stage, but it is not clear why that should occur in this case. The key elements of the infrastructure (e.g. its distance offshore/location of the ship-berthing area) and the maximum number of shipping movements are fundamentals on which the rest of the assessment is based and there appears to be no reason why a more detailed assessment, including quantitative hydrodynamic modelling, should not be undertaken prior to approval. An example of such a study is provided by Appendix O12.1 of the Olympic Dam Expansion Draft EIS (BHP Billiton 2009).

The need for a more detailed assessment is underlined by some key errors or gaps in the data presented for the qualitative assessment.

Firstly, the predominant tidal current directions have been described as “northeast during flood and southwest during ebb tides” (Section 13.5.4.7) or “easterly to westerly depending on the tide cycle” (Section 14.4.3.6). It is suggested therefore that “suspended sediment carried by the propeller-induced current, even if exerting in a northwest direction, is unlikely to reach the subtidal habitat”. However, this ignores the influence of a key hydrodynamic feature of the area, namely the clockwise eddy at Port Bonython during the ebbing tide, shown in an animation and the model calibration report provided with the Olympic Dam Expansion Draft EIS (BHP Billiton 2009). The influence of this eddy could direct the suspended sediment directly towards the subtidal reef.

Secondly, the assessment fails to adequately describe the receiving environment and its vulnerability to sediment deposition. Section 14.3.4.3 provides an unconsolidated set of extracts from previous studies and the benthic surveys by SARDI described in Appendix K1, yet only makes a brief (misspelt) mention of the red alga *Gigartina brachiata*. The misspelling of this species, reproduced from the source document, may not seem particularly relevant in a document that contains dozens of errors in species names. But in this case it does suggest that insufficient attention has been paid to understanding the reef ecology and how it may be impacted. *G. brachiata* should have stood out from the literature review. It is significant to the assessment for two reasons, neither of which have been discussed in the EIS:

- It is a turfing species. Sedimentation has been linked to shifts in reef ecosystems from canopy forming macroalgae to turfs, which become entrenched as they accumulate further sediment (Turner et al. 2007; Gorgula and Connell 2004).
- It is the dominant species in the shallow subtidal reef at Port Bonython (approximately 2 m depth), with a cover of 60-70% personally recorded during surveys a few years ago. *G. brachiata* and other turfs have also been recorded at several sites in the area at lower densities (10-50%) at 5m depth (G. Edgar/DEWNR, unpublished data). Neither *G. brachiata* nor any turf was recorded in the SARDI surveys reported in Appendix K1 (which were also at 5 m), nor in the towed video transects that extended inshore to 2-3 m depth. A review of the towed and diver-held video footage would be appropriate.

The key inference from the above points is that the receiving environment does respond to sediment deposition, and further deposition of sediment may result in an expansion of the reef area dominated by turfs.

2 Underwater Construction Noise

Section 14.4.2.4 states:

> *When considering cephalopods the main focus has been on the aggregation of the Giant Australian Cuttlefish along the reef area from Black Point to Point Lowly (May-September). During the Project planning phase, it was decided that inshore construction activities at or in close proximity to the reef will not occur during the Giant Australian Cuttlefish breeding season, in order to minimise the risk to the breeding population. Monitoring will be undertaken at the beginning of the aggregation season. Should the presence of Cuttlefish not be detected, piling activities will continue within this zone.*

There are a number of assumptions underpinning this statement that are questionable or (at best) are not sufficiently precautionary:

- that hatchlings, which emerge as late as early November (Hall and Fowler 2003), will not be affected by inshore construction noise
- that cuttlefish migrating towards the spawning reef will not be affected by construction noise further offshore
- that some cuttlefish will arrive despite construction noise in order to trigger the suspension of inshore construction, and that inshore construction will not delay the arrival of the cuttlefish at the spawning reef

Instead, it is proposed that the following mitigation measures be adopted:

- there should be no construction activities anywhere along the proposed jetty between the end of April and mid-June, to allow cuttlefish to migrate to the reef without noise disturbance.
- inshore construction activities should not occur between the beginning of May and mid-November.

3 Oil spill Response

The dispersion of information across chapters, incorrect cross-referencing between chapters and inadequate or incorrect referencing of sources makes it very difficult to understand how the risks associated with a major oil spill have been assessed and mitigated. It becomes even more concerning when there are significant discrepancies between different sections.

Sections 13.5.4.4 and 14.4.3.6 (the latter referring to Chapter 17) state that oil spill contingency plans are in place for Port Bonython. Section 13.5.4.4 cites the plan as “AGC (1988a,b)”, but the reference list contains only a (duplicated) entry for a report AGC (1989), *Whyalla Investment Park, Declaration of Environmental Factors*, which doesn’t seem to be the right report. Section 14.2.1 refers to an Oil Spill Contingency Plan prepared for Santos in 1998 as an information source for the overall EIS but again this document is not included in the reference list and does not appear to be readily available e.g. via a web search. It is hoped that the Santos oil spill contingency plan was developed in 1998 and not 1988 or 1989 (i.e. before the ‘Era’ spill). The ‘Era’ spill was 300 t which is 30 times greater than covered by a Tier 1 spill that Flinders Port has the equipment to handle (Section 13.5.4.4). There is no mention of how the Santos plan or any other plan/approach would deal with Tier 2/3 spills such as the ‘Era’. Section 14.4.3.6 states that “certainly the lessons of the ‘Era’ spill have been taken on board and procedures improved to prevent a similar incident from occurring” (there is a reference to Chapter 17 regarding the ‘Era’ but no such information in that Chapter) but there is little to inspire confidence in that statement.

Sections 13.5.4.4 and 14.4.3.6 state that the proposed BCEF will operate under the Santos plan but on redirection to Sections 17.4.8 and 17.5.5 it is indicated that an oil spill contingency plan has yet to be developed. Then there is a reference in Section 17.5.5 to cleanup in accordance with the “Flinders Ports oil spill management plan”, which assumably means the Flinders Ports Oil Spill Contingency Plan (FPOSCP). The reference list does not contain this or any other oil spill management plan.

The FPOSCP currently covers only the existing ports and confirms that it is geared to handle spills of up to 10 tonnes (Tier 1 spills), with larger spills requiring the assistance of regional, state or national resources. The FPOSCP refers to the South Australian Marine Spill Contingency Action Plan (SAMSCAP), which according to the AMSA website is currently being revised. The SAMSCAP is briefly mentioned in Section 13.5.4.4 but there is no indication of how it may contribute to oil spill response and no mention of this document or anything else of direct relevance to oil spills in Section 17.3 which purports to show the policy and legislative context for key risks.

Section 14.4.3.5 (“Aquaculture and Fisheries”) acknowledges that aquaculture could be impacted by a large oil spill but makes no mention of any fisheries, many of which rely on the sort of habitat that was impacted by the ‘Era’ spill.

Overall, the poorly referenced, widely dispersed, inconsistent and incomplete information provided by the EIS does little to inspire confidence in the statement about the lessons learnt from the ‘Era’ spill. The reader is redirected all over the document, with a number of dead ends, to be told that an oil spill contingency plan is in place (with two different plans mentioned), but also that it is currently being developed. There are unreferenced or incorrectly referenced mentions of a Santos plan but the date is ambiguous (spanning a decade and bracketing the ‘Era’ spill). There is an unreferenced, misnamed mention of an existing plan that covers only existing ports, and for spills only about 3% the size of the ‘Era’ spill. There is only a brief mention of the relevant SA policy context that is probably critical to the handling of spills greater than 10 tonnes (Tier 2/3 spills). There is no mention of oil spills in the EMP.

Clarity is required in the EIS about:

- the status of the oil spill response/contingency plan for the new port
- How Tier 2/3 spills will be addressed
- The correct reference and public availability of the Santos Oil Spill Contingency plan

AMSA (2005) identified a number of lessons from the ‘Era’ spill that should be directly addressed by the EIS:

- Is there provision for high wind situations such as the 25 knot winds that prevented containment booms from being used to manage the ‘Era’ spill?
- How will the cleanup of relatively inaccessible and delicate areas such as mangroves be addressed, given the difficulties faced near Port Pirie after the ‘Era’ spill?

Section 13.5.4.4 refers to regular [oil spill response] training sessions and exercises held at a number of ports on an annual basis. Is this training audited, and are there publicly available reports on the training?

4 Introduced Marine Pests

Sections 14.5.1.7 and 14.5.2.3 discuss a range of measures for reducing the risk of introduction of pest species, including compliance with biofouling guidelines and ballast water management requirements, and monitoring. The EIS concludes that the risk of introduction of pest species is expected to be low following adherence to these measures.

Despite this apparent low risk it is difficult to believe that such measures will prevent all future introductions.

The assessment should include a benchmarking study that in its simplest form assembles readily available information on the number of introduced species detected during numerous port surveys in Australia, particularly where repeat surveys have occurred, and compares it with the cumulative number of shipping movements. Other factors that could be incorporated into the study are the dates of implementation of management measures, the type of pest species and the ports of origin.

5 Ecological Monitoring Program

Section 14.2.2 describes the survey undertaken to characterise habitat values, suggesting that they "were of sufficient detail that they may be used to provide a baseline for comparison for any future post-construction monitoring". It is difficult to take such a statement seriously in an EIS that contains so many inaccuracies and omissions which collectively undermine its credibility and reduce confidence in the ability of the proponent and its sub-consultants to undertake robust monitoring. Some examples include:

- the list of dominant seagrasses in Northern Spencer Gulf omits *Posidonia australis*, the dominant species in nearshore waters (Section 14.3.3.1)
- the lack of emphasis placed on turfing algae in the assessment and the failure of the benthic habitat study to record them (see "Sediment Deposition" above).
- benthic survey results in Appendix K1 recording the sea star *Goniodiscaster seriatus,* whose range is restricted to WA (Edgar 2008), while the local species *Anthaster valvulatus* has not been mentioned; and recording *Haliotis rubra* which is not found in northern Spencer Gulf and is probably *H. scalaris*.
- an apparent unawareness of taxonomic changes, e.g. some very common fish species are referred to by names that are out of date by decades (Section 14.3.4.3 and Appendix K1), and an apparent unawareness in Section 14.4.2.3 (iii) that *Heterozostera tasmanica* and *H. nigricaulis* refer to the same species (Kuo 2005)
- many other species names misspelt, misformatted or otherwise incorrect, e.g. at least half a dozen errors on the first page of Appendix K2 alone, and a common species such as *Scaberia agardhii* is misspelt in several different ways through the document
- The red alga *Platysiphonia mutabilis* is stated to occur only westward of the SA Gulfs (Section 14.4.3.9) but is widely distributed through the eastern states and New Zealand (Womersley 2003)

It is therefore recommended that the proponent provide further information about how they will ensure that the design and implementation of their monitoring program will be of an adequate standard, including details of quality assurance processes and peer review.

6 References

Australian Maritime Safety Authority 2005, *Major Oil Spills in Australia*, AMSA, Canberra.

BHP Billiton (2009) Olympic Dam Expansion Draft Environmental Impact Statement.

Edgar, G.J. (2008) *Australian Marine Life. The Plants and Animals of Temperate Waters*. Reed New Holland, Australia. Second edition.

Gorgula S.K. & Connell S.D. (2004). Expansive covers of turf-forming algae on human-dominated coast: the relative effects of increasing nutrient and sediment loads. *Marine Biology* 143, 613–619.

Hall KC and Fowler AJ (eds.) (2003) The fisheries biology of the cuttlefish *Sepia apama* Gray, in South Australian waters. Final Report to FRDC (Project No. 98/151). SARDI Aquatic Sciences, Adelaide, 289 pp.

Kuo, J (2005). A revision of the genus *Heterozostera* (Zosteraceae). *Aquatic Botany* 81, 97–140

Turner D., Kildea T. & Westphalen G. (2007). Examining the health of subtidal reef environments in SA. 2. Status of selected reefs based on the results of the 2005 surveys. SARDI Publication No. RD 03/0252-6. SARDI, Adelaide.

Womersley, H.B.S. (2003). *The marine benthic flora of southern Australia - Part IIID Ceramiales - Delesseriaceae, Sarcomeniaceae, Rhodomelaceae*. pp. 533. Canberra & Adelaide: Australian Biological Resources Study & State Herbarium of South Australia.

[redacted]

17 Nov 2013

Submission for the Draft EIS on the Port Bonython BCEF Proposal

Email to: DPTI.PDPublicSubmissions@sa.gov.au
Minister for Planning
Att'n: Mr Robert Kleeman
GM, Assessment, Statutory Planning
Roma Mitchell House,
GPO Box 1815
Adelaide
SA5000

Dear Sir,

I am a member of the Alternative Port Working Party. We are a group of concerned professional Whyalla residents. I am a retired professional engineer with over 40 years experience in mining, heavy engineering, and steelmaking.

The APWP strongly supports sensibly located industrial development in the Whyalla region. We believe it should be located in areas where it has the best chance to be competitive and does not detract from the liveability of the Whyalla region.

We believe such areas exist in close proximity south of Whyalla and, by conserving the Lowly Peninsula for recreation and tourism, we believe we can have "The Best of Both."

I have reviewed several sections of the EIS and attach my submission.

Detailed review of the entire document (over 1000 pages) was not possible in the limited time allowed by the Minister.

Yours faithfully,

[redacted]

Submission – SGPL Port Bonython Bulk Commodities Export Facility – Draft EIS of Sep 2013.

Questions based on the EIS submitted by SGPL for the proposed Bulk Port on the Lowly Peninsula at Port Bonython.

P 54 - Sec 1.8.2
- Para 1. First dot point is not true. Why has the fact that Arrium Mines presently exports through the port of Whyalla been ignored?
- Para 3 – Rail transport costs are not directly proportional to distance. Port environmental costs are not impacted unless the operator chooses to employ reduced controls at a remote port. Why have these facts been ignored? Is it to give the desired conclusion?

P 54 – Sec 1.8.3
Why have only a few of the port options been included here, yet more are mentioned later? (Sec1.8.7 & 1.8.8)
To present a comprehensive EIS it is necessary to compare all options fairly, evenly, and dispassionately. Why has this not been carried out?

P 56 – Sec 1.8.8
Of the five dot points included, only the zoning reference is valid. The existing jetty is exclusively for petroleum products – the BCEF vessels will have to avoid it. This is a negative point.
The deep water access claim is contested and there is no mention of ship sailing being tide-dependent, yet this is conceded in the body of the report. This is a negative point.
Close proximity to iron ore claim is a furphy. Actual rail access is required and is not provided. The nearest ore in the Middleback ranges is already exported through Whyalla Port.
The minimal impact on the local community is contested by the community itself.
Why has the evaluation been skewed?

P 47 – Sec 1.1
- Para 4. The admitted main reason for the site being ‘chosen’ by SGPL is that the state Government itself dictated the location before the EOI was advertised. Why has this dot point been omitted?

P 57 – Sec 1.8.9 Table 1.8a
This table is disingenuous. It is skewed in favour of BCEF and is not a true representation of the whole ‘picture’. For example:

BCEF – Advantages – Why is “open rail access” noted, yet the same rail access for Port Pirie is ‘damned with faint praise’ by noting “some capacity to carry additional mining product”
- Disadvantages – Why is there no mention of closeness to holiday and residential homes?
Why is there no mention of seabed disturbance over 20km of fishing grounds?
Why is the unique cuttlefish aggregation only mentioned as being ‘in close proximity’ when in fact the jetty is right on top of the spawning grounds?
Why is there no mention of the massive capital investment costs which will have to be paid for in port usage charges for this BCEF to be viable?

Why is there no mention of private ownership being a disadvantage when it is trumpeted as such for the other new ports?
Why is lack of a multi-use ability not mentioned as a disadvantage?
Why is there no mention of the possible obliteration of a registered heritage site (#6432/3041) due to closeness of the 4th shed?

Whyalla – Capacity – Why is this limited to 13mtpa? It is rumoured that Arrium might well reveal plans for further expansion.
- Disadvantages - Why is private ownership a disadvantage?
Why is lack of 'multi-use' not mentioned as a disadvantage?

Port Lincoln, Port Pirie, Darwin – Disadvantages - Why are these ports not disadvantaged due to being 'multi-use' ports?

Nonowie – Capacity – Why listed as 'unknown'? It is limited only by the availability of ore. This is similar for Myponie Point and Cape Hardy. These errors show a lack of effort by the proponent.

- Disadvantages – How can you state there are no development plans made, yet note the capital costs are high?
- Ownership and planning issues are not a hindrance to this option, so why are these 'disadvantages'?
- Services are no more an issue than at Port Bonython site so why is this not noted for BCEF?
- Transhipment is an option not a requirement. It would allow for early return on investment which is an advantage. Does BCEF have this option?
- Jetty length is a furphy. What matters is cost to miner for loading ore - $ per tonne. What are the comparable figures for each of these options?
- Advantages – Why is 'priority employment area' not included? It is as close to Whyalla as BCEF – or closer!
- Why is possibility of connection to Arrium's mines been omitted?
- Why is advantage of closeness to Eyre Peninsula mines omitted?

Port Spencer – Disadvantages – Why is 'grain connection' a disadvantage? It is an advantage.

Note that the ore from Peculiar Knob (Fig 1.8d in Northern Gawler area, noted as owned by Western Plains, but bought by Arrium Mines several years ago!) now is exported through Whyalla port by Arrium, and will never be available for BCEF. **So what annual ore tonnage will BCEF really be exporting?**

Table 1..8a is skewed to assess all options in terms of BCEF (perceived) advantages. **Why does SGPL not assess each option on its own?**
What matters is tonnage, $ per tonne, with no detriment to environment or community.
"She'll be right!" is NOT the way to go. Do you have a 'magic wand' to reverse all your damage once it is obvious? If not, then DON"T DO IT.

P 63 – Sec 1.10.2.3

-Para 2. Why does DPTI refuse its own request regarding info on the diesel storage project? Why does SA government refuse information on Santos jetty for its requested EIS? Without this information we can only assume the state government does not support, nor want, a full and proper risk assessment and the proponent is unconcerned by the refusal.

P 1 – Sec 1

- Para 3 – Why is there no mention of the present use for tourism for the ambiance and scenic beauty of the Lowly Peninsula, and the views – particularly across the gulf?

- Why is there no mention of the present ability to view the unique annual aggregation of the giant Australian Cuttlefish exactly where the BCEF is proposed to be sited? And which will be risked in its entirety for the sake of the state government 'losing face' by having to admit the selected location is wrong?

App E – Drawings

There are no drawings showing the full layout of the BCEF 50mtpa facility yet this EIS states it is being submitted to cover the 50mtpa facility (P1 Sec 1 Para 5). Why are there no accurate drawings submitted?

- P 2/14/15/16 – Do not show the location of the Sanctuary Zone, nor the existing cuttlefish visitors information board or viewing platform which will be re-located, nor where they will be re-located to.
- **P15 does not show the BCEF exclusion zone added to the Santos exclusion zone.**
- P14 Shows the extra expansion shed needed and the extended original sheds. Extrapolating from shed and conveyor 501 elevation drawings reveals that the floor level of the easternmost corner of the extra shed needs to be at least 5m above existing ground level with the perimeter access road at the same level. **Allowing for the fill angle of repose, brings the perimeter fence on, or over the heritage listed site #6432/3041. How is this allowable?** Where will all of this fill come from? How can you justify the claim that the sheds will not be obtrusive when this 4th shed will tower 35metres over the surrounding land? This land is already on a spur from the Lowly plateau!
- Is the footprint to accommodate the new boundary for the extended sheds, perimeter road, and fence (Sk 32) included in the total vegetation area to be cleared? (As stated in the Executive Summary, page 17 – Terrestrial Ecology – Impact Assessment – approximately 228 hectares of vegetation will be cleared during the construction phase of the project….This is an upper limit and it is likely that vegetation cleared will be far less).
- P13 – Shows 8 dolphins at the single wharf but all others show 6. Why the discrepancy?
- P23 – shows the flow chart which quantifies inloading capacity by train at 20mtpa and outloading over the jetty at 13mtpa (capacity though of 26mtpa single berth). **Where are the figures and corresponding drawings for the capacity which this EIS is applying for?**

P443 – Sec 14.4.3.2

- Para 3 – Second dot point – Why conclude that 'impacts are likely negligible' (Pun not excused) if the cuttlefish have to travel through the noise zone to get to their breeding ground if you do not have data? Others might well conclude that the cuttlefish will be disoriented or diverted and result in no breeding. With the sudden and unexplained drop in numbers this year (2013) it is plainly obvious that unknown factors are present and any extra man-made disturbance must be avoided until the factors are defined and a community-acceptable avoidance strategy formulated.

P 445 – Sec 14.4.3.5
- How can commercial and recreational fishing NOT be affected, when the loaded vessels will be dragging their keels over 20km to deep water and creating turbidity over this distance?
- Why do you not state in this section that loaded ship sailing times are affected by the state of the tide due to lack of sufficient depth of water?
- How are commercial and recreational fishing not affected when the passage of up to 554 (empty and loaded) ships requires a significant safety clearance?

P446 – Sec 14.4.3.6
- Subtidal Habitat…Propeller wash of 0.7m/s means an increase of 70% over the tidal velocity of 1.0m/s. How is this 'minor'?
- Fairway Bank - Para 2 – There is no water as deep as 20m at the northern end of Fairway Bank. How can you disagree with the marine chart?
- Yarraville Shoal – Sailing times of loaded ships is restricted by Flinders Ports. How can you say there is no restriction on sailing?

P454 – Sec 14.6 Table 14.6a
- Item 5 – Prop wash disturbance – How is the rating of "minor significance" justified with 277 vessel movements every year dragging their keels over 20 km of gulf bottom?
- Item 7 – Suspect "construction vessel management" should read "operational vessel management". How is the "minor significance" rating justified with the injuries or death of the struck mammal?

Ps 544 to 570 – Sec19.5
- Many of the plans identify inspections and frequencies but few identify training and qualifications of inspectors and none identify practical frequency of inspection dictated by climate/ environment. Weeds grow rapidly especially after summer rains. A 6 monthly inspection just doesn't cut it.
- What action will SGPL be taking to ensure contractors and their employees understand and comply with all aspects of the EMP?

P553 – Sec 19.5.5.1.2 and P 214 – Sec 7.8 - Table 7.8a
- What provision has been made for the safe escape of fauna from inside the fenced grounds of the storage sheds and conveyors and the balloon loop? There is no mention of this inevitable occurrence. Use of the entrance gates is a recipe for accidents – another escape path is vital.

RP-9 Nov 2013 (Rev 2)

[redacted]

17th November, 2013.

<u>Submission – EIS on the Port Bonython Bulk Export Facility Proposal.</u>

Email : DPTI.PDPublicSubmissions@sa.gov.au

Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning

Roma Mitchell House
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

This is the first of several submissions. It relates to **<u>sections 1 and 3 of Appendix A1 Final EIS Guidelines</u>**

I am a member of the Alternative Port Working Party (APWP) which is a group of professional Whyalla residents, who are concerned to encourage the most efficacious development of a diverse range of industrial and other economic opportunities and quality of life attributes of this region of South Australia.

Areas which are immediately north of the city and potentially also an area adjacent to a deep-water shipping lane about 25 kilometres south of Whyalla, are most suitable for industrial activities.
The Lowly Peninsula north east of Whyalla is unique in this region for opportunities for recreation and tourism and coastal living.

Judicious matching of areas of our land and Gulf to those activities for which they are most suited, is the key to achieving "best of both" - success in business and liveability outcomes in this region.

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my Engineering experience in Heavy Industry and my service in Local Government. <u>See footnote.</u>

It is most regrettable that only 6 weeks have been allowed for responding to the draft EIS. The time is clearly not adequate for a rigorous review and provision of comprehensive feedback covering the Draft Statement (598 pages) and its Appendices (524 pages).

I attach my review work notes in respect to **sections 1 and 3 of Appendix A1 Final EIS guidelines**.

Yours faithfully,

[redacted]

Footnote

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my Engineering experience in Heavy Industry and my service in Local Government:

Engineering
My Engineering career here spanned more than 41 years.
It principally involved Management of Engineering Design and Capital Development Projects.
It ranged across Mining, Ore Beneficiation and Concentrating, Rail and Slurry transport, Pelletising, Ironmaking, Cokemaking, Steelmaking and Salt Production .
The development of Port Whyalla Facilities for Trans-shipping iron ore to Cape vessels was an important component of the last major capital project for which I was Engineering Manager, prior to commencement of my retirement in 2010.

Local Government
I served two terms on the Whyalla Council as Councillor for South Ward, in the period 1995 -2000.
I was Chairman of the Council Infrastructure and Environment Committee and also served on the local Coast Care Committee.

Attachment A.

AJAS Notes/prompts in relation to Contents 1 and 3 (EIS PROCESS) of Appendix A1 Final EIS Guidelines of Draft EIS by SGPL Sept 2013

Guidelines

1. Introduction

> **The ... (DAC) is the independent statutory authority...determining the appropriate form of assessment......and setting Guidelines.**
>
> **Figure 1**
>
> **DPTI prepares preliminary description of significant issue and draft Guidelines...**
>
> **Figure 1**
>
> **Commission...reports to Minister on decisions regarding level of assessment and content of Guidelines.**

ISSUE:

The process as described in the above shows DPTI had a leading role of influence over deciding the content of Guidelines; this challenges the notion of Independence of role of DAC.

QUESTIONS:

1. ***Was the DAC acting independently in determining the main issues, given the role of the DPTI?***
2. ***Was the DAC acting independently in determining the guidelines, given the role of the DPTI?***

Guidelines

1. Introduction

> **...Act ...requires an EIS to be publicly exhibited for a period of at least 30 business days...**
>
> **The object of section 46 is to ensure that matters ....are fully examined....**
>
> **Figure 1**
>
> **EIS exhibited for minimum of 6 weeks ...**

ISSUE:

The process as described in the above does not allow sufficient time for review of the EIS documentation and provision of considered feedback, which are pre-requisites for matters to be fully examined.

Note that there are 150 issues listed in the Guidelines for the Proponent (and therefore for all of us) to consider and address;

> ***The Proponent's Statement runs to 598 pages***
>
> ***There are 24 appendices which run to 524 pages.***
>
> ***There are many references listed by the Proponent***

There has to be a more realistic period than 30 business days allowed for opportunity for comprehensive consideration and feedback by the General Public and other important stakeholders including:

- *Whyalla Council*
- *Whyalla Chamber of Commerce*
- *EYRE PENINSULA and WHYALLA RDA*
- *Member for Giles*
- *Member for Grey*

QUESTIONS:

1. *Who has decided the period for public feedback?*
2. *Who can decide to extend the period for public feedback?*
3. *Will an extension of 100 days be granted beyond the currently nominated closure date for provision of public feedback about the proposal and related EIS ?*
4. *Will an extension of 100 days be granted beyond the currently nominated closure date for provision of feedback about the proposal and related EIS by parties such as the Whyalla Council and Regional Development Authority*

Guidelines

3. The EIS PROCESS

The EIS must consider the extent to which the expected effects of the development are consistent with any Development Plan, the Planning Strategy and any matters prescribed by the Regulations under the Act.

3.1.1 ...understanding....the need for the proposal, the alternatives, the environment that will be affected, the impacts that may occur and the measures to be taken to minimise these impacts.

3.1.3 .....decision makers may consider the environmental aspects of the proposal in parallel with social, economic, technical and other factors.

3.1.13 The Governor is the relevant decision maker under Section 48 of the Act, when a development application is subject to the EIS process.

The Governor can at any time, and prior to completion of the assessment process, determine that the development will not be granted authorisation. This may occur if it is clear that the development is inappropriate or can not be managed properly. This is commonly referred to as an "early no"

ISSUE:

Given that

- *this proposal is highly risky in functional, environmental, economic and social terms and is therefore inappropriate.*

- ***a vastly superior alternative proposal just outside Marine Park 10 on an open access shipping lane beyond Yarraville Shoals is being ignored.***
- ***our past experience has shown that the EIS process, such as is now taking place, is incapable of adequately serving the Public Interest.***

there is a clear need for the Governor to determine an "early no."

QUESTIONS:

1. ***What is the process which can trigger an "early no" decision by the Governor?***
2. ***When can the trigger process for an "early no" decision be commenced?***
3. ***Who can trigger the process for an "early no" decision to be commenced?***
4. ***What are some examples of an "early no"?***
5. ***What are the protocols for encouraging consideration of an "early no"?***
6. ***What assistance can be provided by Government departments to members of the public who want to encourage and facilitate consideration of an "early no"?***
7. ***What assistance can be provided by Government departments to the Whyalla Council to encourage and facilitate consideration of an "early no"?***
8. ***What assistance can be provided by Government departments to Eyre Peninsula and Whyalla RDA to encourage and facilitate consideration of an "early no"?***

[redacted]

17 November, 2013.

<u>Submission – EIS on the Port Bonython Bulk Export Facility Proposal.</u>

Email : DPTI.PDPublicSubmissions@sa.gov.au

Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning

Roma Mitchell House
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

This is the third of several submissions. It relates to **<u>section 5 of Appendix A1 Final EIS guidelines</u>**

I am a member of the Alternative Port Working Party (APWP) which is a group of professional Whyalla residents, who are concerned to encourage the most efficacious development of a diverse range of industrial and other economic opportunities and quality of life attributes of this region of South Australia.

Areas which are immediately north of the city and potentially also an area adjacent a deep-water shipping lane about 25 kilometres south of Whyalla, are most suitable for industrial activities. The Lowly Peninsula north east of Whyalla is unique in this region for opportunities for recreation and tourism and coastal living.

Judicious matching of areas of our land and Gulf to those activities for which they are most suited, is the key to achieving "best of both" - success in business and liveability outcomes in this region.

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my engineering experience in Heavy Industry and my service in Local Government. <u>See footnote.</u>

It is most regrettable that only 6 weeks have been allowed for responding to the draft EIS. The time is clearly not adequate for a rigorous review and provision of comprehensive feedback covering the Draft Statement (598 pages) and it's Appendices (524 pages).

I attach my review work notes in respect to **section 5 of Appendix A1 Final EIS guidelines**.

Yours faithfully,

[redacted]

Footnote

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my engineering experience in Heavy Industry and my service in Local Government:

Engineering
My Engineering career here spanned more than 41 years.
It principally involved Management of Engineering Design and Capital Development Projects.
It ranged across Mining, Ore Beneficiation and Concentrating, Rail and Slurry transport, Pelletising, Ironmaking, Cokemaking, Steelmaking and Salt production .
The development of Port Whyalla Facilities for Trans-shipping iron ore to Cape vessels was an important component of the last major capital project for which I was Engineering Manager, prior to commencement of my retirement in 2010.

Local Government
I served two terms on the Whyalla Council as Councillor for South Ward, in the period 1995 -2000.
I was Chairman of the Council Infrastructure and Environment Committee and also served on the local Coast Care Committee.

Attachment C.

AJAS Notes/prompts (incomplete at 17 Nov 2013)
in relation to Contents 5 (The Main Issues) of
Appendix A1 Final EIS Guidelines of Draft EIS by SGPL Sept 2013

Discussions should be generated from the following red notes in italics:

Guidelines

5 THE MAIN ISSUES

PLANNING AND ENVIRONMENTAL LEGISLATION AND POLICIES

5.1.1 ...proposal's ...variance from ...Development Plan and State Planning Strategy.

5.1.2 ...changes ...to the zoning of the site .....

Current industrial zoning of this particular area of coastal land ***is inappropriate.***

and

The Proposal for Cape Class Shipping is hostile to the purpose of Marine Park 10.

It should also be noted that the proposal does not involve any chemical processing based on hydrocarbon feedstock and therefore does not conform in this respect with the intent of the Special Industry (Hydrocarbons) zoning.

Further, the proposal has no elements of chemical industries (that could be regarded as compatible with chemical industry requiring hydrocarbon feedstock) and therefore does not conform in this respect with the intent of the Special Industry (Hydrocarbons) zoning of the site.

5.1.5 .....consistency with ....conservation...including the Marine Parks Act 2007

The proposal for Cape class shipping is hostile to the purpose of Marine Park 10.

5.1.6 ....other relevant plans or studies that relate to the area

Should heed findings arising from 1970's Redcliffes Petrochem Studies –keep industrial impacts out of the Head of Spencer Gulf.

Should consider various objectives of the 2012 Whyalla Council Statement of Intent for Industrial Rezoning of Nonowie coast - plus keep industrial impacts out of the Marine Park10 etc etc etc

NEED FOR THE PROPOSAL

5.1.8 Justify ...the proposal from ....sustainability perspective ...including reasons for ...location .

A key strategic question relating to long term sustainability of the Port, which should be addressed separately by representatives of Government, Public Servants and the Proponent is:
'Should the port be located where

- *the depth of its Shipping lane will limit the capability of the port to use of the largest vessels in the CAPE class (almost 19 metres laden draft)*
- *or where depth is sufficient to allow movement in the longer term to use of the Very Large Ore Carrier class of vessels with laden draft of 23+metres?*

5.1.9 Justify the selection of the proposed location from an environmental and economic perspective in comparison with other existing or approved alternative sites on Eyre Peninsula.

A lot of challenges to the restrictive effect of literal interpretation of this guideline (ie only compare this location with existing or approved alternative port sites) can be argued:

Generally, the analysis and justification for selection of the port location must be much broader and more rigorous than has occurred to date. Currently the approach to selection of the location appears to have been driven principally by availability of State owned land.
It clearly is not holistic with respect to considering such matters as:

- *rail hub connection options*
- *slurry line options,*
- *agricultural uses and transport routes*
- *other uses not related to mining*
- *shipping lanes*

Further, there has been inadequate discussion of the functional requirements which have to be satisfied by the shipping lane and portside estate, to achieve efficient operation of a cost effective and profitable multipurpose facility.

There is a need for an agreed comprehensive list of key site selection criteria (objectives and requirements) for a Deepwater Port and also for a Portside Industrial Estate .
***** ***An Example set is included with this submission as Attachment D -please provide comments on it.***

There should be a transparent, systematic and rigorous line by line comparison of location options against the included example set of site selection criteria. (or comparison against a more comprehensive set of criteria.)
Please provide such a comparison, ensuring options for a phased development of deepwater shipping facilities along the coastal area south of Yarraville Shoal are considered and included.

5.1.10 Outline ....demand for the facility
Demand for this facility will very likely be further forestalled by additional expansion of Port Whyalla. Expansion options for Port Whyalla might include:

- *set up of additional berths for trans shipping from the wharf within Port Whyalla*
- *adoption of some container handling facilities to access/handle ore for trans shipping*
- *more self propelled barge capability with greater capacity and speed of operation for longer range of trans shipping*
- *additional trans shipping transfer points, including perhaps south of Yarraville Shoals*
- *If very large export demand arises then there may be progression to a staged Port Nonowie development outside Marine Park 10 and beyond Yarraville Shoals near the (24m deep) open access shipping lane.*

ENVIRONMENTAL ISSUES

Coastal and Marine

5.1.11 ...comprehensive risk analysis ...ecological assets .. ..how operational phases might impact ... **direct** mitigation strategies ..residual risk ....more explicit interventions.

Many of the issues and concerns about this proposal that are identified by various interested parties, are likely to be avoided or substantially diminished by setting up export-import facilities outside Marine Park 10 near the (24m deep) open access shipping lane south of Yarraville Shoals, with the Industrial estate laid out on the adjacent extensive , flat and lightly vegetated Nonowie plain.

5.1.12. ...investigate potential effect....including cumulative impacts ...in conjunction with:

- Expansion or addition to the Whyalla port facility

The constraints to shipping which are imposed by the choke point in the shipping lane over Yarraville Shoals will be exacerbated each time Port Whyalla ramps up its export capability and activity through trans shipping.

Note that additional expansion options for Port Whyalla might include:

- *set up of additional berths for trans shipping from the wharf within Port Whyalla*
- *adoption of some container handling facilities to access/handle ore for trans shipping*
- *more self propelled barge capability with greater capacity and speed of operation for longer range of trans shipping*
- *additional trans shipping transfer points, including perhaps south of Yarraville Shoals*
- *If very large export demand arises then there may be progression to a staged Port Nonowie development outside Marine Park 10 and beyond Yarraville Shoals near the (24m deep) open access shipping lane.*

5.1.14 ... location, orientation ...of jetty...

*This is a **confined** deep-water berth site. (ie it is a pothole of water exceeding 20 metres depth)*

*The layout of berth facilities and the nature of operations through it will be **constrained** by a number of conditions which are unique to this locality.*

Laden deep draft vessels of Cape class must depart from the proposed berth in an easterly direction initially and then make a hard turn to south west for exit through the channel past Fairway Bank .The Cape vessels must rely on tug assistance for these departure manoeuvres.

The limits of the pothole and mandatory route for shipping to manoeuvre out of it dictate the location of the loading berth and its orientation. The proposed berth orientation could not be significantly changed if further site investigations were to indicate such a requirement, to better deal with the effects of wind waves or sea swell or wind or tidal currents or some combination of these influences.

Hydrocarbon loading facilities to the east, with attendant hazard zone restrictions during their operations, further constrain the space for the number and length of new loading berths and the times when vessels may approach or leave them.

The site dictates various requirements for significant tug assistance for Cape vessel manoeuvres in the area. It also dictates that laden Cape vessels must depart from the loading berth on rising tide, typically a couple of hours before the tide peaks, to make safe passage down the Gulf shipping lane. This requirement is contrary to a preference to take the Cape vessel off berth during ebb of the tide to reduce risks of damage to berth or vessel.

The depth and width constraints of the channel leading away from the berth past Fairway Bank and beyond, give rise to need for slow passage of Cape vessels in some areas, both for reasons of vessel safety and for reduction of propellor induced turbulent wash of the sea bed within Marine Park 10 and at Yarraville Shoals.

<u>It is important to note that the above Port confinement factors and Shipping operational constraints would not be applicable to an export/import facility outside Marine Park 10 on a (24 m deep) open access shipping lane south of Yarraville Shoal.</u>

5.1.21 ..... potential impacts...increased shipping traffic and activities ...

Many of the issues and concerns about this aspect of the proposal, that are identified by various interested parties, are likely to be avoided or substantially diminished by setting up export-import facilities outside Marine Park 10 on a (24m deep) open access shipping lane south of Yarraville Shoals.

5.1.23 ...sedimentary profiles in ...ship docking/manoeuvring .... risks from exposure ...

Many of the issues and concerns about this aspect of the proposal, that are identified by various interested parties, are likely to be avoided or substantially diminished by setting up export-import facilities outside Marine Park 10 on a (24m deep) open access shipping lane south of Yarraville Shoals

5.1.24 ....measures to protect ....from shipping activities .. turbulence during docking and manoeuvring ...

Many of the issues and concerns about this aspect of the proposal, that are identified by various interested parties, are likely to be avoided or substantially diminished by setting up export-import facilities outside Marine Park 10 on a (24m deep)open access shipping lane south of Yarraville Shoals

5.1.25 ...measures to ensure ...shipping activities .....in an environmentally sustainable manner. ....and the ....requirements of the Upper Spencer Gulf Marine Park Management Plan.

Port Bonython seems to function satisfactorily as a Panamax class port in that it is not tide dependent for departure of its laden Panamax vessels without risk of grounding.

Further, the underkeel clearance that exists (about 7 metres) when the laden Panamax vessels manoeuvre from the Hydreocarbon loading berth and travel through the various shallow zones of the shipping lane , might just provide sufficient water column buffer to safeguard the seafloor and its flora and fauna from the destructive effects of propeller induced turbulent wash.

But do we know – is there evidence to provide assurance that Marine Park 10 is currently secure in this respect with Panamax shipping?

How can an assurance be provided that the seabed in the Marine Park and at Yarraville Shoals, will be immune from destructive effects of propellor induced turbulent wash, when the proposed introduction of Cape class vessels will reduce Underkeel clearance by almost 7 metres?

Many of the issues and concerns about this aspect of the proposal, that are identified by various interested parties, are likely to be avoided or substantially diminished by setting up export-import facilities outside Marine Park 10 on a (24m deep) open access shipping lane south of Yarraville Shoals.

5.1.27 ....whether sand deposits will obstruct ship manoeuvring when entering or exiting the proposed facility

Note that this is unlikely to be an issue of concern for a similar facility outside Marine Park 10 in a 24m deep shipping lane south of Yarraville Shoals.

SUSTAINABILITY

5.1.30 ...the use of alternative or renewable energy ...

Will the proponent volunteer to purchase 100% green electricity? (note the precedent set by BHP Billiton's proposal for powering its seawater desalination plant and pump stations)

Will it be a condition of approval of the development that the proponent purchase 100% green electricity?

5.1.35 .... the potential generation of erosion scarps ...

Note that this is unlikely to be an issue of concern for a similar facility outside Marine Park 10 in a (24m) deep-water shipping lane south of Yarraville Shoals.

5.1.37 Describe the ecologically sustainable objectives ...

The Proposal for Cape Shipping through the shallow shipping lane is inherently hostile to Marine Park 10 ecological sustainability.

5.1.38 ....design guidelines ....to ensure sustainability.

Note that Chapter 16 does not address promotion of <u>sustainability</u> by this proposal.

It discusses some aspects of good engineering practice to reduce waste and inefficiency which are related to <u>viability of operation over the short and perhaps medium term.</u>

These are sensible, commendable and highly desirable approaches in some instances but they are not going to the essence of SUSTAINABILITY, which is an intergenerational phenomeneon.

The Objective of the Proposal is not to promote Sustainability.

It's sole objective is to facilitate export of non renewable iron ore resource –thereby reducing the resource available to following generations. This is the essence of "unsustainability".

5.1.39 ...arrangements ... to ensure ... environmentally sustainable ... in the long term

Many of the issues and concerns which can be identified under this guideline are likely to be avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.

5.1.40 ..means by which the sustainability .... will be audited...

Native Vegetation (Terrestrial and Marine)

5.1.41 Quantify and detail the extent, condition and significance ....

5.1.42 Quantify ...that may need to be cleared or disturbed ...

5.1.43 Calculate the level of clearance ...

5.1.44 ...measures to deliver any significant environmental benefit ...

5.1.45 Identify impact avoidance, minimisation and mitigation measures and their effectiveness. *Many of the issues and concerns which can be identified under the EIS guidelines relating to Native Vegetation (both Terrestrial and Marine) are likely to be avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.*

5.1.46 Detail the abundance, condition and significance ....

5.1.47 Describe the extent of ....loss or disturbance...

5.1.49 Detail appropriate buffer distances that will be required between the proposed development and TEPS or the iconic Australian Giant cuttlefish species, <u>including feeding areas, nesting sites and roosting sites.</u>
Note that the text I have underlined here has not been carried over into the Appendix B1 Cross References to Guidelines

5.1.52 Identify impact avoidance, minimisation and mitigation measures and their effectiveness. *Many of the issues and concerns identified above (5.1.41 onwards to 5.1.52) are likely to be avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep shipping lane south of Yarraville Shoals using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.*

Geology and Soils

5.1.55 ....changes to seabed profiles... risks ...sediment plumes.
The risk of CAPE vessel propeller induced turbulent wash causing scouring of the seabed, grit blasting of marine life and/or dispersal of sediment plumes through the Marine Park 10 is unlikely to be an issue of concern for a similar export/import facility located outside Marine Park 10 in a (24m) deep shipping lane south of Yarraville Shoals.

5.1.56 ...impact on landscape quality of the coastal environment ...
The proposal will have a highly deleterious impact (clearance and displacement of flora and fauna) on the densely vegetated site. Shipping will cause disruption of the marine life along the shipping lane within Marine Park 10 and at Yarraville Shoals.

Many of the issues and concerns which can be identified under the EIS guidelines are likely to be avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep *shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate*

Recreation and Tourism

5.1.65 Describe the impacts on the tourism and conservation values ...

5.1.66 Describe any net benefits or opportunities.....
The key word in here is NET.
Clearly in relation to benefits, the NET is negative.

*The **opportunity cost** of indefinitely locking out all sustainable quality of life initiatives for the region is unknown but very significant.*

*There would be no such **opportunity costs** associated with a similar facility located outside Marine Park 10 in a (24m) deep shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.*

Air Quality and Noise

5.1.68 ...the extent to which ...noise emissions ...can be reduced... to minimise impacts
Please note that there is a significant uphill incline which the locomotives must force the consist of ore trucks up as they pass False Bay and Black Point to reach the elevated site of the train unloading station. What are the noise implications of the locomotive engine effort through this area?

Noise during construction and ongoing operation would be less likely to be of concern for a facility operating on remote Nonowie plain and a 24m deep shipping lane outside Marine Park 10 beyond Yarraville Shoals, than at lowly Peninsula as is proposed.

There are fewer human receptors both onshore and offshore and there is no known Cuttlefish aggregation phenomenon along the Nonowie coast south of Whyalla.

5.3 TRAFFIC AND TRANSPORT
A general issue with coverage of this topic is that it is too narrow and focussed on the near term;

- *should canvas more road transport options eg from Eyre Peninsula covering both mining and agricultural commodities*
- *Should canvas future piped slurry options*
- *should canvas more rail transport options eg from Eyre Peninsula, covering both mining and agricultural commodities*

5.3.7 ...requirements for ... future rail operations and impacts ...
A significant deficiency in the current approach is failure to properly explore potential/need/options for :

- *development of a rail hub which connects Eyre Peninsula Narrow Gauge rail network, Arrium rail network and the National standard gauge rail network.*
- *and can feed all of their users to a common efficient deep water port*

5.4 ECONOMIC DEVELOPMENT

5.4.4 Outline the opportunity for further investment in the area arising from the proposal including alternate and additional port facilities.

Maximising potential for a diverse range of uses and attracting many users may be key to achieving establishment of the facility and maintaining its viability.
The current proposal falls short of seeking this, being focussed on export of iron ore utilising only rail to transport ore to the port, and this from the north.

What about linking with Eyre Peninsula rail networks?
What about other minerals?
What about slurry delivery lines to the site?
What about processing activities at the portside estate?
What about opportunities for moving Agricultural and other bulk commodities?
What about other transport functions through the facility?
What about Import functions?
What about Heavy lift facilities for Manufacturing, Military, Agriculture and Mining sectors?

It is clear that the proponents were given a 'poisoned chalice' when they were invited to put forward this proposal based on Lowly Peninsula with all it's attendant limitations and issues of sensitivity:

- *A tide dependent port with a shipping lane which passes through a marine park and is operationally compromised by choke points are two key offshore issue to cope with.*
- *The relative isolation of Lowly Peninsula from Eyre Peninsula operating mines and Agriculture is another impediment.*

Greater space for opportunities for port and industrial estate expansion, easier connections to Eyre Peninsula customers, fewer compromises and limitations on efficient high availability shipping operations, all appear to make an export/import facility on a (24m) deep open access shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate, more likely to attract future diversification and growth.

5.5 RISK/HAZARD MANAGEMENT

Many of the issues and concerns which can be identified under these (5.5) EIS guidelines are likely to be avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep open access shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate

5.6 EFFECTS ON COMMUNITIES

Many of the issues and concerns which can be identified under these (5.6.1-15) EIS guidelines are likely to be managed just as easily, or avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep open access shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.

5.7 NATIVE TITLE

Many of the issues and concerns which can be identified under these (5.7.1-3) EIS guidelines are likely to be managed just as easily, or avoided or diminished by setting up export-import facilities outside

Marine Park 10 in a (24m) deepopen access shipping lane south of Yarraville Shoals, using the extensive lightly vegetated adjoining Nonowie plain for the Industrial Estate.

5.8 CULTURAL HERITAGE

Many of the issues and concerns which can be identified under these (5.8.1-6) EIS guidelines are likely to be managed just as easily, or avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep open acces shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.

5.9 EFFECTS ON INFRASTRUCTURE REQUIREMENTS

5.10 CONSTRUCTION AND OPERATIONAL EFFECTS

Many of the issues and concerns which can be identified under these (5.10.1-15) EIS guidelines are likely to be managed just as easily, or avoided or diminished by setting up export-import facilities outside Marine Park 10 in a (24m) deep open access shipping lane south of Yarraville Shoals, using the extensive, flat and lightly vegetated adjoining Nonowie plain for the Industrial Estate.

5.10.14

Describe the management agreements between the District Council of Whyalla and the proponent...

What discussions have taken place?

What time is available for such discussions?

5.10.15

....arrangements for ....decommissioning of the facility ....

What will remain for the use of the site by the generation following decommissioning?

Attachment D

EXAMPLE SET of Key site selection criteria

Objectives and requirements for Deep Water Port:

1. **Port is to be capable of serving the largest capacity vessels in the deep draft Cape class, which are suitable for transport of bulk commodities (from existing and potential mines and primary producers) at low cost to and from overseas destinations.**

2. **Port is to be capable of receiving large/heavy lift items as may be required from time to time by the heavy industry, energy, mining, military and agricultural sectors.**

3. **Port is not to be tidal dependent for Cape vessel movements, requiring a minimum of 22 metres depth of water at the berth(s) and throughout the Shipping lane at low tide.**

4. **Port is to have a shipping lane which is deep, wide and straight - without choke points –to allow free passage at all times without speed restraint and without necessity for tug assistance to negotiate the route.**

5. **Port is to have loading/unloading berth(s) in an area not significantly influenced by strong currents.**

6. **Port is to have loading/unloading berth(s) in an area not significantly influenced by sea swell.**

7. **Port is to have loading/unloading berth(s) in an area not significantly influenced by wind waves.**

8. **Port is to have loading/unloading berth(s) in an area not significantly influenced by strong winds.**

9. **Port is to have loading/unloading berth(s) located and orientated such that port operations will not be significantly influenced by commonly prevailing strong winds, wind waves, sea swell or currents or combined effects of these influences.**

10. **Port is to have a local generous anchorage area with adequate depth of water for manoeuvring multiple Cape class vessels to and from stand by.**

11. **Port is to have a wide area of deep water access for fully laden Cape class vessels to leave the berth and proceed down the Gulf without being constricted by tide or weather conditions or vessels at anchor.**

12. **Port is to have a wide area of deep water access for Cape class vessels to arrive and leave without influence from the passage of other shipping associated with the Pirie, Whyalla or Bonython Ports.**

13. **Port area is to be located where it cannot be compromised by generation of temporary or permanent exclusion zones which can arise from bulk handling of Hydrocarbons or other Dangerous Goods at nearby facilities or ports.**

14. **Port is to be located where it cannot be compromised by potentially hazardous activities such as firing of military ordinance on lands in the vicinity of the port.**

15. **Port is to be located where shipping operations will cause mimimal ongoing disruption of the marine environment.**

16. **Port is not to be located in a Marine park or other area recognized for the presence of unique marine habitats or species or occurrence of unique marine behaviours.**

17. **Port site selection must take into account the requirements for the port to be designed and equipped for operation with TARGET ZERO spillages and emissions.**

18. **Port is to be located where little or no dredging is necessary. Where dredging is required an appropriate land based depositary shall be available.**

19. **Port is to be located adjacent a large and relatively flat area of land which is suitable for an industrial estate and which is not regarded as highly desirable for recreational activities, tourism or coastal living .**

EXAMPLE SET of Key site selection criteria

Objectives and requirements for Portside Industrial Estate:

1. **Estate is to accommodate facilities for receiving, storing and handling a range of bulk commodities for transport to and from overseas destinations.**

2. **Estate is to be able to service agriculture and other industries, plus existing and potential mines, on Eyre Peninsula and in the northwest, north and north east of the state.**

3. **Estate is to accommodate Onshore Processing and manufacturing facilities.**

4. **Estate is to be equipped to handle large heavy lift items as may be required from time to time by heavy industry and the energy, mining, agricultural and military sectors.**

5. **Estate is to be established on a large, accessible and relatively flat area of land**

6. **Estate is to be established on land which is not regarded as highly desirable for recreational activities, tourism or coastal living.**

7. **Estate is to be remote from known and foreseeable areas of public activities.**

8. **Estate is to be located where its potential for future expansion will not be constrained by established and foreseeable military, industrial, recreational or residential uses of adjacent lands.**

9. **Estate is not to be located close to known geological fault lines.**

10. **Estate is to be located on flat expansive terrain offering flexibility of layout of heavy haulage road and rail around the site.**

11. **Estate is to be located where haul road and rail access can easily be provided to it at gradients which are acceptable for heavy haulage.**

12. **The Estate is to be supported by transport and services corridors which are routed well away from the boundaries of Whyalla for avoidance of noise and traffic impacts on the city.**

13. **The transport corridors which service the Industrial estate, are to address materials sourced from Eyre Peninsula AND materials from the northwest, north and north east of the state.**

14. **Estate is to be located close to a Port suitable for the largest capacity deep draft vessels in the Cape class. (Cape class ~180,000t capacity)**

[redacted]

17 November, 2013.

Submission – EIS on the Port Bonython Bulk Export Facility Proposal.

Email : DPTI.PDPublicSubmissions@sa.gov.au

Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning

Roma Mitchell House
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

This is the second of several submissions. It relates to **section 4 of Appendix A1 Final EIS guidelines**

I am a member of the Alternative Port Working Party (APWP) which is a group of professional Whyalla residents, who are concerned to encourage the most efficacious development of a diverse range of industrial and other economic opportunities and quality of life attributes of this region of South Australia.

Areas which are immediately north of the city and potentially also an area adjacent a deep-water shipping lane about 25 kilometres south of Whyalla, are most suitable for industrial activities. The Lowly Peninsula north east of Whyalla is unique in this region for opportunities for recreation and tourism and coastal living.

Judicious matching of areas of our land and Gulf to those activities for which they are most suited, is the key to achieving "best of both" - success in business and liveability outcomes in this region.

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my engineering experience in Heavy Industry and my service in Local Government. See footnote.

It is most regrettable that only 6 weeks have been allowed for responding to the draft EIS. The time is clearly not adequate for a rigorous review and provision of comprehensive feedback covering the Draft Statement (598 pages) and it's Appendices (524 pages).

I attach my review work notes in respect to **section 4 of Appendix A1 Final EIS guidelines**.

[redacted]

Footnote

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my engineering experience in Heavy Industry and my service in Local Government:

Engineering
My Engineering career here spanned more than 41 years.
It principally involved Management of Engineering Design and Capital Development Projects.
It ranged across Mining, Ore Beneficiation and Concentrating, Rail and Slurry transport, Pelletising, Ironmaking, Cokemaking, Steelmaking and Salt production .
The development of Port Whyalla Facilities for Trans-shipping iron ore to Cape vessels was an important component of the last major capital project for which I was Engineering Manager, prior to commencement of my retirement in 2010.

Local Government
I served two terms on the Whyalla Council as Councillor for South Ward, in the period 1995 -2000.
I was Chairman of the Council Infrastructure and Environment Committee and also served on the local Coastcare Committee.

Attachment B.

AJAS Notes/prompts in relation to Contents 4 (The EIS Document) of Appendix A1 Final EIS Guidelines of Draft EIS by SGPL Sept 2013

Discussions should be generated from the following red notes in italics:

Guidelines

4 THE ENVIRONMENTAL IMPACT STATEMENT DOCUMENT

4.1.3 NEED FOR THE PROPOSAL

- Arrangements for other users ....to establish additional facilities on site ....

This HAS NOT BEEN ADDRESSED .

This matter is important for assessing (and perhaps enhancing the potential) viability of the proposal, both to attract support for its establishment and for long term viability. There should be discussion about options to achieve:

- *diversity of uses and users;*
- *multifunctional import and export capabilities;*
- *services to agricultural and manufacturing sectors as well as mining sector*
- Expected .... costs, including those that cannot be adequately described in monetary or physical terms ... .

This HAS NOT BEEN ADDRESSED ADEQUATELY

4.1.7 AVOIDANCE, MITIGATION, MANAGEMENT AND CONTROL OF ADVERSE EFFECTS

The design of the proposal should be flexible enough to incorporate changes to **minimise** any impacts ....

Note that the emphasis of the directive of this guideline is to MINIMISE any impacts, which is stronger than just to AIM TO REDUCE any impacts.

More attention is required on options for outright AVOIDANCE - eg relocate the proposal out of Marine Park 10 southwards into an open access deep-water shipping lane beyond the Yarraville Shoals.

Many of the issues and concerns about this proposal that are identified by various interested parties, are likely to be avoided or substantially diminished by setting up export-import facilities outside Marine Park 10 on a (24m) deep-water shipping lane south of Yarraville Shoals, with the Industrial estate laid out on the adjacent extensive and lightly vegetated Nonowie plain.

4.1.8 SOURCES OF INFORMATION

The expertise of those making the judgements including the qualifications of consultants and authorities should also be provided.

This text has not been carried across into the Appendix B1 Cross Reference to Guidelines

18th November 2013

[redacted]

Submission- EIS on the Port Bonython Export Faculty Proposal

Minister for Planning
Attention: Mr Robert Kleeman
General Manager, Assessment, Statutory Planning
Roma Mitchell House
GPO Box 1815
ADELAIDE SA 5000

Submission – Port Bonython Bulk Commodities Export Facility
Draft Environmental Impact Statement Sept 2013

Dear Sir,

I am a member of the Alternative Port Working Party (APWP), a group of concerned professional Whyalla residents. I was born and raised in Whyalla and this is where I have stayed all my working days and now in retirement.

The APWP strongly supports industrial development in the Whyalla region, but believes it should be developed in areas where it has the best chance to be competitive and does not detract from the liveability of the Whyalla region. Such areas exist at or in close proximity to the city and by conserving the Lowly Peninsula for recreation and tourism, new believe we can have the "Best of Both".

I have reviewed the EIS and have attached the two sections allocated to me.

Section 9 Visual Amenity and Section 14 Marine Ecology

[redacted]

9. VISUAL AMENITY

9.1.1. Policy and Guidance

Local Planning Conditions
The Project site falls within the Whyalla Local Government Area. The planning scheme for this area does not designate any specific view or landscape protection area within proximity of the Project.
The General Planning Conditions (Whyalla City Council, 2006) for development within this area, however, include some guidance in relation to visual amenity. The Whyalla Planning Conditions has the objective of protecting the natural character of the area, particularly; the undulating hills, natural dunes and large expanses of low lying native flora which characterise this area. Specifically, for construction, commercial / industrial development, landscaping, and infrastructure, the Planning Conditions require that the visual amenity of the locality be maintained and enhanced.

Response
The Lowly Peninsula is a unique and special place and is the only decent coastal strip within 100Km of Whyalla. A place for tourist and local alike to discover, relax and enjoy.
Question
What form of enhancement(s) will be put in place for this proposed development?

9.1.3. Methodology
Assessment of Visual Impact
Visual Modification
A high degree of visual modification will result if the development contrasts strongly with the existing landscape. A low degree of visual modification occurs if there is minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the development and the environment in which it sits. In this situation the development may be noticeable, but does not markedly contrast with the existing modified landscape. **Table 9.1b** lists the terminology used to describe the level of visual modification.

Response
Maybe noticeable is an understatement. It will be blight on the landscape.
Large rail network with unloading structure, supporting Admin and Maintenance/ Storage sheds, 4 X 400m Length 70m Width 30m Height Ore Storage sheds. 1Km long overhead conveyor structure. 3Km long jetty (with conveyor and large loading head) in Upper Spencer Gulf Marine Park's pristine waters.
Having to endure one ugly infrastructure (Santos) for 30 years means it's appropriate to developed more ugly structures in this area. During those years since haven't we progressed with a more conscience approach in protecting the environment in general and in particular the fragile ecosystems of the Lowly Peninsula and Upper Spencer Gulf?
Couldn't it be said that this prime coastal land has a considerable monetary land value that far out ways the nonsensical industrial proposals.
It doesn't end there! History has shown that we cannot trust what is proposed in these statements – Santos ensured the Whyalla people that the very special and popular Weeroona Bay was not included in their statement only to later change with a supplementary closing off this area to the public.
Another kick in the guts for the Whyalla people.

Question
What investigations have taken place on alternative sites outside the Marine Park zone and south of Whyalla. If No then please explain why?

9.4. Assessment of Daytime Landscape and Visual Effects

9.4.1. Visual Sensitivity of the Study Area

The sensitivity of the study area is highly variable. Some parts of the study area are influenced by a number of historic properties and designated viewing points, resulting in a higher visual sensitivity. Others, including the highly industrialised landscapes of the Whyalla coast and Santos Facility at Port Bonython change the user type and reduce the sensitivity. Lowly Peninsula

Response

Highly industrialised landscapes of the Whyalla coast. To the North yes! So does that mean more is better or they have some already so why not more! In the twenty first century shouldn't we be concentrating on improving the landscape to accommodate for a more liveable community and position heavy industry in less sensitive areas?

Lowly Peninsula is not highly industrialised, only the ugly Santos infrastructure which is not sustainable.The best thing possible is to rezone it for tourism and recreation.

Question

What investigations have taken place on alternative sites other than Lowly Peninsula and south of Whyalla. If No then please explain why?

The Whyalla Foreshore and recreational boats in the Spencer Gulf are considered to be of local visual sensitivity, and viewers are participating in recreation activity and appreciation of the view contributes to the experience. These views are considered to be of local visual sensitivity

Response

No photos from Hummock Hill of Whyalla foreshore or marina.

Port Bonython Road and other local roads are considered to be of local visual sensitivity, as although it has a small amount of traffic it forms the main arrival point for the peninsular, and offers scenic views to the Gulf and surrounding landscapes. The Lincoln Highway is a more heavily trafficked road and connects Port Augusta with Whyalla, and is therefore considered to be of local visual sensitivity

Response

One of the other local roads is Cuttlefish Drive which runs from Port Bonython Road along False Bay, Black Point to Stony Point then back to Port Bonython Road. Stony Point is the location of the Cuttlefish platform. Many intrastate, interstate and overseas visitors are attracted to this area and the sight of large confronting infrastructure close by will have a significant negative impact on the area. Also a substantial increase in recent times of tourists (RV's / caravans) along the northern coastline which benefits our local economy will be in jeopardy from further industrial development on the Lowly Peninsula. Also views of the Gulf and the picturesque Southern Flinders Range.

Question

All the proposed projects for Lowly Peninsula will culminate in a substantial increase in traffic (trucks, tankers etc) on the Port Bonython Road. What action(s) will be put in place to ensure the safety of road users?

9.4.2. Visual Modification of the Project

Buildings, Materials Handling and Storage Facility
The buildings, materials handling and storage facility includes a number of built structures including: an administration building, maintenance shed hazardous goods store/storage, material storage facilities, amenities and car-parking. Refer to Figure 9.4c for an image of the existing Santos Facility. Each of these facilities will be large in scale, including: Administration building 15m x 8m and amenities building 9m x 8m, up to 6m high Enclosed conveyor belt adjoining the rail loop and three storage sheds. Three large sheds (two 270,000t hematite lump and fines sheds with a footprint of approximately 70 x 250m and one 225,000t magnetite storage shed with a footprint of approximately 70 x 190m both with an overall height of approximately 30m) These structures will be simple shed structures, finished in neutral colours.

Response
One is assuming that the above ore storage sheds cater for 25,000 mt. per year. Appendix E page 14 illustrates future storage shed of 400m length (approx.) and existing sheds extended to 400m length. Some consistency in data and information would assist and what other future additions are not in this documentation.

Indeed the ore storage sheds are large in scale and with the high and long conveyor with 3Km jetty will have a significant visual effect on the landscape.
See pages 6 & 7 Noticeable proposed SGPL Sheds

Question
Why is the infrastructure footprint so big?

Can't the Administration office and Maintenance / Storage sheds be positioned closer to the ore storage sheds?

9.4.3. Assessment of Representative Viewpoints
Selection of Representative Viewpoints
A site visit was undertaken during February of 2013. The following viewpoints were selected as representative of the range of views to the site and the proposed development:

Response
Viewpoint 1: This is not a view of Freycinet Trail - Freycinet Trail is on the Eastern side of Point Lowly. Photo: Poor clarity

Viewpoint 2: Below average shot of coastal homes. Photo: Poor clarity

Viewpoint 3: Where's the platform? Also interpretative signs or seating not seen

Viewpoint 4: Don't show interpretative signs or seating in this shot.

Viewpoint 6: Not angled towards proposed site. Photo: Poor clarity

Viewpoint 8: Forward 200m (at bend) would give a better view. Not angled towards proposed site. Photo: Poor clarity

Viewpoint 12: Not Whyalla's Foreshore jetty – Onesteel's ore loading jetty. Photo: Poor clarity

Viewpoint 17: Nice view spoilt by ugly Santos infrastructure. Photo: Poor clarity

Views from Whyalla and the Lincoln Highway

The Whyalla Foreshore Jetty is located off Buttingarra Way, and connects to the foreshore parklands along Beach Road. It offers views across the Gulf, at a distance of approximately 13.5km from the proposed jetty, and 15km to the sheds. (Refer **Figure 9.4p**) This is a recreational facility used as a viewpoint and for fishing. This view is considered to be of local visual sensitivity due to its recreational use. The Santos facility and its jetty are visible on the horizon from this location. Large shipping vessels are also visible in the background of the view, travelling across the Gulf. From this location it is likely that the proposed facility and jetty will be visible alongside the Santos development, and ships will be visible on the horizon as they approach and use the facility. Due to the visual context of industrialised landscapes, and existing use of the Gulf, and mitigating effects of distance, it is expected that there will not be a noticeable change in the character of these views. Therefore, it is expected that views from this location will experience a negligible visual impact during both construction and operation due to there being no reduction in the amenity in views from a location of local visual sensitivity.

Response
Increased shipping from the present 100+ ships per year entering Upper Spencer Gulf to 400+ ships per year will add a substantial visual impact in the area.

The Stony Point Cuttlefish Diver"s platform is located to the west of the Santos facility and is located within approximately 750m of the proposed jetty, and 1.4km to the sheds. (Refer **Figure 9.4g**) It is a recreational area, currently accessed by an unsurfaced track, and provides access across the rocky shore for divers, interpretive signage and seating area. The Santos facility is clearly visible to the east within the context of these views. This view is considered to be of local visual sensitivity due to the recreational use.

Response
Flinders Port's spokesperson has indicated that a Cuttlefish viewing platform will be attached to main jetty.

Question
No mention in EIS - Comments please on size and accessibility of such a platform!!

Table 9.4a: Summary of Viewpoint Assessment

Response

VP Location	Construction Visual Impact	Operation Visual Impact
6 Port Bonython Road near Santos	***Moderate Adverse*** ~~minor adverse~~	***Moderate Adverse*** ~~minor adverse~~
11 or near 9? - Rail overpasses	***Moderate Adverse*** ~~minor adverse~~	***Moderate Adverse*** ~~minor adverse~~
17 View from recreational boat	***Moderate Adverse*** ~~minor adverse~~	***Moderate Adverse*** ~~minor adverse~~

Response
The sheer size of these infrastructures will have a significant visual impact on the area.

Question
The Visual 3D computer model that was produced is less than satisfactory in many parts.
Why haven't artist's impressions of the entire proposed infrastructure (large sheds etc. on the landscape) been included in the EIS?

Table 9.7a: Summary of daytime visual effects

Element	Inherent Mitigation Significance of impact	Additional Mitigation Significance of impact
Views from Port Bonython Rd to the facility	***Moderate Adverse*** ~~minor adverse~~	***Moderate Adverse*** ~~minor adverse~~

Views from Port Bonython Road (p276)

Further northwest along Port Bonython Road and approaching the Project site, road users currently view a largely undeveloped landscape. (Refer **Figure 9.4k**)

Response
Undeveloped landscape! Keep it that way.

Views from Port Bonython Rd to the railway. (p278)
Views from Port Bonython Road at approximately 15km from the Project site, road users currently view a largely undeveloped roadside landscape, with some existing infrastructure visible such as a roadside pipeline and high voltage power lines. (Refer **Figure 9.4o**) **The vegetation is low and includes with scattered trees, allowing for long views into the surrounding landscape.** The coast, main facility and jetty will not be visible. The rail corridor will be running alongside the road to the north, and following the road as it curves to the south. This rail corridor is set within a 50 metre cleared corridor, and raised on a small embankment. The removal of vegetation will be noticeable and the **rail clearly visible with limited filtering by roadside vegetation**. During both construction and operation it is expected that the **rail corridor construction will be visually prominent with little opportunity for filtering by landform or vegetation**. It is expected that there is likely to be a noticeable reduction in visual amenity to a view of local visual sensitivity, resulting in a minor adverse visual impact during both construction. During operation, when large and trains of over a kilometre in length are using the track, it is expected that there will be a considerable reduction in visual amenity and therefore a moderate adverse visual impact. This impact is likely to reduce to a **minor adverse** visual impact over time as vegetation recolonises the rail corridor.

Response
Viewpoint 11 shows existing landscape of low vegetation and long views of existing landscape.

	Moderate Adverse ~~minor adverse~~	***Moderate Adverse*** ~~minor adverse~~

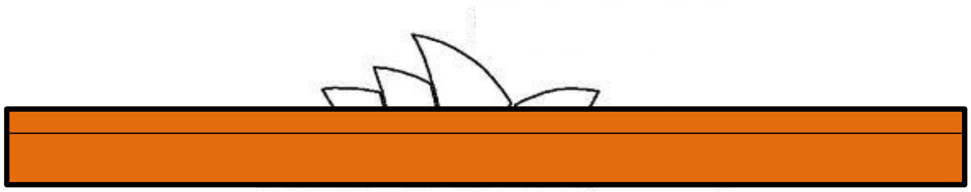
Views from Spencer Gulf
The Spencer Gulf is a popular area for recreational fishing, diving, and boating. Views from recreational boats in the vicinity of the site are considered to be of local visual sensitivity due to the importance of this activity to the local community. (Refer **Figure 9.4u**) The Santos facility and its jetty are visible on the horizon from boats using this area. Large shipping vessels are also visible using the Santos facility and travelling across the Gulf to other nearby ports. From recreational boats in the vicinity of the site, is likely that the proposed facility and jetty will be visible alongside the Santos development, and vessels will be visible on the horizon as they approach and use the Port facility. Due to the visual context of industrialised landscapes, and existing use of the Gulf, it is expected that there will be a **noticeable change** in the character of these views. It is expected that viewers will experience a **minor adverse** visual impact during both construction and operation from this location of local visual sensitivity.

Noticeable proposed SGPL Sheds

Opera House: 185m Length 120m Wide 67m Height

SGPL Ore Storage Sheds: 2 x 250m Length 70m Wide 30m Height 1 x 190m Length 70m Wide 30m Height

SGPL Ore Storage Sheds: (future) 3 X Sheds (existing) extended to 400m Length 1 X Shed (new) 400m Length



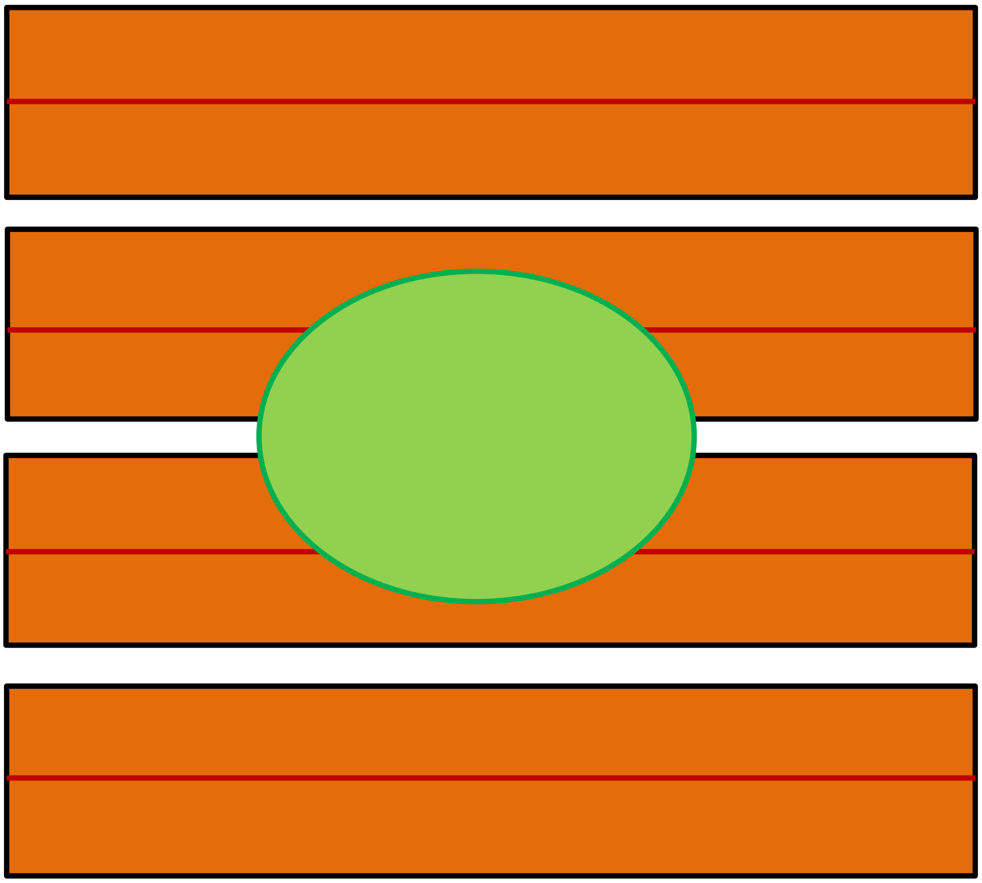
SGPL Ore Storage Shed (future) superimposed on Sydney Opera House Port Bonython

Noticeable proposed SGPL Sheds cont.

Adelaide Oval: 167m Length 124m Wide

SGPL Ore Storage Sheds: 2 x 250m Length 70m Wide 30m Height 1 x 190m Length 70m Wide 30m Height

SGPL Ore Storage Sheds: (future) 3 X Sheds (existing) extended to 400m Length 1 X Shed (new) 400m Length



Adelaide Oval superimposed on SGPL Ore Loading Sheds (future) Port Bonython

No mention in EIS on other proposed infrastructure (Desal, Diesel Storage etc.) detail regarding visual effects on landscape. It is not reasonable to suggest that information is not publically available. Your liaison with government agencies would allow for this information to be available.

The consequences of all these proposals being developed on the Lowly Peninsula will devastate the landscape and turn it into an unsightly scene that will have a negative effect on our growing tourism industry and will also affect the liveability of Whyalla.

WHAT’S WRONG

WITH THIS PICTURE?

Cuttlefish platform Lowly Peninsula

NOTHING! SO LET’S KEEP IT THAT WAY

14: Marine Ecology

14.3. Existing Environment

14.3.1. South Australian Marine Protected Areas

Habitats and species of conservation significance, it was incorporated into a Marine Park (refer to **Section 14.3.1**). The proposed Bulk Commodities Export Facility (BCEF or the Project) is located within the Upper Spencer Gulf Marine Park also known as Marine Park 10 (MP10). MP10 covers 1602km2 and includes waters north of a line from the southern end of the Whyalla-Cowleds Landing Aquatic Reserve on the western side of Spencer Gulf to Jarrold Point on the eastern shore (DEWNR, 2012b). The Marine Park also includes the uppermost reaches of Spencer Gulf extending north of Port Augusta (**Figure 14.3a**). The landward boundary of the marine park extends at least to the median high water mark and in some instances incorporates coastal Crown Lands including beaches, sand dunes, estuaries and saltmarshes. The ports of Whyalla, Port Bonython (Santos Jetty) and Port Pirie are excluded from the Marine Park.

Response

Building a new port in such a sensitive area makes a mockery of the whole Marine Park protection.

This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.

According to SGPL spokesperson all ports in southern Australia are tide dependant. This would make a port facility south of Yarraville Shoal the first non-tide dependant port in South Australia.

Question

Has serious consideration been afforded locations south of Whyalla (outside the Marine Park) where there is 24m of waters?

Environmental

The most extensive seagrass meadows in South Australia (Barker, 2004)

Response

The 3 fold increase in shipping movements (180,000t Cape size vessels less than 2m under keel clearance and 8/9m propellers) in channel waters (less than 20m deep) south of Point Lowly will stir up the mud and sand sea bed (self-dredging) that could ultimately cover and devastate these seagrass meadows.

Question

What steps will be undertaken and when, to eliminate this possible devastating situation?

Economic

Commercial fisheries including Spencer Gulf Prawn Fishery, the Blue Crab Fishery, the Charter Fishery and the Marine Scalefish Fishery

Response

These industries could be threatened by damage done by large vessels manoeuvring in shallow waters.

This is in an inverse-estuary and Marine Park that has been established to protect venerable species that are unique to Upper Spencer Gulf.

Question

In the EIS review process future steps, prior to recommendation to cabinet and the decision by the Governor ,to address the above issues and eliminate a possible devastating situation?

Fitzgerald Bay aquaculture zone
Response
This part of Upper Spencer Gulf is of concern due to the fact that unknown marine incidents have seen the collapse of this industry.

Tourism; including recreational and charter fishing, fishing competitions, sightseeing cruises and diving/snorkelling with Cuttlefish

Question
Extra-large vessel activity in this confined area could possibly threaten these activities.
What steps will be undertaken and when, to eliminate this possible devastating situation?

Existing coastal infrastructure (e.g. power stations) and proposed infrastructure developments (e.g. desalination plants and port facilities) are of economic importance in the region

Response
Didn't know there was a power station nearby? One at Port Augusta some 40km north.
Because a Refract ration plant was located on the Lowly Peninsula some 30 years ago does that indicate that we have not progressed environmentally and have a better appreciation of our coastlines? That's not Whyalla City Councils mission as it has a high tourism emphasis on this area illustrated in its tourism information's. (Brochures etc.)
Of course infrastructure developments are important - but there is absolutely no excuse for short sightedness.
The appropriate place for the desalination plant is the West Coast with open seas. Could also serve the Eyre Peninsula which is in desperate need of addition water.
The appropriate place for the port facility is south of Whyalla (outside the Marine Park) where there is 24m of water.
Didn't mention the Diesel Storage facility but I will. The appropriate place for this facility is the Cultana Industrial Estate. Basis infrastructure already in place and situated next to rail access.
It is well documented that there are alternative locations for the proposed infrastructures.

The region is part of a broad scale copper-gold geological province within the State and is of economic interest to the resource sector.

Question
Does this indicate the possibility of copper being exported from this port facility?

14.3.1.2. Zoning and Management of Marine Parks
Ensuring suitable access for shipping to enable the export development for the State.

Response
Building a new port facility in such a sensitive area makes a mockery of the whole Marine Park protection.
This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.
Question
Have other sites had serious consideration in Spencer Gulf outside the Marine Park?

14.3.3. Regional Overview

14.3.3.1. Major Habitats and Bio-geographical Regions of the Northern Spencer Gulf

This bioregion extends from Point Riley on Yorke Peninsula, to the head of the Gulf at Port Augusta and to Shoalwater Point on Eyre Peninsula, and covers an area of 4136km2. Key features of the bio region are described in BHPB (2009) as:

A relatively sheltered eastern shore with beach ridges, wide inter-tidal flats, and tidal creeks that are frequently colonised by seagrass, mangrove and samphire communities, refer **Figure 14.3d**

A shallow, subtidal zone, which is generally less than 10m in depth. This zone is colonised by extensive seagrass meadows, refer **Figure 14.3d**

Narrow deep channels up to 30m of depth with fine silt, coarse sand and shell grit bottoms, dominated by benthic invertebrate communities

Rocky intertidal zone and shallow reef communities, which are up to 6m in depth along the west coast that fall away steeply into deep water.

The shallow seagrass and mangrove communities are generally regarded as the most critical areas of the Northern Spencer Gulf (Edyvane 1999a and b, cited in Thiel & Tanner, 2009). The clear, shallow, sheltered waters of this region have the most extensive seagrass meadows in the state, comprising 58.1 percent of the total Northern Spencer Gulf bioregion. This represents 75 percent and 43 percent of the total area of seagrass recorded in Spencer Gulf and South Australia, respectively (Edyvane 1999a and b, cited in Thiel & Tanner, 2009). As discussed in more detail in **Section 14.3.4** below, there are no seagrass meadows or mangroves at the jetty site. The nearest seagrass meadow is located approximately two kilometres away at Point Lowly (refer to **Figure 14.3e**). Seagrass meadows are located at Fairway Bank which is approximately one kilometre from the approach and departure channel for the BCEF. Seagrass meadows also occur in False Bay. A small patch of mangroves occurs in Weeroona Bay, but the nearest major mangroves occur on the eastern shores of the Gulf or south of Whyalla at Cowleds Landing (refer to **Figure 14.3d**).
The most dominant seagrass found in the Northern Spencer Gulf includes *Posidonia sinuosa, P. angustifolia, Amphibolis antarctica* and *Heterozostera nigricaulis* and *Halophila* sp. Mangrove forests in South Australia are composed solely of *Avicennia marina* var. *resinifera*. These occur along the sheltered intertidal margins of Northern Spencer Gulf. Mangrove thickets are well developed on the eastern shore but are less extensive on the western shore (Butler et al, 1977).

Response

The whole fabric of sea life as we know it in Upper Spencer Gulf including Macroalgae, seagrass beds, Posidonia seagrass, rubble substrates, sandy areas around worn casts and Zostera seagrass flats to name a few plus numerous marine species (400+ known) are at risk from the fall out of mud and sand being stirred up by 180,000t Cape size vessels (self-dredging) with less than 2m under keel clearance to the sea floor and 8/9m propellers in channel waters (less than 20m deep) south of Point Lowly.
As you have stated Point Lowly has strong currents and high turbidity and with these 180,000t Cape size vessels leaving port on a rising tide then the mud and sand plumes from the underwater disturbance could carry for many kilometres up the Gulf. The damage it could cause would be irreversible.
No on site modelling has been undertaken which leaves a serious question mark on this whole EIS.
This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.

Question

What steps will be undertaken and when, to eliminate this possible devastating situation?

Figure 14.3d: Major habitats of the Upper Spencer Gulf (adapted from GIS layers provided by DEWNR, 2012b) Map….
Yonga Biounit

The mangrove habitats in this region and their associated mud flats and algal mats, coastal saltmarshes and seagrasses not only provide important habitat for fish and crustaceans but also birdlife (Edyvane 1999b). They support a diversity of fish, crustaceans, molluscs, pipefish and seahorses, some of which are of value to commercial and recreational anglers (Bryars, 2003). The Whyalla-Cowleds Landing Aquatic Reserve which is 3,239ha was established to protect these types of habitats in 1980 (Wood 2007). Edyvane (1999b) classified this aquatic reserve as well as Point Lowly as an area of high conservation value in the Yonga biounit.
In establishing an ecologically representative system of marine protected areas in South Australia, these habitats are recognised as important contributors to the biological productivity and ecological functioning of Spencer Gulf, particularly the northern part (Baker, 2004).

Response
Under serious threat from 180,000t Cape size vessels with less than 2m under keel clearance to the sea floor (self-dredging) and 8/9m propellers stirring up mud and sand. This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.
Question
What onsite studies will been undertaken and when, to obtain data?

14.3.4. Black Point to Point Lowly Marine Environment

A seagrass bed
A sponge community
There is also a small stand of approximately 30 mangroves on the western shores of Weerona Bay

Response
Under serious threat from 180,000t Cape size vessels with less than 2m under keel clearance to the sea floor (self-dredging) and 8/9m propellers stirring up mud and sand. Statement in this EIS says that the current in this area runs easterly.
Question
For how far (distance) and for how long (time) does this current run?

14.3.4.2. Rocky Intertidal Zone
Gastropods, Barnacles and Crustaceans mainly dominate the rocky intertidal zone. The Honeycomb Barnacle (*Chamaesipho columna*), has the largest distribution, inhabiting all levels on the intertidal platform as well as several crustaceans such as crabs and Isopods. The most common Gastropods in the upper levels of the intertidal zone are Sea Snails (*Austrocochlea* sp. and *Bembicium* sp.), whereas the Limpet (*Chiazacmea flammea*) and the Tube Worm (*Galeolaria caespitose*) dominate the mid to lower levels. The Gastropod *Lemintina siphon* extends its range from the lower levels of the intertidal to the subtidal zone (SEA, 1981). The Gastropod *Melanerita melanotragus* and Anemone *Actinia tenebrosa* were also identified during later surveys (Santos, 1986). The sandy intertidal zone (Weeroona Bay and Sandy/Lowly Bays) has a diverse infaunal community consisting of several species of Gastropods, Bivalves, Annelids and Crustaceans (SEA, 1981). The species recorded from this habitat are included in **Appendix K.2**

Response
Under serious threat from 180,000t Cape size vessels with less than 2m under keel clearance to the sea floor (self-dredging) and 8/9m propellers stirring up mud and sand. This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.

Figure 14.3e: Marine Habitat; Black Point to Point Lowly

Response
Map shows a white border around proposed jetty. Is this the exclusion zone and if so how will Cuttlefish platform be accessed?
By scale this distance covers 200m from jetty. When not in use (loading) Santos exclusion zone is 400m. This leaves a corridor between the two jetties of 700m (wide) when no jetty activities are active.
Question
Does this corridor allow recreational boat activities?

14.3.4.5. Sandy/Silt Zones
The most extensive habitat in the vicinity of Stony Point consists of silt/mud substratum. SEA (1981) found this zone to start in depths of 6-10m and extend to the deeper waters at approximately 30m (BHPB, 2009). The substrate is reasonably uniform, with a mixture of silt and mud and occasionally small patches of coarse sand/shell grit. This soft bottom habitat has relatively stronger currents and turbid water. The most common fauna are the Yellow Ascidian (*Polycarpa viridis*), of which there are 8/m2 and *Pinna bicolor*, of which there are 5/m2. To a lesser extent common fauna includes the Scallop *Equichlamys bifrons*, the Spotted Ascidian (*Phalussia depressiuscula)* and the Stalked Bryozoan (*Lanceopora oblique*) (SEA, 1981). *P. bicolor* also supports a diversity of epifauna including the soft coral *Carijoa* sp., numerous sponges, the Hammer Oyster (*Malleus meridianus*), Barnacles and the Pencil Urchin (*Goniocidaris tubaria*). *P. bicolor*, as well as a uniform cover of Stalked Bryozoans, Orange Finger Sponges and Ascidians (epizoic on Pinna) were also recorded at a depth of 20m in the Point Lowly channel during surveys in 1995 (Edyvane & Baker 1996, cited in Theil & Tanner, 2009). As mentioned above, the deeper waters off Port Bonython support a mixture of sparse and medium-sparse seagrass (DEH, 2007a). McLaren and Wiltshire (1984, in Harris & O"Brien 1998) suggested that seagrass communities such as *P. sinuosa* and *Heterozostera* sp. might occur in lower current energy areas away from the main tidal channels, in depths up to 9m. The most common infauna includes an unidentified Burrowing Brittle Star and Tube-Dwelling Sandworm, but abundances are low. Several species of Filamentous Red Algae are the only macroalgae seen in this zone (SEA, 1981). Further offshore the bathymetry of the seabed rises to an area known as Fairway Bank, which supports a large seagrass meadow (Baker, 2004). At Fairway Bank, patches of the green macroalga *Caulerpa cactoides* and sparse beds of *Posidonia angustifolia* were recorded at 10m depth (Edyvane & Baker, 1996 and SARDI S.A. Benthic Survey data, 1995, unpublished; cited in Baker, 2004).

14.3.4.7. Sparse Seagrass Bed
As described in BHPB (2009), the seagrass bed is approximately 150m offshore (as illustrated in **Figure 14.3e**). It is a sparse seagrass community, largely consisting of *Posidonia sinuosa* and *P,australis,* with some Eelgrass (*Heterozostera nigricaulis*) occurring. Bands of the Corkweed (*Scaberia agardhii*) also occur. The density is greatest at about 3.5m, but declines with greater depth. It was noted that the currents were too strong and turbidity too high for dense seagrass to occur in the vicinity of Point Lowly.

The dominant fauna is the Razor Fish (*Pinna bicolor*), which provides a substrate for various epiphytic fauna and flora.

14.3.4.10. Proposed Jetty Alignment Transect
The report by Theil and Tanner (2009) included transect surveys along the alignment of the proposed jetty for the BCEF. These surveys, comprising of both diver and video observations, identified four main habitat groups using cluster analysis of percent cover data:

Rocky reef – canopy Algae and red understorey Algae
80 percent sand, 20 percent seagrass/animal
50 percent sand, 50 percent animal
70 percent shellgrit/sand, 30 percent animal/Algae.

The extent of these four habitat groups along the alignment is shown in **Figure 14.3g**, with the composition of these groups displayed in **Figure 14.3h**.

14.3.5. Listed Species

14.3.5.1. Presence of Listed Species in the Upper Spencer Gulf
The Northern Spencer Gulf supports numerous marine species of conservation value. Some of these species are protected by legislation under the EPBC Act, NPW Act or the Fisheries Act as outlined in **Table 14.3b**.

Table 14.3b: Listed, Threatened, Endangered and Protected Species

Syngnathids such as Pipefish, Seahorses and Seadragons are known to occur in the Upper Spencer Gulf and include two species of Seahorses, *Hippocampus bleekeri* and *H. abdominalis*. The Leafy and Weedy Seadragon (*Phyllopteryx taeniolatus* and *Phycodurus eques*), are known to occur in Spencer Gulf and are likely to occur in the upper regions of the Gulf.

14.3.5.2. Profile of Conservation Species Likely to Occur in the Upper Spencer Gulf
Known threats affecting Southern Right Whales in Australian waters are identified in the Conservation Management Plan for Southern Right Whale (SEWPaC 2012a) as entanglement and vessel disturbance. Potential threats include whaling, climate change/variability, noise interference, habitat modification and overharvesting of prey.

Table 14.3c: Whale sightings recorded in the Upper Spencer Gulf (SA Whale Centre cetacean sighting log up to the end of 2012)

Date	Species	Town	Number	Behaviour
19.09.2012	Humpback Whale	Point Lowly	2	Diving, tail lifting, head lifts, travelling, blowing
11.08.2012	Unidentified	Point Lowly	1	Travelling
03.07.2012	Southern Right Whale	Point Lowly	2	Breaching, tail lifting, tail slapping, flipper slapping, head lifts, circling, blowing

20.07.2011	Southern Right Whale	Black Point	2 adults	Breaching, diving, tall lifting, tail slapping, flipper slapping, head lifts, body rolling, circling, playing, travelling, feeding
20.07.2011	Southern Right Whale	Point Lowly	2 adults	Tail slapping
11.09.2010	Southern Right Whale	Point Lowly	2 adults	Travelling
21.07.2010	Southern Right Whale	Whyalla	2 adults	Breaching
03.07.2006	Humpback	Port Augusta	3	Breaching
30.05.2006	Humpback	Port Augusta	2	Swimming in area for about 1 hour before moving south
20.08.2002	Southern Right Whale	Whyalla	1 adult	Tangled in fishing net
26.08.1999	Southern Right Whale	Port Augusta	1 adult	None recorded
04.06.1998	Southern Right Whale	Port Augusta	2 adult	None recorded
02.06.1998	Unidentified	Port Bonython	2 adult	None recorded
09.08.1997	Southern Right Whale	Whyalla	2	None recorded
13.07.1997	Humpback	Whyalla	1	None recorded

Response
Suggestion is that you punch in Port Augusta whales on "you tube" and you will observe more recent sightings of whales in Upper Spencer Gulf.

Identified potential threats to Humpback Whales include whaling and habitat degradation as a result of (SEWPaC, 2013b):

- Acoustic pollution
- Entanglement
- Physical injury and death from ship strike
- Built structures that impact on habitat availability
- Changing water quality and pollution.

Syngnathids (Pipefish, Seadragons)
Syngnathids are a family of fishes that include Seadragons, Seahorses and Pipefish and are known from a variety of habitats in South Australia, but are particularly well known as inhabitants of shallow inshore waters, including seagrass areas. All Sygnathids gained protection under the *EPBC Act 2000*, giving the family of fish protection in all Australian waters. The family was also given protection in South Australian waters under the FM Act in 2006

Response

Marine Parks 10 information states that the Seahorses and Pipefish habitat Fairway Bank. Seahorses being of a fragile nature could be under threat from
180,000t Cape size vessel turbidity and disturbance.
This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.
Question
What steps will be undertaken and when, to eliminate this possible devastating situation?

14.3.5.3. Non-threatened Species of Local Interest
The preliminary findings of a dolphin survey commissioned by BHP Billiton at Point Lowly in January and May 2010 (Gibbs 2010), suggest that Point Lowly is a relatively high use area for Bottlenose Dolphins with all life stages sighted (i.e. adult, juveniles and calves) and a variety of behaviours observed including resting, feeding, socialising and transit (Gibbs 2010).
The presence of cow and calves pairs in the sheltered waters of the bay adjacent, and to the west of the lighthouse point, suggests that this may be a nursery area.

Response
Currents running in an Easterly direction transporting ploom's from 180,000t Cape size vessel turbidity and disturbance could affect this nursery area.
Question
What on site studies will be undertaken to monitor this situation pre decision to progress the project?

Giant Australian Cuttlefish (*Sepia apama)*
Cuttlefish Protection
Lifecycle
Sepia apama differs from many other species of Cuttlefish by spawning in winter as opposed to summer; likely due to local environmental conditions and food availability for juvenile stages (Hall & Fowler 2003). The aggregation of *Sepia apama* on the fringing subtidal reef around Point Lowly generally begins in May and is over by August with a peak in abundance around early June although the timing of peaks can vary between years (Hall and Fowler, 2003). Mating behaviour is reliant on vision, as males use elaborate colour displays to court females (Steer et al. 2013),which is of interest because of the potential effects of turbidity. Studies of the South African Chokka Squid (*Loligo reynauldii*), Roberts (1998, cited in Steer et al.2013), indicated that wave height, turbidity and sea temperature were the key parameters in spawning success. Periods of high turbidity arising from onshore winds and coastal swell were found to disperse spawning aggregations, presumably because of poor visibility (Augustyn et al. 1994, Roberts & Sauer 1994, cited in Steer et al. 2013).

Population Status

The decline of the population prompted a recent study into the possible cause of the decline (Steer et al 2013). The results of this report were inconclusive, with the only correlation found being a negative correlation with rainfall (i.e. years of low rainfall had high Cuttlefish abundance; high rainfall years had low abundance). The report also suggested that there was not sufficient data to rule out that the high numbers present around the late 1990‟s and early 2000‟s was an unusual natural phenomenon, and that the population was now returning to a more „normal‟ level. There is also the possibility that the population has become more dispersed, using other, smaller habitat areas for spawning in the Upper Spencer Gulf (Steer et al, 2013)

Response

Inconclusive! Several theories:

- *Is the oil leakage from the Santos facility entered the surrounding Gulf coastal waters?*
- *A colony of Seals that appeared from nowhere in recent times.*
- *Seabed disturbance by Cape-size vessels.*

Question

Will the increase shipping associated with this project add to this situation?

Pearl Oyster *(Pinctada albina sugillata)*	Bivalvia(Oyster)	Cryptogenic	Native to the Torres Strait and east coast of Australia. Anecdotally been reported in the USG since the 1980‟s.	Confirmed records from Port Bonython and Fitzgerald Bay. Established in USG.

Response

Records need updating – Try Fitzgerald Bay to Port Augusta

Turbidity and Suspended Solids

Construction activities can impact on adjacent marine communities as a result of sediment disturbance, which when excessive, can result in adverse impacts, including:

Increased turbidity in the water column affecting visibility for fauna and reducing light availability for flora

Increased suspended solids in the water column, which may be abrasive and cause clogging e.g. of gills

Sedimentation through silt deposition smothering fauna and flora.

As indicated above, piling and propeller wash from construction vessels are the main marine activities which could have impacts. The potential effects with regard to the inshore reef and offshore benthic communities are examined below.

Response

All the more reason why this is a poor location for a port facility.

This is in an inverse-estuary and Marine Park including sanctuary zones that have been established to protect venerable species that are unique to Upper Spencer Gulf.

Effects of Pile Construction

(i) ***Reef Community***

Pile construction will occur in the subtidal reef, extending for approximately 200m offshore outside of the aggregation season. For the first 1km piles will have 5m centres laterally and 32m centres longitudinally. Piling will have an impact on turbidity and sedimentation, but it is expected that the effects will be localised and transitory. It is difficult to quantify the effects, but in this case, it is considered that the effects on reef biota will be minor as a result of:

The current proposal indicates that open ended (hollow) piles of 1-2m diameter (pending detailed design) will be driven into the seabed. It has considerably less disturbance to sediment compared to solid piles. Considering the use of hollow piles and outcome of the Columbia River monitoring study, impacts of the piles installation are considered negligible.

Question
Explain what similarity does the Columbia River project have to this in-verse estuary and Marine Park zone?

14.4.2.6. Marine Pest Introduction
Although often considered more of an issue for international vessel movements, the transfer of pests between ports and regions within Australia is also an issue. Australian ports and construction vessels therefore could be a source of marine pests not currently found within the study area.
It is important to prevent the establishment of marine pests in the Upper Spencer Gulf as they can have a variety of impacts including:

- Threatening and displacing native marine life
- Damaging the attractiveness and value of coastal areas
- Threaten the local economy through impacts to:Fisheries
- Aquaculture
- Recreational activities (e.g. diving, snorkelling, fishing, etc.)
- Amenity value
- Cause human illness.

Because of the potential impacts and in the absence of compulsory guidelines or other safeguards, the introduction and spread of pest species could be very serious. Consequently, with regard to the Significance Criteria, the potential effects are considered to be moderate and the risk rating medium

Response
Pearl Oysters have been introduced to Upper Spencer Gulf with serious consequences from Fitzgerald Bay to Port Augusta. This is no medium risk rating. It is out of control and the authorities have no control over the situation.
Question
Can you detail Significance Criteria?

Aquaculture
The nearest aquaculture leases are in Fitzgerald Bay as shown on **Figure 14.4a** and have previously been used for Kingfish aquaculture; it is understood that there are no operations at this location currently. During construction there is not expected to be any impacts to these leases as there will be no impairment of water quality (Refer to **Chapter 13, Coastal Processes and Water Quality**). There is some risk, albeit unlikely, that marine pests introduced during construction could impact on the leases.

Response
This part of Upper Spencer Gulf is of serious concern due to the fact that unknown marine sources have seen the collapse of this industry.

14.4.3. Operation Impact Assessment and Management

14.4.3.1. Ship Strike
Spencer Gulf Waters

The low numbers of Whales observed in Spencer Gulf, along with the relatively low instance of reported ship strike, suggests that the risk to whales as a result of ship strike is low, even in the context of increasing ship movements.

It should be noted that most of recorded incidents are thought to relate to smaller vessels. There are no formal requirements for larger commercial vessels to report whale strikes, so records may not be complete. Larger vessels travelling at maximum speed may also be unaware of an incident occurring. It is reasonable to assume however that the incidence is low, or there will be higher numbers of dead or injured whales reported along the South Australian coastline

The existing shipping channels into Spencer Gulf are aligned towards the centre of the Gulf in deeper water, meaning that if the Whales move in the shallow inshore waters that they tend to prefer whilst in Australian waters (SEWPaC, 2012a), they may avoid ship lanes and reduce risk of ship strike. These existing shipping channels will be utilised by vessels travelling to and from Port Bonython.

Question
Shallow inshore waters are not defined?

14.4.3.5. Aquaculture and Fisheries

Commercial Fisheries
There will be no effects on commercial fisheries for the following reasons:
There is no loss of seagrass or mangrove habitats, both of which are critically important in the life cycle of many species
As indicated above any effects on water quality during construction will be localised and transitory, with no long-term impacts on water quality with the operation of the port
Shipping will be restricted to the main shipping channels.

As for aquaculture, commercial fisheries could be impacted by a large spill if it involved damage to mangrove and seagrass habitats, direct acute or chronic effects on commercial species, or tainting. However, as mentioned above, with the measures proposed there will be a low risk.
As for aquaculture, commercial fisheries could also be impacted by new introduce species from shipping using the new port. However, as described above with the strict measures already in place and proposed, there will be a low risk.

Response
There is no loss of seagrass? Results show that the shipping channel from berth 3000m to 14500m (3000-5000m 18.5depth @ half ahead, 5000-12000m 19.9depth @ full ahead, 12000-14500 20.6depth @ full ahead)(Marine Park) and also Yarraville Shoal 18.5depth @ full ahead are the two critical areas where propellers wash sediment re-suspension and no numerical modelling has been undertaken to estimate its fate once in the water column and subjected to tidal influences.
This sediment re-suspension could have devastating consequences for the vast seagrass colonies (100's of tons of mud and grit covering seagrasses) which in turn will have critical negative effects on the numerous species that seek protection in seagrasses and reefs.
Question
What steps will be undertaken and when, to eliminate this possible devastating situation?

Recreational Fishing
There will be no effects on Recreational fishing for the same reasons as those for commercial fishing above. In addition there will be only a minor restriction on recreational

fishing near the jetty with a 50m exclusion zone. Overall the effects on recreational fishing should be negligible.

Response
Whales, dolphins and the cuttlefish get a mention but no study in this EIS on the migration routes adjacent to or within the shipping channel of the many marine species that habitat the Upper Spencer Gulf - including snapper, prawns, whiting, sharks, crabs and many more and what consequences the 3 fold in shipping activity will have on the future wellbeing of these species.
Question
What pre construction onsite studies and when on these species will be undertaken to obtain data?

14.4.3.6. Water Quality
Propeller Wash and Turbidity
Turbidity levels may be increased during operation by propeller-induced re-suspension of sediments by bulk carriers and tugs. Three areas of potential impact are considered:

- The subtidal reef, in the vicinity of the proposed jetty
- Along the shipping channel in the vicinity of Fairway Bank
- Along the shipping channel in the narrows, in the vicinity of Yarraville Shoal.

As outlined in **Chapter 2, Project Description**, at full capacity, the Project aims to export 50Mtpa of iron ore which equates to 277 Cape Class vessels annually with a capacity of 180,000t.
When assessing the potential impacts of shipping as a result of the Project it is important to note:
No dredging is required as part of the Project to maintain passage for shipping
Currently Cape-size vessels up to 180,000t manoeuvre within Spencer Gulf to the boundary of the Port of Whyalla port limit. In addition, LPG vessels up to 110,000t manoeuvre within Spencer Gulf to the Santos Facility at Port Bonython. The recommended Shipping Channel used by Flinders Ports is indicated in **Chapter 2, Project Description**
The recommended Shipping Channel as per the Admiralty Chart is a track on the deep water route determined to accommodate a maximum seabed level of -20m Chart Depth. One exception to this is Yarraville Shoals (refer to **Chapter 13, Coastal Processes and Water Quality**).

Response
Current Cape-size vessels up to 180,000t manoeuvre the boundary of the Port of Whyalla port limit but currently do not enter the narrow and shallow channel to the north.
Question
When is onsite numerical modelling programmed to be undertaken?
When is an onsite assessment of sediment re-suspension programmed to be undertaken?
When is an onsite study of content of the bed sediments programmed to be undertaken?
What empirical investigation has been or should be done regarding the risk that self-dredging will occur?

A full physical undersea audit (photo's) is vital on all sensitive areas within the Marine Park and Yarraville Shoal before any final decision is made on the project.

[redacted]

Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment ,Statutory Planning
Roma Mitchell House,
GPO Box 1815
ADELAIDE. SA 5000

Submission –EIS on the Port Bonython Bulk Export Facility Proposal

Dear Sir

I have lived in Whyalla for more than forty years and feel compelled to respond to the Draft Environmental Impact Statement.

There is, first of all, a need for nonresidents, developers and government bodies at all levels and all persuasions to understand that the Lowly Peninsula is an important and valuable asset to the City of Whyalla and its community. It is all we have.

We have no Glenelg beach .
We have no Brighton Beach
We have no Adelaide Hills
We have no Barossa Valley
We have no McClaren Vale

We have the Lowly Peninsula- our own piece of scenic ,beautiful ,peaceful coastline which has serviced us admirably for the purposes of recreation for a long time.
We are a cosmopolitan community sustained by Arrium, our main employer, and we work hard in a harsh climate. We have a history of industry but the steel industry suffers peaks and troughs ,relying on selling iron ore as well as steel . In bad economic periods we feel the pain.

The need to diversify our economy is of paramount importance and the Lowly peninsula could play a huge role in providing diversity of income and employment for Whyalla and Eyre Peninsula.

I have followed the commodity port proposal for five years and recently attended the only public consultation meeting on October 29th .
At best I found it to be sadly lacking. Two hours allocated for this meeting. The first hour was taken up by Govt and Consultant presentations .The remaining time to debate

information in the EIS documents and appendices was nowhere time enough to discuss a document which has been prepared over a period in excess of 12 months.
Hardly good enough.

We in Whyalla are not opposed to development but development at a huge cost especially when more appropriate sites are available is just not acceptable.
We do have a blight on our Lowly Peninsula landscape however, in the form of Santos but I see no good, logical reason to make a bigger mess by adding to it.
In the EIS reference is made suggesting that “The visual industrial landscapes are a visual feature which is of interest to some viewers” This is a nonsense unless the comments are directed at developers. Not many tourists /visitors travel to view any industrial landscape.

With careful consideration regarding the site of a port, Whyalla can have the best of both worlds.
A commodity port south of Whyalla and at about the same distance south as Port Bonython is to the north ,would provide deep water, significant areas of low value flat land and significantly less environmental risk.
There would be no impact on liveability.
A port south of Whyalla could be more expandable than that proposed at Port Bonython and provide more jobs during the construction and operations in the future.
This would enable the Lowly Peninsula to be developed in ways that would support and promote the region, creating more diversity for the jobs market and more revenue for the region and State. The best of both worlds for all .

Issues regarding a restricted port at Port Bonython are many and varied and raise concerns such as;

The overall impact when considering the total industrial facilities, in its many forms, occupying much of the valuable coastal land.

The impact on the marine environment, noise, and visual impact.

The Defence Force has acquired a huge amount of land north of Whyalla adjacent to the Lowly Peninsula .This, combined with the huge footprint of the proposed industrial footprint on the Lowly Peninsula will take away completely any peace and quiet to be found there at present.

The size of ships and the potential propeller seabed disturbance and its risk to the marine eco systems .

The draft EIS leaves some issues unanswered eg. sea bed disturbance, others half heartedly answered eg. cumulative effects and some issues neglected, lost altogether.

There is great need for nominated groups such as the Stony Point Environmental Consultative Group to be responsible and accountable in its duty to keep watch on our Gulf.

.
Those who respond clearly have very good reason for doing so, and I must leave the serious and sometimes technical or scientific questions and comments to those more capable and aligned with such things than myself.

The community relies on those involved in this EIS review and decision-making process to arrive at the right outcome and thereby deliver good governance. All things considered I have little faith in this system but feel that if responses are not made it will be assumed that the community, in its silence, is in agreement with this proposal. Many are simply feeling “brow beaten”. With that in mind I can only hope that the public record will show our stand for what we believe to be the right decision and encourage others at some later date to voice what needs to be said.

Locate the commodity port in a more suitable site, south of Whyalla and save the Lowly Peninsula to create diversity of jobs and promote our region.

[redacted]

[redacted]

18th November, 2013.

Submission – EIS on the Port Bonython Bulk Export Facility Proposal.

Email : DPTI.PDPublicSubmissions@sa.gov.au

Minister for Planning
Attention : Mr Robert Kleeman
General Manager, Assessment, Statutory Planning

Roma Mitchell House
GPO BOX 1815
ADELAIDE SA 5000.

Dear Sir,

This is the fourth of several submissions. It relates to **Chapter 16 Sustainability**

I am a member of the Alternative Port Working Party (APWP) which is a group of professional Whyalla residents, who are concerned to encourage the most efficacious development of a diverse range of industrial and other economic opportunities and quality of life attributes of this region of South Australia.

Areas which are immediately north of the city and potentially also an area adjacent to a deep-water shipping lane about 25 kilometres south of Whyalla, are most suitable for industrial activities.
The Lowly Peninsula north east of Whyalla is unique in this region for opportunities for recreation and tourism and coastal living.

Judicious matching of areas of our land and Gulf to those activities for which they are most suited, is the key to achieving “best of both” - success in business and liveability outcomes in this region.

My motivation and qualifications for pursuing these matters arise principally from two aspects of my 47 years background in the Whyalla area – my Engineering experience in Heavy Industry and my service in Local Government. See footnote.

It is most regrettable that only 6 weeks have been allowed for responding to the draft EIS. The time is clearly not adequate for a rigorous review and provision of comprehensive feedback covering the Draft Statement (598 pages) and its Appendices (524 pages).

I attach my review work notes in respect to **Chapter 16 Sustainability**.

[redacted]

[redacted]

Attachment E.

AJAS Notes/prompts (incomplete 18 Nov2013)

in relation to Draft EIS by SGPL Sept 2013

Discussions should be generated from the following red notes in italics:

16 Sustainability

16.1 Introduction

The purpose of this Chapter is to assess the sustainability performance .....sustainability merits ....sustainability objectives....

16.2. Background

16.2.1 Legislation and Policy Overview

....'development that meets existing needs without compromising the ability of future generations to meet their own needs'.

'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

The promotion of sustainability ......is included as **one of three key objectives for South Australia in the state planning strategy (DPTI, 2013), a focus also reflected in the regional volume for the Eyre Peninsula.**

After an encouraging early start (see yellow highlights above) this Chapter loses focus on the primary overarching objective: **"the promotion of sustainability**"

It takes up and applies a methodology directed to identifying good engineering practices for reducing waste and inefficiency in some aspects of construction and operation; these practices are related to ***viability of operation over the short and perhaps medium term.***

They may be sensible, commendable and highly desirable approaches in some instances but they are not going to the essence of SUSTAINABILITY, which is an intergenerational phenomenon.

It must be acknowledged that the Objective of the Proposal is not to promote Sustainability.

Its sole objective is to facilitate export of non renewable iron ore resource –thereby reducing the resource available to following generations.

To put it another way:

The port and portside industrial estate and the services infrastructure to it, having the sole purpose of exporting iron ore- a finite non-renewable commodity – is an undertaking in unsustainable activity. This goes to the essence of "unsustainability".

Table 16.3b: Final Project significance criteria

This table is flawed by its omission of an important category –MARINE- and associated Category objectives and Credit commentary.

16.4 Baseline Assessment

16.4.1 Baseline Assessment results

Management Systems

c) Risk and Opportunity Management

…………………… The risk register includes consideration of the following receptors: …..

Marine *matters are not mentioned here –were they addressed?*

Energy and carbon

c) Use of Renewable Energy

No investigations have been undertaken into opportunities for using renewable energy or the feasibility these opportunities to date.

Here is a lost opportunity.

Will the proponent volunteer to purchase 100% green electricity? (note the precedent set by BHP Billiton's proposal for powering its seawater desalination plant and pump stations)

Will it be a condition of approval of the development that the proponent is required purchase 100% green electricity for operation of its plant?

Land

Waste

Ecology

b) Ecological value

d) Habitat Connectivity

The focus in the above sections is on Terrestrial matters.

Please note that there is no section under 16.4 Baseline Assessment Specifically for addressing MARINE – it appears that this topic has been missed out again in considering sustainability.

Community Health, Wellbeing and Safety

This section is incorrect where it states "the Project is located in an industrial area".
The site is attractive, greenfield, undulating coastal land with dense coverage of healthy native vegetation.
Opportunity costs have not been adequately identified.

The social impact assessment is deemed to be sufficient to ensure all adverse impacts to the community health and wellbeing are minimised, and opportunities to positively enhance the community identified.

Whoever deems this is just plain wrong:

- *The assessment process has been flawed*
- *The adverse consequences have not been sufficiently explored and quantified*
- *The opportunity costs have not been adequately explored and quantified*
- *There has not been rigorous pursuit of minimisation of disbenefits – particularly through AVOIDANCE –such as by locating the proposal in an area which is much more suited to its industrial functions.*

Innovation

No innovation initiatives as defined by ISCA have currently been identified for the Project

At least 6 innovative initiatives have not been canvassed:

1. *Option to be servicing the agriculture/farming/pastoral sectors and thereby introduce an element of "sustainability" into its functions.*
2. *Option to be an integrated multi-function **import and export** facility*
3. *Option to be a multi-user facility which includes servicing of farming along with manufacturing, military and mining sectors.*
4. *Option to locate where a multi gauge rail hub can be achieved to connect Eyre Peninsula rail, Arrium rail and National Standard Gauge rail.*
5. *Option to locate outside Marine Park 10 to eliminate environmental and issues.*
6. *Option to locate on a deep wide shipping lane south of Yarraville Shoals where shipping from the port would not be tidal dependent.*

16.4.2

16.5

16.6

It must be acknowledged that the Objective of the Proposal is not to promote Sustainability.

The Proposal cannot be rated as 'good' or 'commended' for Sustainability Performance

Regional Development Australia
WHYALLA & EYRE PENINSULA INC.

Ref/File No: P020210

[redacted]

Minister for Planning
Attention: Mr R Kleeman
General Manager, Assessment (Statutory planning)
Department of Planning Transport and Infrastructure
GPO Box 1815
Adelaide
SA 5000

Dear Mr Kleeman,

RE: Regional Development Australia - Whyalla and Eyre Peninsula, Submission [redacted] response to the Environmental Impact Statement for the proposed Port Bonython [redacted] Commodities Export facility.

Thank you for the opportunity to respond to the Environmental Impact Statement for the proposed Port Bonython Bulk Commodities Export facility, released for public comment on 3 October 2013.

We note that the major development assessment process provides an opportunity for formal public consultation to occur prior to a decision being made to approve, approve with conditions or reject a proposal. In this context Regional Development Australia - Whyalla and Eyre Peninsula is pleased to provide this response and to highlight issues associated with the project and its implementation.

The primary role of Regional Development Australia - Whyalla and Eyre Peninsula is to grow and strengthen the economic and social infrastructure of the Whyalla and Eyre region. The organisation is made up of local business, community leaders and staff who work with government, industry and the community to support development of the region.

RDA - Whyalla and Eyre Peninsula is the primary economic development agency in the region and it is structured to reflect and represent views of both the local (Whyalla) and wider Eyre Peninsula community.

Whyalla is a growing population centre of significant current and future national economic importance. For the past decade, Whyalla's economic development has been firmly based on supporting and encouraging sustainable industry growth in combination with increased amenity. These principles have underpinned the transformation and growth of the local economy. If the region is to thrive and grow it is vital that all future development within the region be undertaken on the same basis.

Yours Sincerely,

[redacted]

Regional Development Australia

WHYALLA &
EYRE PENINSULA INC.

Submission in response to the Environmental Impact Statement for the proposed Port Bonython Bulk Commodities Export facility.

18 November 2013

[redacted]

[redacted]

Regional Development Australia Whyalla and Eyre Peninsula (RDAWEP) role in the region, Brief Background.

The primary role of RDAWEP is to grow and strengthen the economic and social infrastructure of the Whyalla and Eyre region. It is the primary economic development agency in the region and it is structured to reflect and represent views of both the local (Whyalla) and wider Eyre Peninsula community.

RDAWEP's mission is to develop a globally competitive economy and liveable communities through fostering environmentally and socially sustainable business and industry development. RDAWEP identifies five issues as being critical to the sustainable development of the region: water security, business development, infrastructure provision, workforce development and liveability enhancement. This response is consistent with its strategic plan and role as the key agency for economic and community development in the region.

Context of our response to the EIS

RDAWEP conducted an internal analysis of the EIS, inspected the proposed development site and surrounding area and considered the contents of the EIS within a context of existing relevant strategic plans and objectives and local intelligence gathered in its regional daily business operations.

Overview of Whyalla, the surrounding region and context of the project

The City of Whyalla is South Australia's second largest regional city. It has a population in excess of 22,000 people and is the most significant service centre in the region providing retail, education, health, community and other services for residents of Whyalla and for residents of the surrounding greater region.

Manufacturing is the largest industry and Whyalla is the largest industrial city in regional South Australia. Whyalla is a hub and principal centre for manufacturing, steel production and resource processing in the Upper Spencer Gulf and Eyre Peninsula regions. The manufacturing sector alone employs almost 3,000 people in Whyalla and contributes approximately $341 million per annum to South Australia's gross regional product.

Whyalla is strategically located with transport, engineering, business, retail and education sectors directly involved in meeting the demands of substantial and growing mining and mineral processing developments located both within the immediate vicinity of the city and in remote locations to the north, south and west.

Mining is one the region's emerging and most important growth industries. Whyalla is located within the large mineral provinces of the Gawler Craton and the Eucla Basin. These areas have demonstrated substantial mineral resource deposits while also offering great potential for the discovery of new mineral deposits and petroleum sources in the future. There are emerging developments in a range of minerals including heavy mineral sands, iron ore, copper and gold, with increased levels of exploration for other commodities including uranium, zinc, nickel, diamonds, petroleum and coal. It is envisaged that Whyalla will become a key centre for the processing and export of mineral resources, as a service centre for supporting industries and for training and skilling the future workforce of the region.

The region which surrounds the city has many other positive attributes including magnificent natural resources, vast stretches of untouched coastline, vibrant coastal and inland rural communities with a quality of lifestyle, amenity and services which is the envy of many Australians who live in regional Australia.

Considerations

The comments within this submission are predominantly weighted towards consideration of the projects perceived impact on the five aforementioned critical constraints to economic and community development.

Lack of infrastructure and the inability for existing and potential mines in the region to access efficient bulk commodity transport to export markets has been identified as the key constraint on future economic growth in the region. Construction of the proposed bulk mineral port will assist to address this issue. Its proximity to mine exploration sites in the north of the state and to the national standard gauge network will stimulate mine construction and may potentially offer alternative transport arrangements for existing projects. Mine projects identified in central and northern Eyre Peninsula may benefit if connecting transport infrastructure is determined, through specific project case studies, to be a viable alternative or supplement to alternative port and landside transport proposals.

The Port Bonython project, its associated economic activity and long term export revenue generation potential is substantial at both a State and National level. Focussing on the local level, the three year construction phase with an expected 270 FTE workforce, who would be based in Whyalla is expected to have a substantial positive impact on the local economy. This would primarily be realised in terms of local employment and local supply of goods and services to the project. The planned 40 direct full time operational jobs post construction, will also provide significant long term benefits for the local economy. The economic multiplier effect associated with projects of this type is well established, and for every direct job created typically an additional 3-4 jobs are created indirectly. This indicates that the project could create an additional 200 full time sustainable jobs in the region.

Construction of the port will be staged with the first stage establishing an export capacity of 25Mt/pa. This indicates opportunity for future expansion (stage 2 at 50Mt/pa) and generation of additional employment and associated economic benefits.

In terms of land use, the land based footprint for the materials handling and shipping infrastructure appears relatively small. The proposed location is zoned for industrial use; the land area is low rainfall, non arable, apparent low quality with limited alternate economic potential. The proposed site is also located adjacent to an existing industrial facility, which indicates the project is consistent with an existing land use. A three dimensional visualisation of the proposed site which has been available for public viewing, indicates limited real impact on the visual aesthetics of the area.

The general area surrounding the proposed site does attract tourists and recreational divers; it is also widely used as a recreational area for camping and boating largely by residents of Whyalla. ***It is essential that adequate access to adjacent areas and facilities is maintained and improved for these groups and for growing numbers of visitors to Point Lowly and Whyalla's northern coastline.***

Concerns have been raised publically by some local residents but there appears to be insufficient evidence to demonstrate that the proposed industrial development could not co-exist with other use of the general area, including residences, recreation and tourism, particularly in consideration of the existing (Santos) industrial facilities.

The use of a fully enclosed rail unloading and storage facility and iron ore conveyor including water spraying systems where required, is current best practice that will minimise dust emissions and the air quality impact on surrounding land uses.

A commitment to improve current poor quality infrastructure and other facilities for visitors, undertaken by the project proponent could help to address community concern relating to this issue. This should include consideration for provision of a dedicated tourist drive (visitors trail) and cycle path to enhance tourism and public safety by separating industrial and recreational traffic.

The EIS outlines that Spencer Gulf Port Link is required to develop a detailed industry participation plan. One aspect of the plan is to provide full fair and reasonable opportunities for local small and medium enterprises to supply goods and services to the project. This aspect and undertaking is positive and strongly supported, however, local in this context is not defined. If the local economic benefits described are to be realised, it will be essential that the Industry Participation Plans are not focussed primarily on Adelaide based suppliers. Industry participation plans should reflect this aspect and include specific activities to identify and promote opportunities to Upper Spencer Gulf and Eyre Peninsula based suppliers so that full, fair, reasonable and local access is ensured.

From both a social and economic perspective RDAWEP is obligated to ensure that the need for Fly in, Fly out workers and service providers is minimal. ***It is important that strong communication channels between project proponents, contractors, local industry and suppliers are established. This will also ensure that local people can be trained or up-skilled as necessary, to meet project workforce requirements. It will also assist to optimise local content and keep project costs to a minimum. RDAWEP is keen to work with the proponent to facilitate these processes.***

The proposed project is located within the Upper Spencer Gulf Marine Park. The EIS has identified that increased levels of noise and possible turbidity within the marine environment directly associated with the proposed development may cause negative ecological impacts, including to the cuttlefish population. ***RDAWEP notes that the EIS indicates that further research to assess and address these impacts is required.***

Conclusions

- **It is essential that adequate access to adjacent areas and facilities is maintained and enhanced for tourists, recreational divers, local residents and for growing numbers of visitors to Point Lowly and Whyalla's northern coastline.**
- **A commitment to improve current poor quality infrastructure and other facilities for visitors, undertaken by the project proponent could help to address community concern relating to the project. This should include consideration for provision of a dedicated tourist drive (visitors trail) and cycle path to enhance tourism and public safety by separating industrial and recreational traffic.**
- **It is important that strong communication channels between project proponents, contractors, local industry and suppliers are established. This will also ensure that local people can be trained or up-skilled as necessary, to meet project workforce requirements. It will also assist to optimise local content and keep project costs to a minimum. RDAWEP is keen to work with the proponent to facilitate these processes.**
- **Lack of access to efficient bulk commodity transport to export markets has been identified as the key constraint on future economic growth in the region. Construction of the proposed bulk mineral port will assist to address this issue. Additional positive economic spinoffs are expected in terms of creation of significant numbers of new jobs and opportunity to supply goods and services to the project by local businesses.**
- **The EIS has been analysed for potential impact on the five identified constraints to sustainable development of the region. The project positively contributes to four out of the five constraints, those being business development, infrastructure provision, workforce development and liveability enhancement, on that basis Regional Development Australia Whyalla and Eyre Peninsula supports this significant region building project.**

18 November 2013

Minister for Planning
Attention: Robert Kleeman, General Manager,
Assessment (Statutory Planning)
Department of Planning, Transport and Infrastructure
GPO Box 1815
Adelaide SA 5000

Dear Sir / Madam

RE: Proposed Port Bonython Bulk Commodities Export Facility (Deep Sea Port) – Environmental Impact Statement

On behalf of the South Australian Freight Council Inc (SAFC) Membership I thank you for the opportunity to comment on the proposed Port Bonython Bulk Commodities Export Facility (Deep Sea Port) Environmental Impact Statement.

SAFC is the State's peak, multi-modal freight and logistics industry group that advises both the Federal and State governments on industry related issues, and is funded by both governments and industry. SAFC represents road, rail, sea and air freight modes and operations, freight service users, and assists the industry on issues relating to freight logistics across all modes.

SAFC supports the proposal to develop an open access deep water port at Port Bonython and views the facility as a key enabler for the emerging mining industry in this State. Consequently we encourage the State Government to continue to work in partnership with the Spencer Gulf Port Link consortium to bring this project of State significance to fruition.

The Port Bonython precinct has many advantages over alternative sites including relatively close access to deep water (20 metre draft required for proposed 180,000 tonne vessels), abundant adjacent land to facilitate expansion and the development of complimentary facilities, and limited development by incompatible uses that could impede operations.

This project is particularly significant for junior miners with emerging projects needing to put in place a viable path to market so as they can develop bankable feasibility studies and access project finance.

It is SAFC's observation that the project proponents have discussed all possible environmental risks in the EIS, and where warranted, have incorporated design criteria such as enclosed conveyors that will mitigate those risks. The proponents should be commended for their efforts in this regard.

Nonetheless, SAFC comments that the EIS is unclear as to which mines are considered to be potential customers for the proposed new port facility. As a result it is difficult to determine a likely path to port and associated key road and rail freight facilities.

Given that there is a potentially significant road freight task, including during the construction phase, SAFC suggests that the State Government investigates the necessary upgrades required to bring the Lincoln Highway from Port Augusta to the Port Bonython turnoff, and then from the turnoff to Port Bonython itself, up to a standard that facilitates access by PBS 4 vehicles (Triple Road Trains and other unique vehicles in that class). This capacity enhancement, which could benefit the emerging miners and other current and potential road users (but not directly the port itself), would enable High Productivity Vehicle access to the NT Border and beyond. SAFC acknowledges that the choice of road vehicle type is a matter for individual mine proponents and their chosen heavy vehicle operators.

With regard to rail capacity, SAFC is not convinced that, in the absence of investment in crossing loops (and this may be planned but not detailed in the EIS), there will be sufficient capacity for rail operations on the network, particularly for elements of the network between Crystal Brook and Tarcoola where we understand that available capacity is limited.

Many of the iron ore mines that might provide throughput for a new port at Port Bonython would be expected to utilise the Interstate Mainline, including the Tarcoola to Port Augusta (and Crystal Brook) section of track. Indeed the recently released Draft Integrated Transport and Land Use Plan indicates that investment will be required in this element of the network over the medium (5-15 years) and longer (15 years +) term to accommodate these emerging junior miners.

Moreover, rail operations in the Port Augusta township are less than ideal for trains attempting to access the Whyalla line from the North and West of the State, suggesting that investment in the Port Augusta Triangle project may be necessary to overcome community concerns as well as the inefficiencies of shunting within the Port Augusta township itself. We understand that ARTC has undertaken initial design work in relation to this project, which is able to be triggered at short notice if demand requires its construction.

Whilst SAFC acknowledges that in general ARTC invests in the national rail network as demand requires, there is little to no detail of the rail investment requirements associated with this proposal. It is noted that ARTC is currently upgrading the signalling system between Pt Pirie and Tarcoola which will provide additional capacity and will initially develop its Advanced Train Management System on the Pt Augusta to Whyalla section of track.

The SAFC also notes that ARTC has in place an Access Undertaking with the ACCC that provides a framework for investment in the network in the event that additional capacity is required by new users. In the past two years the number of minerals services operating from Tarcoola to the East has increased to seventeen per week and sufficient investment has been made by ARTC to accommodate this significant growth. This indicates ARTC's willingness to invest in the network when demand warrants.

SAFC notes that there could be further investigations to identify future road and rail capacity requirements, but does recognise that this is likely beyond the scope of the Port Bonython EIS and is therefore not practical without specific detail of future Port users.

Finally, SAFC contends that, due to the relatively short collection space (60-70 metres) between the Lincoln Hwy/Pt Bonython Rd junction and the level crossing there may be some safety issues with road vehicles queuing awaiting the passage of a train. This potential issue will most likely present the greatest risks during peak hour movements (shift start and finish) at both the Port Bonython and SANTOS facilities. This situation would be exacerbated should there be Double Road Train, or even Triple Road Train type vehicles in the mix. Consequently, SAFC contends that the State Government should consider this matter further and if warranted provisions be made to increase the collection space.

In closing SAFC again commends the project proponents and their consultants for the generally thorough manner in which the EIS has been developed and encourages an early approval to facilitate an early commitment of works.

[redacted]

Yours faithfully

[redacted]

Port Bonython Bulk Commodities Export Facility EIS Submission

I have many concerns about the proposed Port Bonython Bulk Commodities Export Facility (BCEF) being constructed on the Point Lowly Peninsula.

Firstly, I am concerned that and I find it very difficult to understand how, this draft EIS has been released for public consultation before consultation has occurred with the Aboriginal custodians and Native Title claimants of the proposed project land. To me the current process appears to be rushing things through, in a most irregular, undemocratic and invalid fashion, without following due process under the various regulatory authorities covering Aboriginal Heritage and Native Title as outlined on page 9 of the EIS Executive Summary.

In Chapter 3 of the Executive Summary it is pointed out that:

> *…a detailed assessment of the Projects impact on Native Title Claimants is yet to occur…*
>
> *Developing a dialogue and consultation with Barngarla is a priority for SGPL, but until such consultation occurs, assessment of any impact on Native Title will be incomplete (p9)*

In clause 11.3.4 a **proposed** Aboriginal Cultural Heritage Survey is discussed which will:

> *…include detailed assessment of the impact of the Project that will provide information to assist the Minister to make a determination or authorisation. (p331)*

And further on, in Clause 11.7.1, after a very comprehensive literature research is discussed and some very relevant information is presented, we are told that:

> *Consultation with Aboriginal people with heritage interest in the Port Bonython area is recommended to complete the impact assessment and is a requirement of any determination or authorisation by the Minister under the Aboriginal Heritage Act 1988. (p336)*

And again in Clause 11.7.1 we are being asked to accept that, "*...developing a relationship with traditional owners and Native Title Claimants [is] an extremely high priority for SGPL" (p336). B*ut to date there is no evidence provided to support a developing relationship with the custodians and the public consultation process will conclude before any evidence is able to be provided.

A more detailed reading of this issue concerns me even more. The tone of the language used and the manner in which Clause 3.3.1.1 is written does not convince me that "developing a dialogue and consultation" with the Barngarla people "is a priorty for SGPL". The clause acknowledges that:

> *If the Project affects significant Aboriginal sites it will be necessary to seek permission to damage or destroy the site, or sites, from the Minister for State Aboriginal Affairs under Section 23 of the Aboriginal Heritage Act 1988. All efforts to avoid impacts to Aboriginal sites will be made. Cultural heritage is addressed in further detail **Chapter 11, Cultural Heritage**. (p84)*

There is no mention of any process of consultation with the custodians here. The process identified here first is that of seeking permission from the Minister "to damage or destroy the site, or sites." The statement, "All efforts to avoid impacts," comes after the strong opening sentence, almost as if it were an afterthought.

If consultation and dialogue are genuinely the priority of SGPL then clause 3.3.1.1 should have outlined a process which would firstly involve consultation and negotiation with the Aboriginal custodians to avoid or mitigate these impacts before identifying the necessity to seek permission from the Minister **"to damage and destroy…"!**

I therefore ask that:

a) **evidence of genuine and relevant dialogue and consultation with the Aboriginal custodians and Native Title claimants**

and

b) **evidence of an agreed heritage management plan, negotiated as required under the Aboriginal and Torres Strait Islander Heritage Protection Act 1984 and the SA Aboriginal Heritage Act 1988**

be included in a supplementary EIS to be made available for public perusal and comment before it passes to the Minister for assessment.

Another concern I have regarding the consultation process is that the public consultation period has not been long enough for an individual with other family, work and community commitments to read, review and write a comprehensive submission on such a lengthy and detailed document. The EIS public consultation process in general leaves a lot to be desired with only one public meeting required and with the public not having another opportunity to give feedback to the proponent's publicly released Response Document to the EIS.

I therefore wish to recommend that the government review its legislation in regard to public consultation guidelines for environmental impact statements increasing the time for public consultation and feedback in the process where very large complex documents are produced.

I am also concerned about the impact that increased shipping may have on the movement of whales up into the Upper Spencer Gulf. I made a submission in July of this year responding to the Port Bonython Bulk Commodities Export Facility EPBC 2012/6336, Preliminary Documentation Report on my concerns about the Southern Rights. I am pleased to see one further sighting at Point Lowly of two more Humpback Whales recorded on 19/9/2012 in the data presented in this EIS. However this EIS has still not convincingly shown that there will be no significant impact by the project on the Southern Right Whale population moving through the Upper Spencer Gulf basically because the figures cited in Table 14.3 (p425) only go back to 1997 and do not take into account that the post-whaling population decline has not yet fully recovered. Once construction starts and more shipping traffic is present then the figures ascertained through pilot monitoring and radio communications mitigation procedures will be corrupted and could not be used to determine what the possible recovery could be without the increase in shipping. Data collection prior to any construction will be useful but it will need to be taken over a period of decades to ascertain a recovery trend.

Therefore I still maintain that the Precautionary Principle should be invoked in the case of whale protection until more evidence is gathered to ascertain what a fully recovered Southern Right travelling pattern could be in future for the USG considering that the post-whaling recovery is only " estimated to be approximately 10% of the pre whaling population".(Clause 4.1 p7 Ref 1) There may be no currently recognised movement patterns through the Gulf but if the recovery were allowed to progress without the impact of the construction of additional infrastructure, such as an export facility, then future figures may well show considerably increased Southern Right Whale movement patterns throughout the Upper Spencer Gulf.

I wish to point out that the table entitled Operational Initial Assessment With Standard Mitigation (i.e. Statutory Requirements) on p454 shows the following:

Ship strike on marine mammals as a result of construction vessel movements	*Moderate*	*Unlikely*	*Medium*

but I think there is an error as it shows "strike rate as a result of ***construction*** vessel movements" but the table is titled "Operational Initial Assessment".

I am also concerned generally about the possible negative impacts that the increased shipping traffic for the BCEF will have on the very fragile marine environment of the Upper Spencer Gulf, which is an inverse marine estuary with regular dodge tides and which provides many marine nursery eco-systems for a wide range of marine species.

I am particularly concerned that there will be shipping congestion due to the small area of adequately deep water and the need to wait for tidal movements to allow passage over the local shoals. This congestion will increase the possibility of collision between not only fully loaded ore vessels but also between oil laden vessels and ore laden vessels and therefore will increase the possibility of both oil spillages and ore spillages. The EIS acknowledges that the mitigation measures identified in the EIS such as standard compliance biofuels guidelines and setting up oil spill contingency planning procedures will not necessarily prevent accidents and negative impacts and this is of particular concern when we are expecting a huge increase in shipping numbers over the years if the BCEF goes ahead.

I also point out that Port Bonython is just capable of accommodating Cape sized vessels at present but will not be able to move to future efficiencies and accommodate the next sized vessels, which I believe are even currently being used in some Australian ports.

I am also concerned that, in particular, noise generated during construction will negatively impact upon communications among whales and dolphin pods.

I am also concerned that the passage of shipping over the local shoals will cause turbidity which may impact on the Giant Australian Cuttlefish and other marine species. As yet I understand that the evidence presented in the EIS regarding turbidity is from modelling and not from actual in situ data and can therefore be considered questionable.

I believe that the issue of providing port infrastructure to accommodate the increasing mining activities on Eyre Peninsula should be looked at as a Peninsula wide strategy rather than having many individual small ports addressing the need. I strongly believe that the current state government needs to provide more leadership and initiative to pull together the mining groups instead of pushing a divisive approach as is the case now.

Therefore in summing up my concerns for such a fragile marine area I maintain that the Precautionary Principal should be invoked and further more in depth investigations should be conducted for alternative sites for a multiple use port facility or facilities further down the Gulf where it widens considerably and provides larger areas of deeper water.

I was very concerned recently when the size of the footprint of the BCEF was pointed out to me. I had not fully realized the great size of the ore holding sheds until I saw that they will basically be as big as Whyalla's shopping mall, Westlands. Despite having seen the presentation given at a Whyalla City Council meeting addressing the visual impact of the development, I was not convinced by the presentation that the visual amenity impact would be low.

I am concerned that with the establishment of the BCEF at our iconic and much loved Point Lowly, the area will be industrialised with further development and lost as a an important recreational and tourism site for current and future residents and their families of Point Lowly, Whyalla, Eyre Peninsula, South Australia, Australia and the world.

I grew up in a port environment and I cannot reconcile the images of a bulk commodities export facility described in this EIS and my love of the images of Point Lowly and the treasured memories I have of wonderful family excursions there with my husband and our children.

[redacted]

Reference List

1) www.arup.com
   Port Bonython Bulk Commodities Export Facility
   EPBC 2012/6336: Preliminary Documentation Report
   06 June 2013
   Prepared by Arup on behalf of Spencer Gulf Port Link

Santos Ltd
ABN 80 007 550 923
Santos Centre
60 Flinders Street
Adelaide South Australia 5000
GPO Box 2455
Adelaide South Australia 5001
Telephone: 61 8 8116 5000
www.santos.com

Santos
We have the energy.

18 November 2013

Minister for Planning
Attention: Robert Kleeman
General Manager, Assessment (Statutory Planning)
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

Dear Robert

Re: Environmental Impact Statement (EIS) for the Port Bonython Bulk Commodities Export Facility

Santos Ltd (Santos) provides the below comments on the Environmental Impact Statement (EIS) that has recently been published by Spencer Gulf Port Link for a Bulk Commodities Export Facility (BCEF)[1] proposed adjacent to Santos' Port Bonython hydrocarbon processing facility ('the Santos site').

The EIS identifies numerous pre-emptive management measures that have been embedded into the project design, or that will be developed as components of the Environmental Management Plan (EMP) for the BCEF, in order to reduce, eliminate or mitigate the various identified risks. It is important that the detailed design is appropriate and that appropriate management measures be implemented.

1. Potential Marine Impacts

Santos notes the potential of the proposed jetty construction and ship movements to affect marine water quality and marine ecology. These are relevant to Santos because Santos has an ongoing programme of marine monitoring that is undertaken to assess whether groundwater contamination beneath the Santos site is affecting the marine ecology. Santos' marine monitoring programme includes rocky shore sampling sites located 500 m, 1000 m, 1500 m and 3000 m west of the Santos jetty and sub-tidal reef survey sites located 500 m, 1500 m and 3000 m west of the Santos jetty. The proposed BCEF jetty will be located 1400 m west of the Santos jetty, and so is within the area covered by Santos' marine surveys. Therefore, if the proposed jetty and associated shipping operations affect marine water quality or ecology, this may impact results of future marine surveys conducted by Santos, making it difficult to assess whether any impacts detected are due to the new facilities or to the Santos site.

2. Potential Shipping Impacts

Additional ship movements may affect the movement of ships to the Santos site. The BCEF proposal involves up to 277 ships per year, which is approximately ten times the number of ships that use the Santos jetty. Santos understands that shipping from the proposed BCEF facility will come in close proximity of the existing jetty used by Santos, and that further studies and consultation with Santos are required to determine hazards and risks associated with this, and to determine appropriate mitigation measures and controls.

3. Potential Groundwater Impacts

Santos notes that the EIS contains erroneous information about groundwater wells on the Santos site. The EIS reports, based on information from the WaterConnect website[2], that there are two potentially operational

[1] http://www.spencergulfportlink.com.au/?page_id=647

irrigation groundwater bores in the locality (unit nos, 6432-1097 and 6432-1101), both of which are within the Santos terminal. Although the EIS is correct in reporting that this information is shown on WaterConnect, these two bores are in fact Santos well numbers MW134 (Permit 185354) and MW138 (Permit 185356). WaterConnect also lists the majority of the other Santos groundwater wells, with their purpose shown as 'INV' (investigation), whereas it lists those two wells as 'IRR' (irrigation). Santos suspects there was a data entry error when the information was uploaded to the WaterConnect website, such that the entries shown as 'IRR' were intended to be shown as 'INV', as the two wells in question are no different from the other monitoring and potential extraction wells on the Santos site.

4. Potential Impacts from Dust

Fallout of dust from the proposed BCEF may affect the operations and/or maintenance of infrastructure at the Santos site. It is important that appropriate mitigation measures be implemented.

5. Potential Impacts from Vibration

It is important that appropriate controls be implemented to prevent vibrations from piling or from future train movements affecting ground conditions or the stability of infrastructure at the Santos site.

[redacted]

[2] https://www.waterconnect.sa.gov.au/Systems/GD/Pages/default.aspx#Unit Number

P 22
Received
18/11/13.

Minister for Planning
Attention Mr Robert Kleeman
General Manager, Assessment, Statutory Planning
Roma Mitchell House
GPO BOX 1815
ADELAIDE SA 5000

Dear Mr Kleeman

Please find enclosed;- Submission – EIS on the Port Bonython Bulk Export Facility Proposal.

[redacted]

RECEIVED
18 NOV 2013
DPTI
PLANNING DIVISION

14th November 2013

DEPT. PLANNING & LOCAL GOVT.
Document No. 8128602
File No. 2013/03359/05

SUBMISSION – EIS ON THE PORT BONYTHON BULK EXPORT FACILITY PROPOSAL

MY CONCERNS :-

1. The unknown effects on the marine life

2. The lack of consideration for the Whyalla community, tourists and residents living near the proposed project.

3. The unwillingness of the South Australian Government to consider an alternative site or sites.

The unknown effects on the marine life

My concern is that the proponent simple does not know how seriously the stirring up of the sea bed by the propellers of the ships coming in and going out will affect the marine life, being the Giant Cuttlefish, Snapper, Prawns and other smaller marine life.
How could there not be an effect on them as they have been in that area and the channel leading to that area for many hundreds if not thousands of years?
It would seem to me, as a lay person, that there is every possibility that the Cuttlefish could be wiped out along with the snapper and prawn industry.

The lack of consideration for the Whyalla Community, Tourists and residents living near the proposed project.

The Point Lowly area, on which the proposed project is to be situated, is the most beautiful area the community of Whyalla has to visit which is within a reasonable short travelling distance, along with being a tourist destination and home to many residents,
It would appear that no consideration has been given to the above mentioned people.
The project will mean that there will be a railway line which will see trains carrying iron ore rumbling along 24/7, storage sheds and the like which will be any eyesore and the real possibility of dust from the iron ore. The proponents say that there will not be a dust problem as the rail containers will be covered and the sheds will be dust proofed, however having lived in this city for many years which has been an iron ore product related manufacturing city, I simply do not believe that there will not be a dust problem.
Who would want to visit an area which will be subjected to the rumblings of the trains 24/7, the eyesore of sheds and the like and the possibility of iron ore dust around you?
Adelaide residents have many beautiful areas to visit. The community of Whyalla do not!

The unwillingness of the South Australian Government to consider an alternative site or sites

The South Australian Government stated that this area is the only suitable site for this project.
The Whyalla Alternative Working Party, which consists of very qualified people who have lived and worked in Whyalla for many years, who I understand have approached ministers of the South Australian Government many times to suggest an alternative site further down the coast south of Whyalla, which would have little or no effect on the marine life or environment in that area. However the government has , to date, chosen not to consider their recommendations.

Connecting Community Conservation

Conservation Council SA

Address: The Conservation Centre
Level 1, 157 Franklin Street
Adelaide SA 5000

Phone: (08) 8223 5155
Fax: (08) 8232 4782

Email: general@conservationsa.org.au
Web: www.conservationsa.org.au

ABN: 22 020 026 644

18 November 2013

Minister for Planning
Attention: Robert Kleeman
General Manager, Assessment (Statutory Planning)
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

Email: DPTI.PDPublicSubmissions@sa.gov.au

RE: Port Bonython Bulk Commodities Export Facility Environment Impact Statement

Dear Robert

The Conservation Council of South Australia welcomes the opportunity to provide comment on the Environmental Impact Statement (EIS) for the Port Bonython Bulk Commodities Export Facility.

Conservation Council SA is an independent, non-profit and strictly non-party political organisation representing around 50 of South Australia's environment and conservation organisations and their members. Conservation Council SA has developed a comprehensive view of environment policy in *South Australia in a Changing Climate: A Blueprint for a Sustainable Future*[1] This document sets out, at a strategic level, policy positions in six key environmental areas, including marine and planning issues.

We have previously provided comment on the Spencer Gulf Port Link's preliminary documentation report in July this year. We strongly reiterate our serious concerns and recommendations regarding the project, in particular its location.

In the midst of multiple ports being suggested for Spencer Gulf in a largely ad hoc manner, the Conservation Council SA does not accept that this proposal provides the best solution for consolidation or placement that would protect the region's marine environment, EPBC-listed species and the Giant Australian Cuttlefish.

The northern Spencer Gulf population of the Giant Australian Cuttlefish arguably should be a species or population of national significance, listed as critically endangered under the EPBC protection framework. This population is unique in its breeding aggregation, which occurs in False Bay and off the Point Lowly Peninsula and makes it distinct from other Giant Australian Cuttlefish. This bulk commodities port is located directly within the very small and geographically constrained breeding aggregation and nursery of this population.

The Conservation Council SA respectfully suggests that this location would be better suited for development that expands and enhances the existing

[1] http://www.conservationsa.org.au/blueprint.html

recreational use of the population of Whyalla and for broader regional tourism development. This includes the development of ecotourism that builds on the international interest in the northern Spencer Gulf Giant Australian Cuttlefish, and improving opportunities for aesthetic enjoyment, diving, boating, fishing and camping, with development that is appropriate to support these interests.

Conservation Council SA would strongly argue for a consolidated, single multi-user bulk minerals export facility located lower in the Spencer Gulf. We would also argue the need for a thorough Strategic Environmental Assessment to determine the best location for such a port in the Spencer Gulf. The Cape Hardy proposal, for example, may provide a preferable alternative.

We have some comments on the current Environmental Impact Statement.

1.6.1. Project Location

The project location description presents selective information relating to land use, and no context about the port directly covering the Northern Spencer Gulf Giant Australian Cuttlefish breeding aggregation and hatching grounds.

The documentation does not acknowledge the location being in the Upper Spencer Gulf, where the Gulf is narrower and where the impact of large-scale shipping would be increased and concentrated, compared with potential alternatives further south. This aspect is critical to the merits and harm of the project.

The Conservation Council SA rejects this location as a suitable place for the bulk export facility. The site poses an unacceptable and unmanageable risk to the Northern Spencer Gulf Giant Australian Cuttlefish. It poses an unnecessary risk to the Slender-Billed Thornbill and Southern Right Whale, both EPBC-listed species. It increases the impacts of shipping on the marine environment, including sediment mobilisation, oil spills and whale strikes, with a massive increase in traffic in the area.

In selecting this location, Flinders Ports and the state government failed to pay regard to the environmental impacts at this site in comparison with other sites such as Cape Hardy. This is a fundamental failing of the proposal in both the EIS process and its substance.

It does not take into account that the regional need for bulk minerals exports may potentially be double what is identified in this proposal, should proposed mining activity come into production from multiple mines during this cycle or a future cycle of high mining activity.

At the stated capacity of 50MT/annum, 277 ships per year is a significant volume of shipping traffic to bring all the way up to near the top of the Gulf waters.

It massively increases congestion, risk of ship strikes of whales, and propeller wash of sediments that may also contain heavy metals. The risk of shipping accidents resulting in oil or fuel spillage would be a considerable threat to marine life and mangrove areas.

Being around 200km higher in the Gulf than an alternative location at Cape Hardy (for example), the Port Bonython proposal would add around 110,000 kilometres of unnecessary shipping travel in Spencer Gulf each year.

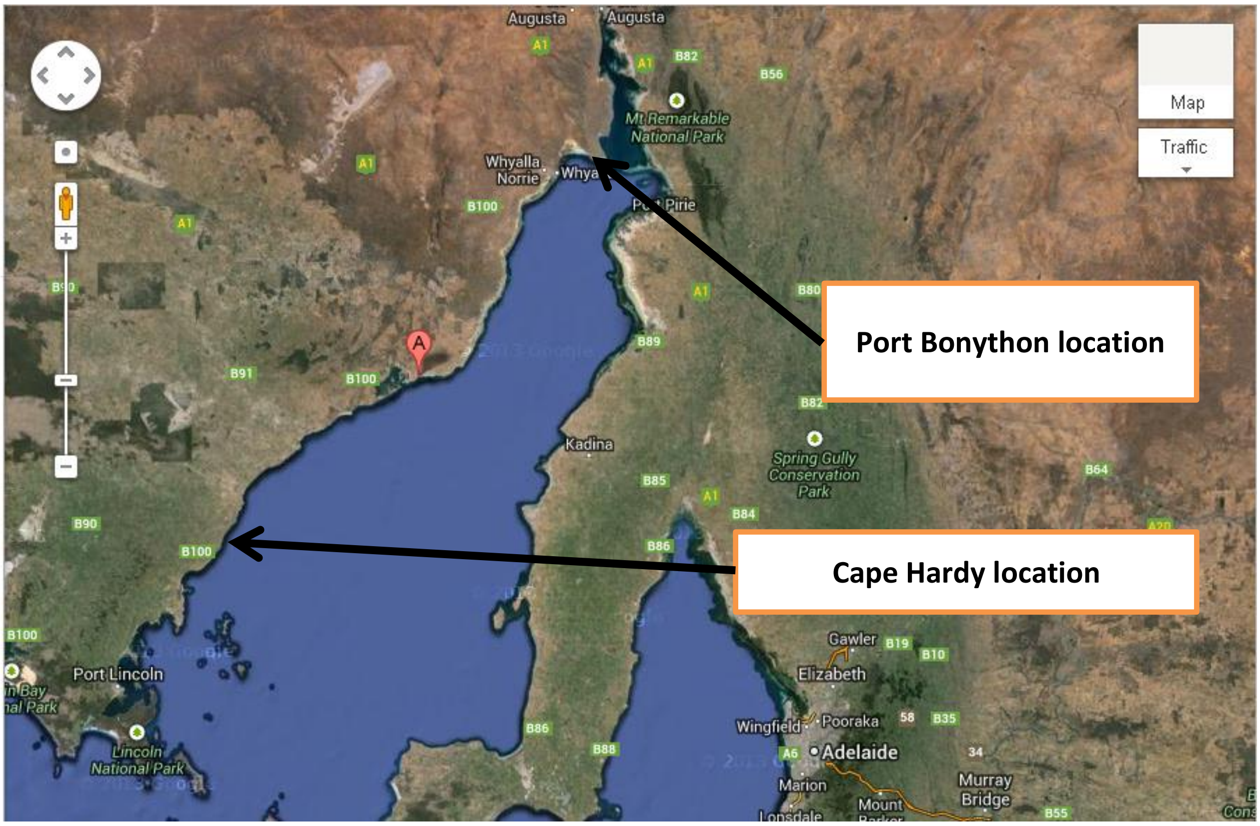


Figure 1: Google image showing the location of the proposed Port Bonython project compared with the opportunity further south.

1.7. Need for the Proposal

The Conservation Council SA is not convinced that there is a need for this proposal to proceed before a thorough Strategic Environmental Assessment has been made to determine the best location for a multi-user bulk minerals export facility in Spencer Gulf.

1.8. Project Alternatives

The Conservation Council SA is extremely concerned that Spencer Gulf Port Link has sought to avoid scrutiny of the location of this port proposal in comparison with other potential locations, by claiming that the government has already selected this location through the expression of interest process in 2008. Nowhere in the government's decision to invite expressions of interest had a proper process been undertaken to determine the environmental risks for such a massive facility, in comparison with other locations in the region.

Spencer Gulf Port Link has failed to recognise that such an evaluation is essential in an Environmental Impact Assessment such as this. There is no excuse for it not to have considered an alternative site for a consolidated bulk minerals export facility that would meet regional needs, whilst reducing the environmental impacts on Spencer Gulf - to reduce harm to the Giant Australian Cuttlefish and the Slender-Billed Thornbill, to reduce whale strikes and to prevent congested and unnecessary shipping.

One large capacity port needed for this region of Eyre Peninsula

There is a common belief that one well-placed multi-user, multi-minerals bulk export facility may be required to meet regional needs on the eastern side of Eyre Peninsula. However, there are currently at least four new ports being proposed including at Point Lowly, Cape Hardy, Lucky Bay and north of Tumby Bay. Each proponent is spending large sums of money towards a successful environmental assessment and approval of their project. Yet the opportunities to consolidate, and place a single facility in the best location, are not being properly explored. The cumulative impacts of all four ports and related infrastructure for road, rail, energy, water, desalination handling and storage, are not being examined. Previous valuable work such as the Draft Spencer Gulf Marine Plan (DEH 2006) is not being used to consider where ports might best be placed.

The current project approval frameworks (both state and federal) do not have an adequate process to undertake or adequately fund strategic assessment and planning activities that would deliver a better outcome.

We will seek a statement of reasoning from the government and those assessing this proposal as to why there is a section on project alternatives in this EIS if no project alternative locations were to be genuinely considered.

Failure to properly assess the differing environmental impact s of alternative port locations

It is disturbing that the section that assesses the Port Bonython site in comparison with other potential locations describes issues that are not environmental considerations in its justification. The following matters are not environmental aspects and impacts in the way they have been assessed:

- Proximity to rail and related rail costs
- Proximity to iron ore and ore reserves
- Capital Costs
- Capacity
- Vessel size and efficiency
- the do nothing option

Given that this document is supposed to be an Environmental Impact Assessment, this chapter should properly deal with the environmental aspects and impacts in the context of the relative impact on infrastructure requirements and costs.

There is a significant risk that this proposal will result in significant harm to the environment whilst not even being able to meet the long term bulk export needs of the region.

1.8.4. Capacity

The Conservation Council does not agree with the statement that "The proposed solution at Port Bonython offers the highest capacity of any of the potential common-user options, followed by Port Pirie (20Mtpa), Port Spencer (5-10Mtpa), Port Lincoln (up to 15Mtpa) and Darwin (2-10Mtpa) (PwC, 2013)". This statement appears to ignore the potential to build a consolidated multi user, multi minerals bulk export facility in an alternative location such as Cape Hardy.

The section on capacity also ignores that the tidal constraint and risk of congestion at Port Bonython may also create a capacity constraint to the possible regional need for expanding capacity up to 100 Mt per annum.

1.9.2. EPBC Significant Impact Referral Process

The Conservation Council of South Australia has made comment on the EPBC Referral, with concerns expressed about the Northern Spencer Gulf Giant Australian Cuttlefish, Southern Right Whales and Slender-Billed Thornbill, suggesting that these impacts would be prevented or greatly reduced if the proposed port was located further south in the Gulf.

3.4.1. South Australia Strategic Plan 88

Strategic Plan Target of No Species Loss

This project runs the risk of significant harm to the Northern Spencer Gulf Giant Australian Cuttlefish, to the extent that it may seal the fate of this population to become extinct. Whilst the current taxonomic status of this population has not yet been clarified, there is every chance that in the near future it will be assessed as a distinct species. Should the species be forced to extinction by known factors such as industrialisation of Point Lowly as well as unknown factors, then the decision for this proposal to go ahead may result in the first extinction of a marine species in Australian waters.

Flinders Ports, the Minister and the Governor should acknowledge this possibility.

Chapter 12, Climate Change and Greenhouse Gases

This chapter provides a great deal of text that describes what others are doing but not what Flinders Ports will do to mitigate the impact of its energy use and the greenhouse gas emissions associated with this project.

12.3.2. Policy Context and Legislative Framework

National Greenhouse and Energy Reporting Act 2007

Flinders Ports has inappropriately constrained its assessment of greenhouse gas emissions to the Scope 1 and 2 emissions described for Corporations reporting under the National Greenhouse and Energy Reporting Act (2007).

In selecting emissions factors published via the National Greenhouse Accounts (NGA) Factors (DCC, 2012), designed for use by companies and individuals to estimate GHG emissions, Flinders Ports should endeavour to provide the more comprehensive impact assessment covering scope three emissions associated with fuel use and electricity use as an absolute minimum.

12.3.3. Methodology and Assumptions

Flinders Ports should provide reference to the documents that show that shipping around Australia provides a lower greenhouse gas impact compared with an option that may include rail transport to Darwin before loading onto ships.

12.3.4. Potential Impacts

The Document describes that total electricity use in the operational phase will be 106.18 GWh per year. This is a significant requirement that equates to the electricity consumption of over 15,000 households.

12.3.5. Management and Mitigation Measures

The greenhouse gas mitigation measures described in this section are nothing more than what should be undertaken by any business to reduce its costs and work in an efficient manner. There is no sign of dedicated commitment to reducing greenhouse gas emissions or supporting renewable energy in this chapter.

It is unacceptable and offensive to describe a range of potential greenhouse gas mitigation measures in Table 12.3e: Potential mitigation measures to reduce the Project's GHG emissions, without any commitment to implementing any of these measures. It is simply not possible to assess the adequacy of this project proposal without any firm description about what mitigation measures, if any, will be undertaken.

Barriers to Implementation

In relation to barriers to implementation, there is nothing that would prevent an organisation such as Flinders Ports designing, building and operating a project to be as efficient as possible during design and construction, followed by a commitment to purchase renewable energy as accredited GreenPower as a % proportion in its Power Purchase Agreement, and accredited carbon offsets to mitigate non-electricity emissions.

The question is not about "Resistance by vested interests on the uptake of using renewable energy sources", it is about the whether there is anything stopping Flinders Ports from contributing to renewable energy as accredited GreenPower, to build on the minimum power percentage of renewables that are required by the Renewable Energy (Electricity) Act. The answer is that there is nothing that prevents Flinders Ports from including GreenPower in its contracts.

12.3.6. Residual Impacts

Flinders Ports has not proposed any commitments to deal with residual impacts. The Flinders Ports statement that "The ideal climatic conditions of the Eyre Peninsula region present the opportunity to become the largest renewable energy province in Australia that could participate in the National Electricity Market" is most disturbing, because despite this opportunity, Flinders Ports has provided no commitment to include any percentage of accredited GreenPower in its power purchasing. Without a minimum percentage of accredited GreenPower, Flinders Ports is not contributing to the sustainability of South Australia.

Quite simply, Flinders Ports has not presented any commitment for supporting renewable energy at scale or offsetting emissions associated with this project.

Chapter 14, Marine Ecology

14.2.2. Marine Surveys

It appears that marine surveys were not undertaken across the proposed area during the period leading up to the cuttlefish breeding aggregation, during the aggregation and after the peak of the aggregation. Given that there is some uncertainty as to where the female cuttlefish may reside when they move into and out of the main aggregation, it is necessary to quantify the extent of cuttlefish presence along the full length of the proposed jetty, where the ships birth, and in the areas affected by propeller wash.

As this has not been done, there is no ability to assess the impact of the port operation on the cuttlefish.

14.4.3. Operation Impact Assessment and Management

Ship Strikes

Earlier this year, a 12 meter Southern Right Whale was found dead in Spencer Gulf as a result of blunt trauma to the head. It also showed signs of large propeller lacerations. The Conservation Council SA is not convinced by Flinders Ports' claims and assumptions in relation to the impact of ship strikes in building this port so far north in Spencer Gulf.

The Conservation Council is concerned that the increase in ship numbers as a result of the project will increase the likelihood of ship-strike occurring. We also consider that this risk will be amplified in the Northern Spencer Gulf given that:

- the Southern Right Whale numbers are still recovering from previous whaling and may increase the frequency of use in the Northern Spencer Gulf
- the Northern and particularly the upper Spencer Gulf are constrained
- marine noise in the Gulf, which is already high, would be dramatically increased with an increase of Cape- or even Panamax-sized shipping in Northern Spencer Gulf. Such an increase may result in this area becoming sufficiently polluted with marine noise to interfere with any recovery of Southern Right Whales in the Northern Spencer Gulf

An indication of the extent of this traffic increase is given in the Upper Spencer Gulf Marine Park Regional Impact Study (DEWNR, 2012), which states on Page 11:

"Port, harbour and shipping operations

- There is considerable shipping and port activity in this park. Whyalla, Port Bonython and Port Pirie are major shipping and industrial hubs. Currently there are about 360 vessel movements per year and this is expected to increase to over 1,000 movements by 2020. In addition there are many barge movements. For example, on average 16 barges (i.e. 32 ship movements) are required to tranship iron ore from Whyalla to one Panamax size vessel. Should the Olympic Dam expansion proceed, BHP proposes to barge equipment from a transhipment point near Point Lowly to a landing facility 12 km south of Port Augusta at Snapper Point. There is potential for congestion in this area if the various planned inland mining developments take place, and access to suitable anchoring grounds and transhipment points is critical. However, no significant impacts on shipping activities arising from the zoning in this park expected, which is consistent with Government policy commitments."

It is our belief that the cumulative impact of increased shipping and transhipping activity in the Upper Spencer Gulf Marine Park and in Lower Spencer Gulf should be considered as a major threat to the recovering western Southern Right Whale population, who appear to be visiting Spencer Gulf with increasing frequency. Displacement (acoustic trauma) and collision mortality/injury risk. This should be a priority action, considering the active proposals for new iron ore exports at Port Spencer (Lipson Cove) and Lucky Bay. All necessary State and Federal for these facilities are yet to be granted.

Of the SEWPaC Species Profile and Threats database (SEWPaC, 2012c) nominated as threats to the survival of the Southern Right Whale, this proposal increases the following risks:

- Habitat degradation from activities including:
  - physical injury and death from ship strike;
  - acoustic pollution;
  - built structures that impact upon habitat availability and/or use;
  - changing water quality and pollution; and

Indeed the Conservation Council of South Australia argues that a large-scale multi-user bulk minerals export facility in this location is much more likely to cause these impacts compared with a location in the southern Spencer Gulf where the Gulf is wider and shipping activity would be minimised considerably as a result.

14.5. Mitigation Measures

The best mitigation measure to protect the Northern Spencer Gulf is to build this large bulk export facility in the southern Spencer Gulf.

In addition, shipping speeds of Cape- and Panamax-sized vessels should be reduced to 10 knots when operating in Gulf waters.

Chapter 16, Sustainability

The Chapter on Sustainability is flawed given that the environmental impact of the location has not been properly assessed in comparison with less harmful locations further south in Spencer Gulf.

It is not sustainable to risk causing the extinction of the Northern Spencer Gulf Giant Australian Cuttlefish.

In addition, the references to greenhouse gas emissions and renewable energy are not credible given that no commitments have been made to support renewable energy as GreenPower, or to offset any emissions.

[redacted]

Submission on the Environmental Impact Statement (EIS) for the Proposed Port Bonython Bulk Commodities Export Facility (Deep Sea Port)

I was born in Whyalla 71 years ago into a Pioneer Family who have been involved in the Whyalla Community since 1915. I have lived away for two different periods in my life and have now resided back for the last 24 years. I have taught in all the State schools in Whyalla, so I have mixed with a wide range of people and still continue to work part-time. I was the inaugural Leader of the Whyalla Landcare Group, am a member of several groups including National Trust and have followed Whyalla City Council proceedings closely over many years. Therefore, I am very familiar with the land and sea area under question in this EIS.

People in Whyalla care for our environment. We live on the side of a Gulf, not an open sea and have learnt to live with this different environment. Pt. Lowly and the Pt. Bonython area are the City of Whyalla's prime recreation and leisure spot and if we were to lose this, it will, I believe deeply affect the social and emotional well-being of our citizens.

I believe that it will be very detrimental in many ways if this Peninsula is any further industrialised. I have listened to numerous presentations about the fragile nature of the seabed in this part of the Upper Spencer Gulf. Yet this EIS does not consider this. The EIS seems to focus on profits for the Company involved and has not given sufficient consideration for the future.

The water where the jetty is proposed is too shallow. I've sailed out there in Whyalla Yacht Club races. I've looked at the charts and the tide times. I cannot see where the dodge tides and this shallow depth have been taken into consideration in this EIS. I **do not** believe that the jetty **will not** have a detrimental effect on the Giant Cuttlefish. We do not have enough data to know this, it is just wishful thinking. There has been no research into the increase in shipping and the larger vessels already using the Gulf. Perhaps Arrium's increased output is part of the problem? Imagine if even more shipping was allowed.

The increased Shipping movements are said to be 277 per year for this project, therefore up and down the Gulf 544 times. Where is the research into what this will do to the suspended sediments in the area? What damage will it do to the floor of the Gulf? How will it affect the seagrass? This area (adjacent to False Bay) is close to very shallow water, so the wash from shipping propellers and tugboats will constantly stir the bottom. In the event of a crisis during ship movement, say due to strong winds, there is really limited manoeuvrable room for large ships, hence further sea-bottom damage.

I note on Page 58. -1 Project Intro some of the objections to the proposed Nonowie Port .

“There is no current development plans or developer for this”

That is not for want of Whyalla citizens wanting this to happen.
We have had a respected group of Whyalla citizens with nearly 300 years of combined industrial experience working on a plan for an alternative port since it was announced some years ago. However, the Government of South Australia has refused to assist.

“Access to deep water”
Yes a major advantage. Just look at the maps, there is room for large ships to even turn around, they cannot do that at Pt. Bonython.

“Located away from community/cultural areas (subject to confirmation)”

It is a very different situation at Pt. Lowly and Pt. Bonython. This new project creates monsters of buildings and infrastructure that will destroy the peace, tranquility and views of an area used by tens of thousands of people from all over Australia for their recreation and leisure.

“High Capital Cost”

It is time the cheapest and nastiest options are not foisted on country people, nor on our environment. Cheap now, usually means payment by a later generation to clean up! Why not build the BEST!

“Incompatible with current planning”

Whose planning?…..only the company who wants to build at Pt. Bonython. Unfortunately the State Government hasn’t got any planning for ports in South Australia. They seem to be following the model for ports that it used for shipping grain. Build little ports all over the place instead of looking for the BEST site for all of South Australia.

I believe that is would be of economic benefit to the whole state and produce the same benefits for Whyalla and Eyre Peninsula if the Nonowie Port was the one that goes ahead. Better to wait and plan successfully, than plow ahead with a flawed model. That is what we have been asked to comment on now.

Another point:
On Friday February 20, 2009 the Member for Giles, Lyne Breuer spoke in Parliament about the results of a report compiled by Ms. Barbara Chappell, from discussions held within the Whyalla Community. I may have missed this report in the EIS, but I believe it clearly sets out what the local community wants and their objections to the current proposal.

I believe we need a new port. One new port, not ports up and down the Gulf. From my readings, the ONE that ought to be pursued is Nonowie Port. It seems to tick all the boxes.

[redacted]

RECEIVED
ATTORNEY-GENERAL'S
OFFICE

18 NOV 2013

MINUTE *forming* **ENCLOSURE** *to:*

Government of South Australia

Office of the
Leader of the Government in the Legislative Council
Minister for Agriculture, Food and Fisheries
Minister for Forests
Minister for Regional Development
Minister for the Status of Women
Minister for State/Local Government Relations

eA168465

TO: **THE OFFICE MANAGER**
OFFICE OF THE MINISTER FOR PLANNING

RE: **IRON ORE SHIPPING TERMINAL ETC – PORT BONYTHON**

I refer to the attached letter received 11 November 2013 from Ms Avril Wagner regarding the proposal for an Iron Ore shipping terminal, jetty and sea route at Port Bonython and the effect on marine creatures.

I understand this matter falls within the portfolio responsibilities of your Minister and this correspondence is forwarded to your office for attention.

Ms Wagner has been advised that her correspondence has been referred to your office for consideration.

Zora Doukas
Office Manager to the
MINISTER FOR AGRICULTURE, FOOD AND FISHERIES

15 /11 /2013

PLN0010/13
ATTORN
Rec'd 18/11/13
BPLN1071
Martin

ATTORNEY-GENERAL'S DEPT.
AGD557945

COPY

eA168465

Government of South Australia

Office of the
Leader of the Government in the Legislative Council
Minister for Agriculture, Food and Fisheries
Minister for Forests
Minister for Regional Development
Minister for the Status of Women
Minister for State/Local Government Relations

Level 9
Terrace Towers
178 North Terrace
Adelaide SA 5000

GPO Box 1671
Adelaide SA 5001
DX 667

Tel: (08) 8303 2926
Fax: (08) 8303 2533
Email: minister.gago@sa.gov.au

[redacted]

On behalf of Hon Gail Gago MLC, Minister for Agriculture, Food and Fisheries, thank you for your letter received 11 November 2013 regarding the proposal for an Iron Ore shipping terminal, jetty and sea route at Port Bonython and the effect on marine creatures.

While the Minister appreciates receiving your letter, I advise that this matter falls within the portfolio responsibility of Hon John Rau MP, Minister for Planning and your correspondence has been forwarded to that office for consideration.

Should you have any further queries in relation to your correspondence, please contact the Office of Minister for Planning on telephone 8207 1723.

Yours sincerely

Zora Doukas
Office Manager to the
MINISTER FOR AGRICULTURE, FOOD AND FISHERIES

15/11/2013

Dkt No	eA 168465
File No	
Action Officer	JC
Indexer	JS
Cc	

[redacted]

MINISTER'S OFFICE
RECEIVED
11 NOV 2013

HON. GAIL GAGO,
MINISTER FOR AG/FOOD/FISHERIES.

DEAR MINISTER GAGO,

REGARDING THE PROPOSAL FOR AN IRON ORE SHIPPING TERMINAL, 3 KM. JETTY AND SEA ROUTE AT THE PORT BONYTHON SITE ; CONSIDERING THE SIZE AND BULK OF THE LOADED CAPE VESSELS WITH TWO METRES CLEARANCE UNDERNEATH A SPINNING 18 METRE PROPELLOR THE SEA FLOOR MUST SUFFER DAMAGE.

IF THESE CHANNELS ARE THE ROUTE OF MIGRATING FISH AND OTHER MARINE CREATURES, MUCH DEVESTATION MUST RESULT.

IT SEEMS OTHER SITES WITH ACCESS TO DEEPER WATER SHOULD HAVE BEEN SUGGESTED FOR THE TENDERERS TO CONSIDER. MAYBE AN EXTRA EFFORT SHOULD BE MADE TO CONSIDER THIS "BEFORE IT IS TOO LATE".

WE NEED AN EXPORT PORT FOR ORE FOR OUR PROSPERITY, BUT BELOW THE SHOALS WOULD BE BETTER FOR THE LONG TERM FUTURE OF THE ENVIRONMENT AND ALL THE MARINE CREATURES.

THANK YOU FOR READING THIS AND HOPING FOR A PROPOSAL FROM ANOTHER MORE SUITABLE SITE — PLEASE CONSIDER ATTACHMENT.

REGARDS

[redacted]

AN EXTRA 270 SHIPS A YEAR ON TOP OF SANTOS AND ARRIUM SHIPPING IS ALMOST ONE A DAY.

WHYALLA NEWS
OCTOBER 17, 2013

Bonython water quality threatened

By Daniela DEAN

The sea bed's natural shape and water quality could be affected if the Port Bonython expansion is built, an environmentalist group says.

Alternative Ports Working Party spokesman Sid Wilson is currently in the process of dissecting the Flinders Ports Environmental Impact Statement for the Port Bonython Expansion project.

The party said the waters in the Port Bonython area will be adversely affected by environmental factors such as turbidity if the project goes through.

While the party is still digesting the EIS, some concerns have already arisen with the report.

"We have concerns that they haven't covered the cumulative effects of all the ships that come up the Yarraville Shoal," Mr Wilson said.

"They talk mainly about their 277 ships, and they don't add on Santos and they don't add on OneSteel.

"The data is there in the detail, but the discussion is not there in the outcomes and the likely adverse consequences."

Turbidity is one of the effects identified as a problem to the surrounding environment that will be caused by the type of bulk ships that will be utilising the port.

Turbidity is the displacement of the natural ocean seabed caused by the rotating propellers on the big bulk ships that will be utilising the port.

"These big ships have got eight metre diameter propellers that will be turning at 70 revolutions per minute," Mr Wilson said.

"The EIS acknowledges that there is an issue with this.

"Three thousand metres from the jetty, which is the shallowest place, the propeller velocity and the water wash from the propeller will be 3.7 metres per second."

The report further states that it will be throwing rocks up of 45 millimetre in diameter.

This will be 100 per cent particle resuspension and take an hour for that turbidity to go away.

"At the expected 300 ships a year, more than one every second day, that's a lot of displacement," Mr Wilson said.

"In the report it also talks about how they can't be certain where that turbidity will go or where the displacement will settle."

The EIS suggests one way to mitigate this problem is to armour the berth area with coarser material.

This would mean placing a heavier gravel on the seabed within the port to protect it.

"I don't know how they can make a shallow port less shallower, especially if they are adding more material," Mr Wilson said.

The Alternative Ports Working Party has looked at the depth of water on available charts.

"The APWP's opinion is, going north of the Yarraville Shoal is not good for the environment and has restrictions for the port," Mr Wilson said.

"They say they will not dredge, but that's the only way to get deeper water."

Mr Wilson said the EIS report outlines the only time they can sail is on the making tides.

"The only way they can sail the ships fully loaded is when the tide is coming in.

"Two hours before high tide, they have to leave the port and sail through a very defined route and clear a chokepoint south of Whyalla before the tide ebbs."

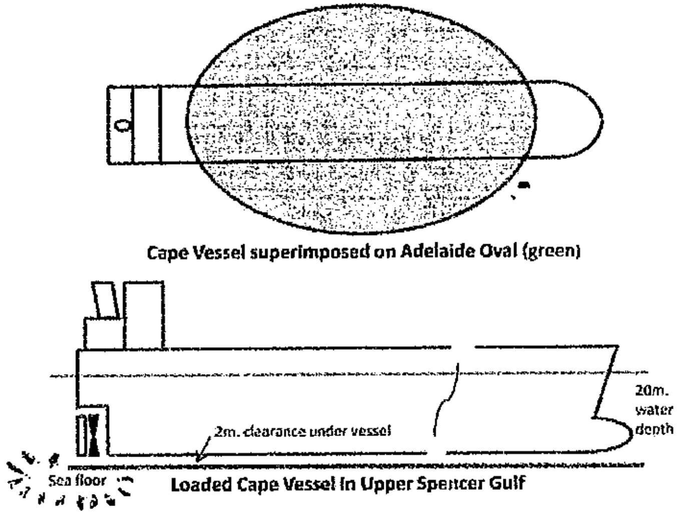
Mr Wilson said this method of sailing the bulk ships fully loaded only on high tides will not be sustainable for productivity.

"I'd like to make it really clear that this is our first impressions on the document," he said.

Mr Wilson's big takeaway message to the public is to ensure they have their say.

He urges Whyalla residents to go along to the public meeting at the Westlands Motel at 7.30pm on Tuesday, October 29 to discuss the proposed development and voice their concerns.

The cut off date for responses relating to the EIS by the public is Monday, November 18.



SIZE MATTERS: A depiction of the size of the bulk ships that will be travelling through the Port Bonython area at the rate of 300 ships per year. The Alternative Ports Working Party have identified the turbidity from these ships will greatly affect the seabeds in the area.

[redacted]

November 25, 2013

To whom it may concern,

Please accept this as my personal submission in response to the **Spencer Gulf Port Link Port Bonyton Bulk Commodities Export Facilty** development proposal's Environmental Impact Statement.

I'm writing to tell you that in my opinion, Spencer Gulf Port Link's proposal to build and operate a facility for the export of iron ore on the Point Lowly peninsula is **ecologically unacceptable**. If approved, the prime breeding habitat of the disappearing Giant Australian Cuttlefish will have a new wharf directly through it. This will be followed by huge shipping activity increases within the Upper Spencer Gulf Marine Park, with shipping running adjacent to two sanctuary zones. The proposed jetty has already displaced the sanctuary zone designed to protect the cuttlefish breeding habitat. Now it threatens to displace or harm the few remaining animals with its noise and bottom disturbance.

The region's Giant Australian Cuttlefish population is genetically distinct, and has been in decline for the past decade. According to the IUCN Red List, should the population be determined to be a distinct species, it would be considered 'Endangered' (based on 2011 data). Efforts to reverse the decline will be irreversibly jeopardised by the introduction of this facility. Giant Australian Cuttlefish are sensitive to changes in water quality, turbidity (they are visual predators) and most importantly, acoustic pollution. **Acoustic trauma can be fatal to cephalopods**, by permanently damaging their hearing and balance, and with it their ability to forage and feed. The vulnerability of Sepia apama specifically to this risk has not yet been researched- a problem which I consider **sufficient reason to reject this application outright**.

The proposed wharf is designed to accommodate ships larger than any previously received in Upper Spencer Gulf. The deep water shipping channel is highly constrained. The seabed sediment holds over a century of heavy metal contamination, which is at risk of being mobilised into the food chain by propellers 6-8 metres in diameter. The results of the analysis of heavy metal contamination in Sepia apama from Northern Spencer Gulf is still pending. The causes of their population decline remain unknown. Now is not the time to be approving this grotesquely inappropriately located facility.

Should my appeal fall on deaf ears, the construction and operation of this Port Bonython proposal will inevitably impact water quality, raise underwater noise levels considerably and degrade the habitat values of this sensitive ecosystem. It can then claim to have played its part in the local extinction of Sepia apama, should that indeed eventuate.

There is far too much uncertainty surrounding the environmental impacts of shipping associated with this development plan, and the proponents have failed to sufficiently address these critical data gaps with diligent study.

The Point Lowly Peninsula is the only known place in the world where hundreds of thousands of Giant Australian Cuttlefish have in recent history gathered to breed. These animals, and the fish nurseries of the region deserve protection and celebration, not new pressure!

I urge you to reject this proposal and insist that the proponents seek alternative locations for the export of minerals, outside of Upper Spencer Gulf to allow for the recovery of this once great marine wonder.

I have attached a series of further responses to passages from the EIS, some questions and criticisms for your consideration. I am also attaching a scientific paper of the utmost importance: the UNEP Convention on Biological Diversity's technical advice paper, 'Scientific Synthesis on the Impacts of Underwater Noise on Marine and Coastal Biodiversity and Habitats.'

Yours sincerely,

[redacted]

Pg. 48
"Port Bonython was selected as a suitable location for the development of a deep water bulk commodities export facility due to its proximity to deep water, interstate rail, mineral resources and sufficient workforce. "

The location was chosen in full knowledge of the region's high environmental sensitivity. The case against using this location for future industrial development was clearly articulated in the Department of Environment's *Spencer Gulf Draft Marine Plan*, published in June 2006. This plan was in development for five years prior, and comfortably predated any public announcement of the State's plan to Port Bonython Bulk Commodities Export Facility's development.

The *Spencer Gulf Draft Marine Plan* recommended that only developments resulting in "negligible impacts" be considered. Despite the proponent's attempts to make a case for negligible impact, this is an impossiblity when the site footprint and future shipping and freight forecasts are considered. If approved, this port is likely to become the state's busiest mineral export facility. It's current location, within the Upper Spencer Gulf Marine Park and straddling the iconic Giant Australian Cuttlefish breeding reef, is unacceptable an a location outside of Upper Spencer Gulf must be considered. The location proposed by the Alternative Port Working Party is a worthy candidate for consideration. It presents an opportunity to retain economic benefits for Whyalla, while bypassing the tidal impediments at Fairway Bank and Yarraville Shoal. I have grave concerns about the future expansion of this facility, above and beyond the 50 million tonnes per annum as presented in this document (due to conflicting information published elsewhere), and can see the probability of these tidal impediments being removed by dredging as subsequent works should demand for the facility increase.

If another port is to be built in Spencer Gulf, it is my belief that Cape Hardy represents a more ecologically suitable choice, and the steel-making industry of Whyalla could benefit greatly from the production of rail to extend the Standard Guage line from Whyalla to Cape Hardy, as well as running spur lines to mines on Eyre Peninsula.

Pg. 48 "Port capacity to increase iron ore export capacity up to 50 Mega Tonnes Per Annum (Mtpa)"

There are chronic inconsistencies to be addressed when describing the ultimate export capacity of this proposed facility. In other documentation produced by State Government and the proponent, many configurations and projected capacities have featured. In the project's 2012 EPBC Act referal, the capacity was described as 'in excess of 50 million tonnes per annum'. A more recent presentation from 'Invest in SA' describes the port's ultimate output as 70 million tonnes per annum. Similarly, graphics depicting berthing configurations on the wharf include as many as three loading berths (two Cape and one Panamax). Three berths simultaneously loading could potentially approach 90 million tonnes per annum!

This points to a need for the Spencer Gulf Port Link Consortium to be honest and transparent in disclosing the full extent of this facility's potential output and associated shipping traffic. Is it up to 50, greater than 50, 70 million tonnes or even greater again? With three berths could the capacity expand even further? What implications does this have for the underwater acoustic impacts of shipping noise on the Giant Australian Cuttlefish? I will come to this matter later.

Pg. 52 <u>Project Alternatives</u>
"The purpose of this EIS is therefore not to explore alternative port locations as the location has already been chosen through the Expression of Interest Process "

This points to a serious problem in the process. The deciding factors regarding this development are clearly dominated by economic imperatives. This location is the closest to a central location between the three main prospective iron ore provinces, and provides access (albeit constrained) to Cape-size vessels, thus improving the economy of scale. If the environment was duely considered, Spencer Gulf Port Link would have ruled this location out long ago and advised the Government accordingly. I stand firm in my belief that alternatives outside of Upper Spencer Gulf must be considered.

Pg. 55
"The proposed development of BCEF is required to provide the increased capacity to service the projected increase in iron ore exports and contribute to the prosperity of the region and South Australia."

This point is arguable. Braemar region miners for example favour a port location on the eastern shore of Spencer Gulf, and the most promising mine developments on Eyre Peninsula have all proposed alternative export pathways which are at various stages of proposal and approval (Port Spencer, Lucky Bay, Cape Hardy). The need for this *specific* facility is far less clear than it was five years ago, unless BHP Billiton is quietly considering utilising the port pending the decision to proceed with the expansion of Olympic Dam (as expressed in their EIS 2009).

Why are the genuinely prospective users of this facility not detailed in this report? I have had contact with many mining companies and the level of interest in Port Bonython is not as great as this document suggests.

Nonowie Port
"Proposed facility in the northern Yorke Peninsula. There is no current development plans or developer for this location ... Likely to require an extremely long jetty to achieve depth requirements "

The Alternative Ports Working Party have been working on the Port Nonowie concept for five years, and the location has *always* been on Eyre peninsula (not Yorke as listed here) and to the south of Whyalla (as shown). The proponent appears to be attempting to diminish the viability of this facility as a genuine alternative to Port Bonython with vague statements such as 'likely to require an extremely long jetty to achieve depth requirements.' This is unfair and inaccurate.

Pg. 63 " Detailed information is not publically available on the Port Bonython diesel fuels storage facility or the Whyalla port facility (Arrium). A request for information was made to DPTI; however the documentation was not released. Information on the current Santos facility is also limited to an Environmental Impact Assessment undertaken in 1981. For this reason, cumulative impacts can only be addressed at a high level. "

I find the difficulty obtaining the Port Bonython Fuels project documentation something of a feeble excuse, and if genuine, another failure of Government process. I was personally able to access this material by a release via the Freedom of Information Act, and since the project is regarded as 'Public infrastructure' under its Crown-sponsored development status, I see no reason why the general public is not privy to the Traffic Impact Assessment Appendix, for example. The citizens of Whyalla in particular should be entitled to know the full extent of what is being planned for the Point Lowly Peninsula and what its implications will be for their recreational playground.

Pg. 89 SA's Strategic Plan
"69. Lose no species: Lose no native species as a result of human impacts. The Project is not expected to result in the loss of any native species. "

This last statement is dangerously ambiguous. It tacitly suggests that an *unexpected loss* of a native species is possible, yet claims no responsibility for this. The most pressing/plausible future case of this occurring is that of the decline of the Giant Australian Cuttlefish of Northern Spencer Gulf. It is possible that acoustic interference or trauma could (possibly not exclusively) prevent the successful recovery of this population or accelerate its decline. The population is believed by many members of the scientific community to be likely to be proven to be its own distinct species or subspecies pending taxonomic work being undertaken by Steven Donnellan.

The IUCN Redlist lists the species generally as 'Near Threatened' and also states that if the population were determined to be a distinct species or subspecies, that it would be listed 'Endangered' based on 2011 season data. It would now likely be considered 'Critically Endangered'. Whether directly implicated in the further decline or not, Spencer Gulf Port Link would inevitably wear some of the public backlash should this population (potentially its own species) become extinct- as would other industrial interests eager to develop the area, including BHP Billiton.

"Marine biodiversity: The Project has been designed and managed to minimise the impact on and diversity of South Australia's unique the health and diversity of South Australia's unique marine environment. "

"The Eyre and Western Region Plan (DPTI) aims to... manage natural resources and protect vulnerable environments and species."

Pg. 93
"Recognise, protect and restore the region's environmental assets"

These greenwashing statements are absurd due simply to the chosen location of the wharf. It intersects the prime breeding habitat of the Giant Australian Cuttlefish! The most critical step to minimising environmental impact is to choose a location which is not highly ecologically sensitive. The Spencer Gulf Draft Marine plane offered such suggestions, but was rejected in favour of economic priorities and geographic convenience. Increased shipping traffic may become an impediment to the population's recovery of unknown magnitude, as previously mentioned.

Pg. 171 <u>Terrestrial Fauna Surveys</u>
"Specific surveys for other groups of fauna, such as mammals and reptiles, were not undertaken as these groups were not represented in searches of threatened species in the study area. Searches of South Australian and Federal databases, resulted in only one recorded threatened (reptile/amphibian) species; a single record in 1950 of a Carpet Python (Morelia spilota) near the tip of Point Lowly (discussed in Section 7.4.3.3)."

The proponent has relied heavily on the work of previous developers to assemble desktop studies. Much of this survey data is old (from 1981 and 1991) and a need for contemporary surveys to be undertaken exists. Terrestrial biodiversity surveys were undertaken by the proponent in winter only, thus practically eliminating the possibility of discovering reptiles or bats. Not surveying for mammals is also an unacceptable oversight. Without surveys for these species, how can impacts on terrestrial fauna be quantified? Paucity of data should not be mistaken for paucity of wildlife, and I fear this has occurred here. Further field studies of summer terrestrial fauna should be undertaken.

Pg. 370 <u>Coastal Processes & Water Quality</u>
"The description of existing water quality and sediment transport is qualitative due to limited data, but it is sufficient for general characterisation of existing conditions. The wave model results presented here are taken from an uncalibrated model... Overall, the data available is considered sufficient for the purposes of this assessment given that the Project does not involve dredging and that water quality and sediment transport impacts are expected to be minimal. "

There is no substitute for data gathered in situ, and I see dependency on desktop study data and modelling to be a problem with oceanographic and acoustic elements of this EIS. The final assumption above neglects to consider the lack of under-keel clearance on approach and departure, and the uncertainty surrounding the ultimate distribution of mobilised sediment beyond the shipping channel. It assumes that there are no sensitive receptors for seabed disturbance other than the cuttlefish reef, which discounts the close proximity of the Fairway Bank sanctuary zone, immediately west of the proposed Port Bonython approach. It also neglects the uncertainty about the migratory paths of the Giant Australian Cuttlefish to and from the breeding reef.

Pg. 381 13.4.3.8. <u>Historical Oil Spills</u>
"As summarised by Gaylard (2011), in 1992 a ship to ship incident between the tanker 'ERA' and the tug boat 'Turmoil' occurred at the Santos jetty, resulting in the spillage of 300t of bunker oil. Strong north-west winds at the time pushed the spill to a front of approximately ten kilometres which impacted on the dense mangrove habitats south of Port Pirie between Fourth and Sixth Creek. Procedures in an oil spill contingency plan were followed in order to minimise impacts. Nevertheless the spill resulted in between 75-100 hectares (ha) of mangroves being oiled. Approximately two to three hectares of heavily oiled areas were initially defoliated increasing to 3.2ha over the next three to four years. By 1996 there were no widespread signs of recovery (Wardrop et al 1996). It was estimated that approximately 60 tonnes of the oil had reached the mangroves (Pfennig, pers comm.). It is intended that the area be resurveyed in the near future, but examination of recent aerial photographs indicates that recovery is slow with most of the area remaining the same. "

I have included three newspaper clippings related to the Era spill incident from The Canberra Times which provide some wider context. Approximately 500 seabirds were oiled, most of which did not survive, according to the official incident report. Impacts to fishing families and businesses were not quantified to my knowledge, although the attached clipping discusses potential compensation claims. Such incidents are clearly 'no win' situations, and increases in shipping activity to the region will increase the likelihood of another accidental spill in the future (by collision or grounding). Will Santos, Port Bonython Fuels and SGPL be ready for the next one?

Pg. 381
13.4.4.1. <u>Shipping Activities</u>
"Flinders Ports undertakes the management of shipping operations in Spencer Gulf including Upper Spencer Gulf, which includes Port of Whyalla, a Cape Transhipment Point (CTP), Port Pirie, Port Augusta and Port Bonython (Santos Jetty). Shipping routes to Port of

Whyalla, Port Pirie, Port Bonython (Santos Jetty) and the CTP are shown in Figure 13.4h. "

In light of Flinders Ports involvement in existing transhipment of iron ore and servicing of the existing Port Bonython jetty, I cannot accept that more in situ studies of oceanography and acoustic transmission were not conducted using existing sound and seabed disturbance influences to produce more accurate models. I can also not accept that no consideration has been given to the impact of iron ore spill on benthic lifeforms. Why have the impacts of iron ore spill not been discussed as a credible environmental risk? Why was more in situ oceanographic data not collected by Flinders Ports during the five years this project has been discussed?

"The existing shipping channel as recommended by Australian Admiralty Chart 778 is along a route with water depth of 20m at Lowest Astronomical Tide (LAT) with the exception of the Yarraville Shoals where the water depth is slightly less than 20m (19.6m) at LAT, and on the vessel departure route (see Figure 13.4j) near Navigation Beacons 5 and 7 where the water depth is approximately 18.5m at LAT. "

Here are the problems and tidal impediments which are likely to impact both maritime safety (grounding) and efficiency in the future. Can SGPL guarantee that these shoals will not be dredged in the future to remove these tidal impediments? If such activities are being considered, why do they not feature in this document, and should it not reflect the full potential scope of the development, including emergency response plans?

Pg. 384

13.4.4.2. <u>Shipping Activities of the Proposed BCEF</u>
"The gross underkeel clearance for vessels manoeuvring in the Spencer Gulf is 0.9 m or 10 percent of the vessel draft (whichever is greater), as required by Flinders Ports. For the fully laden Cape-size vessel this corresponds to a required gross underkeel clearance of 1.8m and hence the Cape-size vessel requires a water depth of 20.1m when manoeuvring or underway. "

These figures are in conflict with the figures presented in the EPBC Act referral. The referral describes under-keel clearance as being 20% of draft when travelling within Spencer Gulf. Is there any scientific case supporting the risk implications of this change, or was it an arbitrary change made for economic reasons? Presumably Spencer gulf Port Link has lobbied the State Government to allow for this increase in environmental risk? Once again, the result will not be a 'negligible' impact.

Pg. 387 13.5.4.4. Oil Spills

"The new jetty development will operate under Port Bonython's existing oil spill contingency plan. Although a ship collision or grounding is unlikely, as the impact could be very high, it would have a high risk rating. "

This is an important admission. It is my belief that a winter oil spill trajectory study be undertaken to complement the Santos summer oil spill trajectory study, undertaken in the 1980's. It may be better to undertake new studies at both seasons, so as to influence an oil spill response plan with the most relevant and current data available.

Pg. 388 13.5.4.7. Ship Movements
"Section 13.4.3.5 indicates that some sediment is mobilised and transported by spring tidal currents, which range up to 1m/s. Satellite imagery and a water quality sampling study conducted in 2008 (BHP Billiton, 2009) also revealed high levels of background turbidity around Point Lowly and the proposed development site. "

"The preliminary results of the propeller wash assessment are summarised in Table 13.5a (refer to Figure 13.5a for distances in metres from the proposed jetty) and indicate that propeller induced velocities are sufficient to mobilise a high percentage of sediments from the seabed. Between 28 percent and 100 percent of sediments could be suspended along the length of the departure channel with 63 percent being resuspended at the wharf. The highest settling time was found to occur at the wharf with an estimated 12-24 hours required for the suspended material (depending on the assumption of the depth of water column involved), to settle out of the water column. "

Settling is one thing, but how far will the sediment disperse, and what bethic habitats will it be impacting or smothering? Will this be quantified regularly during the port's operating life? What will be the Port operators turbidity reporting obligations, given the lack of under-keel clearance, size of vessel propellers and uncertainty surrounding plume dispersal?

Pg. 389
"The primary receptor of the potential impact of the increased turbidity is the subtidal habitat 2.5km to the northwest of the ship berthing area which provides habitat for the Australian Giant Cuttlefish. Considering the predominant tidal current directions being northeast during flood and southwest during ebb tides, suspended sediment carried by the propeller-induced current, even if exerting in a northwest direction, is unlikely to reach the subtidal habitat. "

When considering the impact to turbidity, I would like to know more about the vessels. How large are their propellers? 6-9 metres in diameter? What speed are they turning (RPM) when passing Yarraville shoal and Fairway bank? How quickly will vessels travel at each leg of the approach and departure? These studies appear to be incomplete and lacking detail considering the sensitivities of operating within a Marine Park and adjacent to two sanctuary zones.

Pg. 441

14.4.3.1. Ship Strike <u>Spencer Gulf Waters</u>
"Dolphins are highly mobile, agile animals and their regular presence near the busy Whyalla boat harbour and Santos ship loading facility suggests that they can avoid ship strike, particularly the large, slow moving tugs and bulk carriers associated with operation of the BCEF. "

This does not eliminate risk of work-boat collision during construction, nor does it override the reality that dolphins do get struck by ships in SA waters. For information on this, please consult Cath Kemper at the SA Museum for details (I do not have permission to republish SA Museum data).

"Whales are highly mobile, migratory species that are uncommon in the Upper Spencer Gulf. The two species identified as having a credible risk, the Humpback Whale and the Southern Right Whale, are occasional visitors, with the habitat in the study area not being important for breeding or aggregation areas (refer Section 14.3.5). The low numbers of Whales observed in Spencer Gulf, along with the relatively low instance of reported ship strike, suggests that the risk to whales as a result of ship strike is low, even in the context of increasing ship movements. "

There are serious data deficiencies when it comes to whale occurrences in Spencer Gulf. This is due to the lack of known breeding habitat or whale watching tourism activities based in the region. The SA Whale Centre (based in Victor Harbor) does not encourage sighting records from the region, for example, and local community knowledge about the value of or processes for reporting sightings is extremely low. The coastline is also sparsely populated, with a mostly agricultural industrial focus, meaning few have the opportunity to sight whales and even fewer again have the knowledge to report.

I believe a research priority for the region should be to track the movements of Southern Right and Humpback Whales when they enter Spencer Gulf, so as to better understand their movements and behaviour, and increased probability of interaction with ships as their populations continue to recover and shipping traffic increases.

A whale was struck by a vessel and killed in July, 2013. The results of the necropsy report were not released to the media. There is a trend towards the supression of whale and dolphin strike data which is unhealthy and needs to be reversed. A public register of ship strike data and other whale sightings and interactions in state waters should be made available, with mandatory reporting requirements from crews of commercial vessels- from fishing boats to bulk ore carriers. By gathering this information, we will be in a much better position to appropriately manage the coincident needs of both whale movements and marine traffic.

Currently, ship strike reports are rarely (never?) lodged by the offending party. This is a cultural problem and needs to be overcome with a mature attitude of corporate and industrial responsibility.

Pg. 446 <u>Fairway Bank</u>
"The preferred approach route for ships comes within approximately 500m of Fairway Bank. However, during the approach the vessels will be unladen, decreasing the influence of propeller wash."

Is 500 metres an appropriate buffer zone for a sanctuary zone, considering the activity of vessels will create turbidity and mobilize sediment which will settle with great uncertainty?

"<u>Yarraville Shoal</u>:
The designated shipping route up Spencer Gulf to Port Bonython passes Yarraville Shoal. This area forms the shallowest bottom for ship transit of the Upper Spencer Gulf to Port Bonython and transit of this area is subject to special conditions with Flinders Ports requiring passage only during high tide periods. "

"The relatively narrow, shallow area of the Yarraville Shoal is exposed to high tidal velocities and as such, is likely to have a reasonably coarse substrate, armoured somewhat against erosion from propellor wash. The closest seagrass area on the Yarraville Shoal is approximately 3km from the shipping route. "

Does the absence of seagrass equate to the absence of biodiversity? Is this assumption of lower risk reasonable? What have surveys of this area told us about the composition of its infauna? Has it even been surveyed?

Pg. 447 <u>Nutrients & Algal growth</u>
"The enclosed conveyer system and design of the delivery system to the ships holds aims to minimise ore loss by spills or dust generation, which will minimise any ore material reaching the marine environment, refer Chapter 2, Project Description. The ores being exported are magnetite and haematite, which are virtually insoluble. "

The spillage from the conveyors should be quantifiable, based on results from operations elsewhere. The impact of insoluble iron on benthic organisms should also be discussed and quantified. Examples of transhipment impacts are accessible at nearby Whyalla, at operations which Flinders Ports manage. Why were these impacts not considered, calculated or included in this documentation?

<u>Mitigation measures</u> 14.5.1.5. Vessel Strike
"During construction, appropriate speed limits will be applied to smaller vessels carrying equipment and personnel to and from the land-based storage area and the jetty construction area. Marine mammal observation and shut down procedures will be observed, as part of acoustic noise impact mitigation measures (as above) which will also reduce the risk of construction vessel strike to a low level. "

The word 'appropriate' to describe speed limits is too vague. What will it be 10 knots? Faster? Slower? What information will the determination of this speed limitation be based on?

Pg. 448
"Scheduling of in-shore (or near shore) piling works to avoid the Giant Australian Cuttlefish aggregation season should monitoring determine their presence. "

This telling statement subtly anticipates the demise of the Giant Australian Cuttlefish aggregation. This is a very poor choice of words and a telling reminder of the economic imperative and indifference towards this unique marine phenomenon.

14.5.1.4. <u>Underwater Construction Noise</u>
"Should also consider eggs and allow full gestation period to pass before commencing piling works."

This is critical to the population's survival, but with current levels of uncertainty surrounding acoustic transmission loss and Sepia apama's vulnerability to acoustic trauma, it should not yet be accepted that eggs would be safe even from the sound of shipping traffic. The *Precautionary Principle* must be applied.

14.5.2.1 <u>Operations: Ship Strike</u>
"should a whale be spotted, it is standard procedure that a vessel either steers away from the whale or reduces speed if the whale approaches. The ability of a vessel to undertake evasive action, may be restricted by water depth and other safety issues."

This is well and good in open ocean, but with contraints in the shipping channel, will the skipper of a vessel be able to maneouvre to avoid a collision with a cetacean? I wish to recommend that a 10 knot speed limit on all vessel traffic withing Spencer Gulf be enforced during the winter months until such a time as evidence has shown that risk to cetaceans in the region is sufficiently low to allow greater speeds. Slow down, observe, report, understand, then regulate according to best available evidence, supported by the Precautionary

Principle.

"SGPL will maintain a record of ship strikes within the Spencer Gulf and report any incidents in order to establish a baseline. Should the number of strikes increase, a review of management procedures will be undertaken. With mitigation measures as outlined above, the risk of ship strike will remain low. "

This is unacceptably vague. Southern Right Whale numbers are increasing. Shipping traffic is forecast to increase. The problem will increase... so when it does, what specifically is the proponent prepared to do about it? For starters, I believe that all whale sightings should be logged, due to the paucity of data on whale movements within Spencer Gulf. These should also be made publicly available in real time via a public register, as per the SA Whale Sighting database. This should be considered as a good PR opportunity for the proponent rather than a regulatory burden, and will contribute greatly to our understanding of cetacean behaviour within Spencer Gulf, and facilitate better risk management in the future.

Pg. 458

15.3.2. <u>Ambient Noise Measurements</u>

"In the absence of any underwater ambient noise measurements taken as part of this study, or within the Upper Spencer Gulf, Wenz curves are proposed to be used to describe underwater typical ambient noise levels in the vicinity of the Project."

It is inappropriate for a project subjected to the rigor of full environmental impact assessment to neglect to undertake any in-situ ambient noise or peak profiling. The existing shipping traffic at Port Bonython and loading sound profile at Whyalla's port should have both been sampled to provide useful comparative data for this study. Considering the sensitivity of the Giant Australian Cuttlefish to acoustic trauma, such studies must proceed any consideration of the project's worthiness for approval.

Pg. 465 Underwater noise

15.4.2.8 <u>Cephalopods</u>

"Although no studies on the Giant Australian Cuttlefish (Sepia apama) are available in the literature, based on the published data for other Cuttlefish (e.g. Sepia officianalis) at low-frequency, it is considered more appropriate to use the (more conservative) Sepioteuthis lessoniana (reef squid) hearing thresholds presented in Hu et al (2009) to model the hearing of Sepia apama, because of the similar habitat and lifestyle of the Giant Australian Cuttlefish to the Reef Squid (Aitken et al, 2004).
An approximate audiogram for Sepia apama has been assumed for the purposes of this study based on the hearing thresholds of Hu et al (2009) for Sepioteuthis lessoniana above 400Hz, and the hearing thresholds from Mooney et al (2010) for Loligo pealeii below 400Hz."

Hearing thresholds are one thing, vulnerability is another. Studies must be conducted with Sepia apama to determine the species tolerance for noise pollution and its behavioural and physiological impacts above such levels. Shipping traffic noise remains a key concern, and the findings of Andre (2011, buried in an EIS Appendix) show that damage to cephalopod hearing can prove fatal, as the animals' ability to balance, forage and detect predators are irreparably damaged. The proponent refers to this publication, but diminishes its significance, presumably because it identifies frequencies common with shipping, and relatively low intensities as having the potential to fatally injure cephalopods (in this cases the closest analog being Sepia officinalis).

Appendix L1 – Noise Criteria
"There is not enough available research in the literature to state with any certainty what a safe exposure level for cephalopods would be... further research is required to determine what is the actual safe level for avoiding hearing damage in cuttlefish."

This is a critical admission, and a cue for immediate further research effort!

15.4.2.9 <u>Crustaceans</u>

"Due to the similar hearing characteristics of crustaceans to Cephalopods, and the lack of extensive research into their sensitivity to noise, both groups will be assessed together for

damage criteria. "

If impacts to crustaceans are to be assessed, surely this should involve actual specimens and studies of local species? For example rock crabs and Blue Swimmers, both of which are found along the Point Lowly peninsula's inshore reef? Why has such a study not occurred?

Pg. 470 <u>Underwater Noise</u> : 5.5.1.2. Vessels

"the additional impacts of shipping are generally due to increased traffic rather than introduction of a new noise source. The exception is that the new wharf is closer to the Cuttlefish aggregation at Black Point and therefore it is relevant to predict the increase in shipping noise that will be received at the Cuttlefish breeding area. "

The shipping increase will lead to higher levels of underwater noise (when multiple vessels are moving) and also increased frequency of noise emissions (due to the overall increased quantity of vessels). Scenarios where multiple vessels (ie. A cape and tug boats, or a cape and tugboats at each of the existing and new jetties) should be modelled for cumulative impacts. The models need better local field data though, and that needs to be remedied.

15.8 <u>Summary of Impacts</u>

"Additional shipping noise impacts associated with operation of the new wharf at Port Bonython are predicted to have negligible impacts on the Giant Australian Cuttlefish. Shipping noise is predicted to be below 130 dB re 1 µPa (the approximate hearing threshold of cephalopods) at 1200m from the vessel. The wharf is approximately 2500m from the shallow-water Cuttlefish habitat and hence shipping noise is likely to be imperceptible for the Cuttlefish."

This is an unreasonable assumption to make considering the complete absence of any information regarding Sepia apama's vulnerability to acoustic trauma, relevent statocyst physiology and the multiple layers of uncertainty associated with the region's approximate acoustic profile. Cephalopods exposed to low-intensity sound during Andre's study proved to have evolving impacts which he referred to as 'massive acoustic trauma' which would 'not be compatible with life'. I am not surprised that SGPL chose not to highlight the results of this particular study, the first (and possibly only) of its kind.

Cumulative impacts

18.2.3. Limitations of Study
The aim of this assessment is to:
»» Identify other projects in the area that are relevant to the BCEF
»» Understand the potential impacts of these projects or proposals
»» Consider the combined effect of these impacts with the residual impacts identified for the BCEF.
An assessment should also be based on publically available planning documents that clearly identify impacts of the project. Recent information for the Santos Facility and jetty, the Port Bonython Diesel Fuels Storage Facility (PBDFSF) and the Whyalla Port Facility (WPF) were not publically available. For this reason, cumulative impacts assessed in this EIS are limited as the impacts of other projects are not able to be identified. "

This is very disappointing and an 'easy out' for the proponent and the State Government. If the State was genuinely interested in exploring the cumulative impacts of this project, the State would have insisted on the disclosure of relevant information from Port Bonython Fuels and the Whyalla Port. This lack of disclosure point to yet another chronic problem in the process and a lack of political will to address it in the public interest.

Pg. 525 <u>Exclusion Zones</u>
"It is intended that a restricted area of not less than 50 metres around the proposed jetty will be defined and controls one and four from the Harbours and Navigation Regulations, 2009 (SA) will be applied. "

This description of the exclusion zone is too vague and offers locals, divers and scientists no certainty with respect to the accessibility of long utilised scientific study, fishing and diving sites (most notably the Giant Australian Cuttlefish aggregation). Will the jetty piles be available to scientists and divers? Will rock fishing be possible at this location?

Pg. 562 <u>Ship strike reporting</u>
"Any instances of ship strike to be reported to SGPL and any authorities "

This directive is far too vague to be useful. Ship strikes to marine mammals occurring in State waters are required to be reported to DEWNR under the Parks & Wildlife Act. There is no public register for these. Ship strikes to marine mammals occurring in Commonwealth waters are required to be reported to DSEWPaC. SGPL should in my opinion have a mandate to report any observed cetacean (at least large cetacean) activity in Spencer Gulf to help remedy the poor understanding of their use of Spencer Gulf's waters. Such activity should be made available to the scientific community and to the public via an online public register. This would help SGPL present to the public as an open and transparent organisation which has a genuine interest in reduce its impact upon threatened marine species. Ship strikes should also be recorded and disclosed in this manor. A 10 metre long Southern Right Whale washed ashore near Tumby Bay this winter, and the cause of death was determined by the SA museum to be severe blunt trauma to the head. Possible parallel cuts may also be indicative of propeller strike. As the Southern Right Whale population continues to recover, collision risk between ships and Southern Rights will increase in Spencer Gulf. It is critical that SGPL adopt a management plan which reduces risk of ship strike, for example by enforcing 10 knot seasonal (winter) speed reductions within the gulf, and maintaining accurate records of recent cetacean activity near the shipping channel. These sighting could also inform immediate notices to mariners who may be able to further decrease speed, or otherwise manoeuvre to reduce risk.

Frontiers in Ecology and the Environment

Low-frequency sounds induce acoustic trauma in cephalopods

Michel André, Marta Solé, Marc Lenoir, Mercè Durfort, Carme Quero, Alex Mas, Antoni Lombarte, Mike van der Schaar, Manel López-Bejar, Maria Morell, Serge Zaugg, and Ludwig Houégnigan

Front Ecol Environ 2011; doi:10.1890/100124

Low-frequency sounds induce acoustic trauma in cephalopods

Michel André[1*], Marta Solé[1], Marc Lenoir[2], Mercè Durfort[3], Carme Quero[4], Alex Mas[1], Antoni Lombarte[5], Mike van der Schaar[1], Manel López-Bejar[6], Maria Morell[1], Serge Zaugg[1], and Ludwig Houégnigan[1]

There is currently relatively little information on how marine organisms process and analyze sound, making assessments about the impacts of artificial sound sources in the marine environment difficult. However, such assessments have become a priority because noise is now considered as a source of pollution that increasingly affects the natural balance of the marine ecosystems. We present the first morphological and ultrastructural evidence of massive acoustic trauma, not compatible with life, in four cephalopod species subjected to low-frequency controlled-exposure experiments. Exposure to low-frequency sounds resulted in permanent and substantial alterations of the sensory hair cells of the statocysts, the structures responsible for the animals' sense of balance and position. These results indicate a need for further environmental regulation of human activities that introduce high-intensity, low-frequency sounds in the world's oceans.

Front Ecol Environ 2011; doi:10.1890/100124

The underwater marine environment is filled with natural sounds, but anthropogenic sound sources are increasingly contributing to the general noise budget of the oceans. The extent to which excessive noise in the sea impacts marine life is a topic of considerable concern to the scientific community, environmental groups, and the general public. Sounds produced by human activities can cause physical, physiological, and behavioral effects in marine fauna (including mammals, reptiles, fish, and invertebrates); these effects can be diverse, depending on the spatial proximity of the organism to the sound source. These impacts can result in a reduction in the abundance of fish species, changes in cetacean behavior and migration routes, and a range of physical injuries in both marine vertebrates and invertebrates (Richardson *et al.* 1995). There may be further long-term consequences due to chronic exposure, and sound can also indirectly affect animals through changes in the accessibility of prey, which may also suffer the adverse effects of acoustic pollution (Richardson *et al.* 1995). These effects could negatively affect the conservation of already endangered species that use acoustically contaminated areas for migration, reproduction, and feeding.

Evaluating the acoustic impacts of artificial sound sources in the marine environment is a complex and expensive undertaking. First, there has been relatively little research on the sound-processing and analysis mechanisms in marine organisms. Although it is possible to catalog and record the majority of these sound signals, we still do not know enough about the role sounds play in the balance and development of populations. Second, these sound emissions may not only affect auditory reception systems, but might also interfere with other sensory and systemic organs and processes, with possibly lethal consequences for the affected animal. Furthermore, prolonged or regular exposure to a specific sound may have negative short-, medium-, or long-term consequences. The lack of past research has contributed to the difficulty in obtaining objective data to inform future decisions on the effective control of anthropogenic noise in the oceans.

Another pressing problem relates to the homogenization of measurements. At the moment, there is no well-defined protocol for measuring marine acoustic pollution or any agreement on the best way of depicting the results of these measurements. Although levels of noise pollution in the marine environment are increasing, the variability of the available parameters to measure the resulting effects leads to heterogeneous or fragmented data that appear to be of little use in developing effective management programs (André *et al.* 2010).

Finally, most studies lack information on the long-term effects of sound sources on specific populations and individual species. There are very few datasets showing current ambient noise levels in most areas of the marine ecosystem, and even less historical data. Information on trends is not available, either for European or international waters. According to the US Marine Mammal Commission, underwater ambient sound levels will increase over time, as a result of human activities (eg shipping, offshore industrial construction, resource

[1]*Laboratory of Applied Bioacoustics, Technical University of Catalonia, Barcelona, Spain* [*]*(michel.andre@upc.edu);* [2]*INSERM U.1051, Institute of Neurosciences of Montpellier, Montpellier, France;* [3]*Department of Cellular Biology, Faculty of Biology, University of Barcelona, Barcelona, Spain;* [4]*Department of Biological Chemistry and Molecular Modelling, IQAC-CSIC, Barcelona, Spain;* [5]*Renewable Marine Resources Department, Marine Sciences Institute (ICM CMIMA-CSIC), Barcelona, Spain;* [6]*Department of Animal Health and Anatomy, Faculty of Veterinary Science, Universitat Autònoma de Barcelona, Campus de la UAB, 08193 Bellaterra (Cerdanyola del Vallès), Spain*

Figure 1. *A giant squid (*Architeuthis dux*) carcass on a beach in Spain.*

exploitation) in the marine environment (Marine Mammal Commission 2007). In addition, the potential increase in ambient sound levels will not affect all areas equally, but will differentially impact specific regions where offshore activity is high (eg some of the Exclusive Economic Zones; see OSPAR Commission 2009). Potential effects might not be proportionate to noise pollution levels due to variation in sound propagation and, most importantly, the distribution of marine organisms that are sensitive to sound.

Recently, the UN's Convention on Migratory Species (CMS) recognized that, "anthropogenic ocean noise constitutes a form of pollution [that] may degrade the marine environment and also have adverse effects on ocean fauna, even resulting in individual fatalities, and reaffirming that the difficulty in determining the negative acoustic impact on organisms requires the drawing up of precautionary principles in cases where impact is possible" (COP 2008). The CMS urged agencies that exercise jurisdiction over any species of marine organisms listed in the appendices of the Conference of the Parties (COP 2008) to "develop methods of control on the impact of acoustic emissions arising from human activities in susceptible habitats that serve as gathering points or places of passage of endangered species, and to carry out environmental impact studies on the introduction of systems that may produce noise and their derived risks to marine species" (COP 2008).

The European Union's (EU's) Marine Strategy Framework Directive (2008/56/EC), which aims to improve the condition of all Europe's seas and ensure that human usage of these seas is sustainable, includes a series of objectives for eleven Descriptors of Environmental Status. One of these Descriptors concerns underwater noise: "Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment". Descriptor 11 (Tasker *et al.* 2010) specifically addresses noise sources from pile-driving operations and seismic surveys (low- and mid-frequency implusive sounds) and from shippping (low-frequency continuous sounds).

Interestingly, most studies of noise effects on marine organisms concern endangered species that use sound in their daily activities. Less attention has been paid to commercially valuable species and in particular to invertebrates, such as cephalopods.

In a comprehensive review of the effects of anthropogenic sound sources on fish, Popper and Hastings (2009) concluded that without data "obtained in a systematic way with excellent controls and peer review" it is impossible to develop clear sound-exposure metrics and criteria that could help predict and manage the potential effects of sound on marine life. Indeed, reliable data in this field are extremely limited and, in light of the scope and importance of ocean systems, are urgently required. Of the three main forms of marine macrofauna (mammals, fish, and invertebrates), cephalopods belong to the latter group, about which the least is understood. Situated in the food chain between fish and marine mammals, they are also key bio-indicators for ecosystem balance in the vast and complex marine ecosystem.

In September and October 2001, and again in October 2003, the annual reports of strandings of giant squid (*Architeuthis dux*; Figure 1) along the west coast of Asturias, Spain, showed a statistically significant increase (Guerra *et al.* 2004a). In both instances, the deaths coincided with the proximity of vessels using compressed airguns for geophysical prospecting, and producing high-intensity, low-frequency (below 100 hertz [Hz]) sound waves. Some of the specimens had lesions in various tissues and organs, but all presented pathologies within the statocysts. Because none of these lesions could be linked to previously known causes of death in the species, the presence of geophysical prospecting vessels in the area suggested for the first time that the deaths could be related to excessive sound exposure (Guerra *et al.* 2004b). However, although startle responses were observed in caged cephalopods exposed to airguns (McCauley *et al.* 2000), no studies addressing noise-induced morphological changes in these species were carried out, and doubts remained regarding the possible negative impacts of high-intensity, low-frequency sounds on cephalopods.

Little is known about sound perception in invertebrates, but some evidence suggests that cephalopods may be sensitive to low-frequency sounds (Hanlon and Budelmann 1987). All cephalopod species have statocysts in the cephalic cartilage region. These highly sophisticated structures are responsible for helping the animal to determine its position and maintain balance, and are analogous to the vestibular system of vertebrates (Offutt 1970; Budelmann 1988; Budelmann 1992; Williamson 1995). These balloon-shaped structures contain sensory hair cells, which line the inside wall of a sac-like structure (Budelmann 1988) and include two receptor systems: the macula-statolith system, which indicates changes in position according to gravity and linear acceleration, and the crista-cupula system, which determines angular acceleration (Figure 2).

Statocysts may play an important additional role in low-frequency sound reception (Hu *et al*. 2009), although to date there is no definitive scientific evidence to support this idea. While there is uncertainty regarding the biological importance of particle motion sensitivity versus acoustic pressure, recent electrophysiological studies confirmed the cepaholopds' sensitivity to frequencies under 400 Hz (*Octopus vulgaris*, Kaifu *et al*. 2008; *Sepioteuthis lessoniana*, *Octopus vulgaris*, Hu *et al*. 2009; *Loligo pealei*, Mooney *et al*. 2010).

Here, we present the first morphological and ultrastructural study of the damaging effects on statocysts in individuals belonging to four cephalopod species under low-frequency, controlled-exposure experiments, and discuss the implications of our findings.

Methods

Sequential controlled-exposure experiments (CEEs) were conducted over a period of 2 years on adult individuals (n = 87) belonging to four cephalopod species (*Loligo vulgaris* [*n* = 5], *Sepia officinalis* [*n* = 76], *Octopus vulgaris* [*n* = 4], and *Illex coindetii* [*n* = 2]), that were freshly caught off the Catalan coast of Spain (northwest Mediterranean Sea). The protocol included immediate exposure to 50–400 Hz sinusoidal wave sweeps with 100% duty cycle and 1-second sweep period for 2 hours in either a 2.000-liter fiberglass reinforced plastic tank or a 200 liter (glass-walled) tank, both filled with natural seawater (physiochemically self-filtered; temperature 18–20°C; salinity 35 parts per thousand; and under natural oxygen pressure). The sweep was produced and amplified through an in-air loudspeaker, while the level received was measured by a calibrated B&K 8006 hydrophone (received sound pressure level: 157 ± 5 decibels [dB] in reference to (re) 1 microPascal [μPa], with peak levels at 175 dB re 1 μPa).

Following exposure, the non-anesthetized individuals were decapitated at different intervals, ranging from immediately afterwards to 12, 24, 48, 72, and 96 hours after exposure, respectively. The extraction of the statocysts was performed immediately following decapitation and the tissue was fixed for scanning electron microscopy (SEM), for light microscopy (LM), and for transmission electron microscopy (TEM). Specimens were then processed according to classical SEM, LM, and TEM procedures. In addition, the endolymph was extracted from a further set of individuals and immediately frozen at –70°C for proteomic analysis.

An additional set of live adult individuals (*n* = 100) was used as a control and sequentially processed in the same manner as the noise-exposed cephalopods, immediately following capture.

Results

All exposed individuals from all four species presented the same lesions and the same incremental effects over time. Immediately after exposure, damage was observed in the macula statica princeps (msp) and on the crista sensory epithelia. Kinocilia within hair cells were either missing or were bent or flaccid (compare Figure 3a and 3b). A number of hair cells showed protruding apical poles (Figure 3b) and ruptured plasma membranes, most probably resulting from the extrusion of cytoplasmic material. Hair cells were also partially ejected from the sensory epithelium, and spherical holes corresponding to missing hair cells were visible in the epithelium. The cytoplasmic content of the damaged hair cells showed obvious changes, including the presence of numerous vacuoles and electron dense inclusions not seen in the control animals (compare Figure 3c and 3d). Underneath the hair cells, afferent nerve fibers were swollen and showed mitochondrial damage or complete degeneration. In some specimens, large holes in the sensory epithelium were also observed. The appearance of these lesions became gradually more pronounced in individuals after 12, 24, 48, 72, and 96 hours. Part of the cellular body of the damaged cells was extruded above the sensory epithelium into the statocyst cavity (inset in Figure 3b). The most pronounced lesions were visible in specimens observed 96 hours after sound exposure. In these individuals, the sensory epithelium was severely damaged, with very few hair cells remaining; most of the hair cells had been extruded. The epithelium only presented supporting cells, creating a holed mosaic, where residual hair cells showed either very few bent, flaccid, or fused kinocilia, or none at all.

The almost complete extrusion of the hair cells, as well as the holes present in the epithelium, are clear signs that the noise impact was acute and that hair-cell damage was immediate. In mammals and some fish species, such dramatic damage has only been observed after exposure to extremely high-intensity sound; low- to mid-intensity acoustic stimuli have to date not been known to lead to any obvious mechanical damage to the sensory epithelia (Pujol and Puel 1999; McCauley *et al*. 2003; Popper and

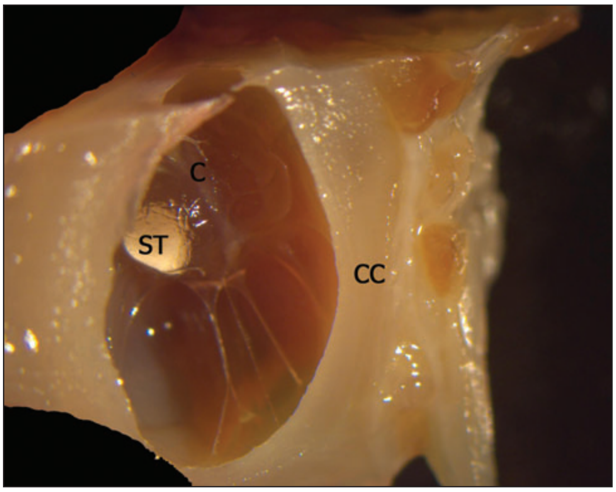


Figure 2. *Lateral view of the interior of a statocyst in* Octopus vulgaris. *Photomicrograph shows the spherical inner sac suspended in the cephalic cartilage (CC) cavity by fibrous strands. The statolith (ST) is attached to the* macula *and the* crista *(C), both of which lie on the inside wall of the sac-like structure.*

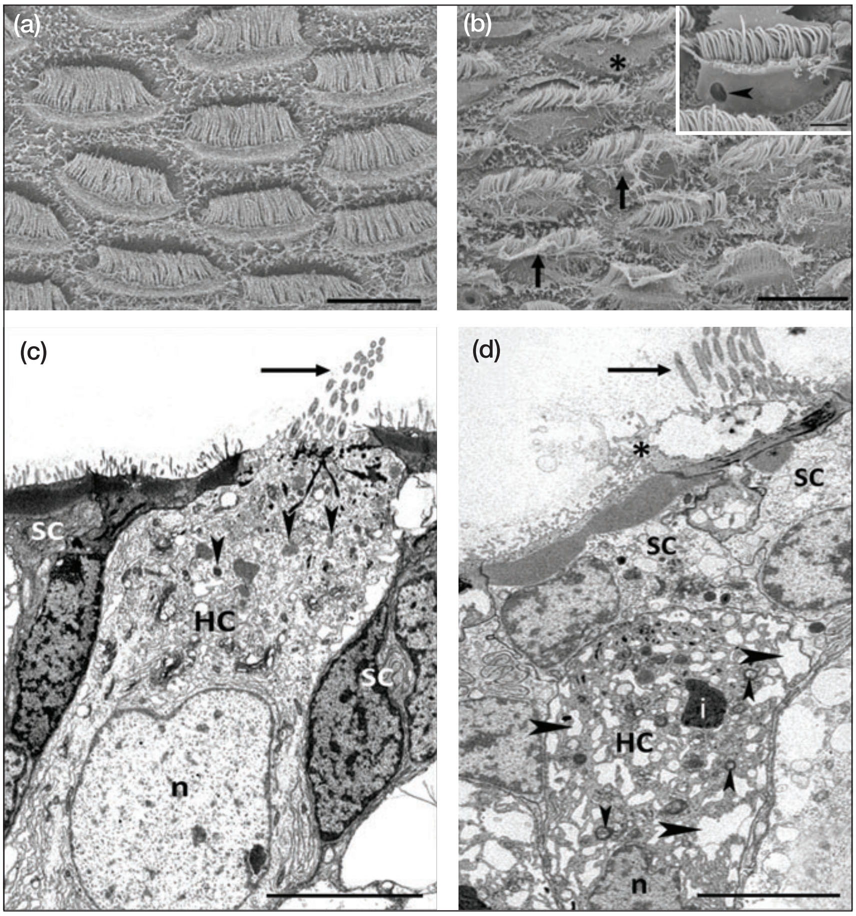


Figure 3. *(a, b) Scanning electron microscope and (c, d) transmission electron microscope images of* Sepia officinalis *macula statica princeps. (a and c) Control specimens, not exposed to sound; (b and d) sound-exposed individuals. (a) Normal sensory epithelium. At the apical surface of the hair cells, all kinocilia are erect and well organized into bundles. (b) Immediately after sound exposure, hair cells show bending and disorganized kinocilia (arrows). Note also one hair-cell apical pole protruding (asterisk). (b, inset) A partially extruded hair cell, 48 hours after exposure. Note the ruptured lateral plasma membrane (arrowhead). (c) Apex of a normal hair cell (HC) in between two supporting cells (SC). The HC shows well-formed kinocilia (arrow) and healthy cytoplasmic organelles. Arrowheads point to three mitochondria. (d) Apex of a severely damaged hair cell, 48 hours after sound exposure. The top of the hair-cell body, including kinocilia (arrow) and cytoplasmic material (asterisk) is protruding into the statocyst cavity. Note the numerous vacuoles (arrowheads), damaged mitochondria (small vertical arrowheads) and a dark inclusion (i) in the portion of hair cells that remains in the epithelium. (n) indicates the cell nucleus. Scale bars: (a, b) 10 μm; (Inset in b) 1 μm; (c, d) 5 μm.*

Hastings 2009). Instead, lesions involved fusion of the stereocilia and deformation of the hair-cell body, with cell death occuring over several days or weeks (Bohne and Rabbitt 1983). However, at the periphery of a severe acoustic trauma, less dramatic damage to hair cells also includes stereociliary disorganization and fusion, and open holes are left in the epithelium following the detachment of the cell apex. This was observed in all cephalopod specimens at 48, 72, and 96 hours after exposure.

In addition to hair-cell damage, the experimental animals showed swelling of afferent dendrites and neuronal degeneration, confirming that the neurons were also affected by the acoustic trauma. In mammalian cochlea, swelling of afferent dendrites occurs during exposure to loud noise, and is the result of an excessive release of glutamate by the inner hair cell (Coyle and Puttfarcken 1993; Mumtaz *et al.* 1999; Pujol and Puel 1999). Under normal conditions, glutamate acts as a neurotransmitter among the inner hair cells, but has excitotoxic (toxicity to nerve cells and processes resulting from excess exposure to a neurotransmitter) effects when secreted in large quantities. The observed impacts on the statoacoustic organs of the noise-exposed cephalopods suggests the occurrence of an excitotoxic process due to an excess of glutamate, which has also been identified as a neurotransmitter in cephalopods (Tu and Budelmann 1994; Di Cosmo *et al.* 2006).

Discussion

The lesions described here are new to cephalopod pathology. Their presence in all of the noise-exposed individuals (versus their absence in controls) and their clear progression over time are consistent with the effects observed in other species that have been exposed to much higher intensities of sound. Why the relatively low levels of low-frequency sound have caused such lesions in cephalopods requires further investigation. In particular, it will be critical to determine the onset mechanism of the acoustic trauma in order to determine whether these animals are more sensitive to particle motion or acoustic pressure, or to a combination of both. Future electrophysiological experiments coupled with postmortem imaging techniques are also needed to determine the tolerance-to-noise threshold of these species. However, the presence of lesions in the statocysts clearly points to the involvement of these structures in sound reception and perception. Given that low-frequency noise levels in the ocean are increasing (eg due to shipping, offshore industry, and naval maneuvers), that the role of cephalopods in marine ecosystems is only now beginning to be understood (Boyle and Rodhouse 2005), and that reliable bioacoustic data on invertebrates are scarce, future studies will have an important contribution to make to the sustainable use of the marine environment. These results indicate that the deleterious effects of marine noise pollution go well beyond those observed in whales and dolphins. Some activities – airgun surveys, pile driving, and sonar uses – have been shown to harm a wide variety of species. However, these findings introduce an additional question about whether other activities (eg shipping, fisheries, offshore operations) that are widely represented in the oceans and produce continuous low-frequency sounds are also affecting marine fauna. If the relatively low levels and short exposure applied in this study can induce severe acoustic trauma in cephalopiods, the effects of similar noise sources on these species in natural conditions over longer time periods may be considerable. Because invertebrates are clearly sensitive to noise associated with human activities, is noise, like other forms of pollution, capable of affecting the entire web of ocean life? Long-term solutions will not be easy to find, but immediate mitigation actions already exist to control noise impacts in areas where future operations are scheduled (eg seismic surveys, construction, operation of windmills, naval maneuvers). Making the necessary improvements will require additional scientific knowledge and stronger political resolve. Furthermore, given the global extent of the noise proliferation problem, it must ultimately be addressed on an international scale. A complex issue such as undersea noise pollution cannot be resolved quickly. Yet now is the time when important progress might be possible, before the problem of increasing noise pollution becomes intractable and its impacts irreversible.

Acknowledgements

We thank E Escolar of the vessel *Nova Míriam* for assistance in collecting cephalopod specimens; JM Fortuño for assistance and advice on SEM images; N Cortadelles for assistance and advice on TEM images; and R Villanueva and B Geary for critical and valuable comments and suggestions. The Spanish Ministry of the Environment kindly funded this work (contract 083/SDGTB/2007).

References

André M, Morell M, Mas A, *et al.* 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029. www.lab.upc.es. Viewed 3 Mar 2011.

Bohne BA and Rabbitt KD. 1983. Holes in the reticular lamina after noise exposure: implication for continuing damage in the organ of corti. *Hearing Res* **11**: 41–53.

Boyle P and Rodhouse P (Eds). 2005. Cephalopods: ecology and fisheries. Oxford, UK: Blackwell Science.

Budelmann BU. 1992. Hearing in non-arthropod invertebrates. In: Webster DB, Fay RA, and Popper AN (Eds). The evolutionary biology of hearing. New York, NY: Springer Verlag.

Budelmann BU. 1988. Morphological diversity of equilibrium receptor systems in aquatic invertebrates. In: Atema J, Fay RR, Popper AN, and Travolga WN (Eds). Sensory biology of aquatic animals. New York, NY: Springer Verlag.

COP (Conference of the Parties). 2008. Report of the Conference of the Parties, Convention on Migratory Species. Rome, Italy: COP.

Coyle JT and Puttfarcken PS. 1993. Oxidative stress, glutamate, and neurodegenerative disorders. *Science* **262**: 689–95.

Di Cosmo A, Di Cristo C, and Messenger JB. 2006. L-glutamate and its ionotropic receptors in the nervous system of cephalopods. *Curr Neuropharmacol* **4**: 305–12.

Guerra A, González AF and Rocha F. 2004a. A review of records of giant squid in the north-eastern Atlantic and severe injuries in *Architeuthis dux* stranded after acoustic exploration. *ICES CM* **2004/CC**: 29.

Guerra A, González AF, Rocha F, *et al.* 2004b. Calamares gigantes varados. Víctimas de exploraciones acústicas. *Investigación y Ciéncia* **334**: 35–37.

Hanlon RH and Budelmann BU. 1987. Why cephalopods are probably not "deaf". *Am Nat* **129**: 312–17.

Hu MY, Yan HY, Chung W, *et al.* 2009. Acoustically evoked potentials in two cephalopods inferred using the auditory brainstem response (ABR) approach. *Comp Biochem Phys A* **153**: 278–84.

Kaifu K, Akamatsu T, and Segawa S. 2008. Underwater sound detection by cephalopod statocyst. *Fisheries Sci* **74**: 781–86.

Marine Mammal Commission. 2007. Marine mammals and noise: a sound approach to research and management. A report to Congress from the Marine Mammal Commission. Bethesda, MD: Marine Mammal Commission.

McCauley RD, Duncan AJ, Penrose JD, *et al.* 2000. Marine seismic surveys – a study of environmental implications. *APPEA J* **40**: 692–706.

McCauley RD, Fewtrell J, and Popper AN. 2003. High intensity anthropogenic sound damages fish ears. *J Acoust Soc Am* **113**: 638–42.

Mooney AT, Hanlon RT, Christensen-Dalsgaard, J, *et al.* 2010. Sound detection by the longfin squid (*Loligo pealei*) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure. *J Exp Biol:* **213**, 3748–59.

Mumtaz JK, Seidman MD, Quirk WS, and Shivapuja BG. 1999. Effects of kynurenic acid as a glutamate receptor antagonist in the guinea pig. *Eur Arch Oto-Rhino-L* **257**: 177–81.

Offutt GC. 1970. Acoustic stimulus perception by American lobster *Homarus americanus* (Decapoda). *Experientia* **26**: 1276–78.

OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

Popper AN and Hastings MC. 2009. The effects of anthropogenic sources of sound on fishes. *J Fish Biol* **75**: 455–89.

Pujol R and Puel JL. 1999. Excitotoxicity, synaptic repair, and functional recovery in the mammalian cochlea: a review of recent findings. *Ann NY Acad Sci* **28**: 249–54.

Richardson WJ, Greene Jr CR, Malme CI, and Thomson DH. 1995. Marine mammals and noise. San Diego, CA: Academic Press.

Tasker ML, Amundin M, André M, *et al.* 2010. Marine strategy framework directive – Task Group II: Underwater noise and other forms of energy. Luxemburg, Luxemburg: Office for Official Publications of the European Communities.

Tu IJ and Budelmann BU. 1994. The effect of L-glutamate on the efferent resting activity in cephalopod statocyst. *Brain Res* **642**: 47–58.

Williamson R. 1995. The statocysts of cephalopods. In: Abbott NJ, Williamson R, and Maddock L (Eds). Cephalopod neurobiology: neuroscience studies in squid, octopus and cuttlefish. Oxford, UK: Oxford University Press.

CBD

Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/16/INF/12
12 March 2012

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE
Sixteenth meeting
Montreal, 30 April-5 May 2012
Item 6.2 of the provisional agenda*

SCIENTIFIC SYNTHESIS ON THE IMPACTS OF UNDERWATER NOISE ON MARINE AND COASTAL BIODIVERSITY AND HABITATS

Note by the Executive Secretary

1. Significant progress has been made in analysing the impacts of underwater noise on marine and coastal biodiversity, including through initiatives under the Convention on Migratory Species, the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), the International Whaling Commission (IWC), and the International Maritime Organization (IMO). In paragraph 12 of decision X/29, the Conference of the Parties to the Convention on Biological Diversity recognized the role of the Convention in supporting global cooperation, and requested the Executive Secretary, in collaboration with Parties, other Governments, and relevant organizations, to compile and synthesize available scientific information on anthropogenic underwater noise and its impacts on marine and coastal biodiversity and habitats, and to make such information available for consideration at a meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as well as to other relevant organizations prior to the eleventh meeting of the Conference of the Parties.

2. Pursuant to this request, the Secretariat of the convention commissioned a scientific synthesis on the impacts of underwater noise on marine and coastal biodiversity and habitats.

An earlier draft of this report was circulated for peer-review through notification SCBD/STTM/DC/RH/VA/78671 (2012-012) dated 23 January 2012 and comments were taken into account in finalizing the report.

** UNEP/CBD/SBSTTA/16/1.

SCIENTIFIC SYNTHESIS ON THE IMPACTS OF UNDERWATER NOISE ON MARINE AND COASTAL BIODIVERSITY AND HABITATS

EXECUTIVE SUMMARY

Introduction and Background

1. **The underwater world is subject to a wide array of human-made noise from activities such as commercial shipping, oil and gas exploration and the use of various types of sonar**. Human activity in the marine environment is an important component of oceanic background noise and can dominate the acoustic properties of coastal waters and shallow seas. Human activities introduce sound into the marine environment either intentionally for a specific purpose (e.g., seismic surveys) or unintentionally as a by-product of their activities (e.g., shipping or construction). Anthropogenic noise can be broadly split into two main types: impulsive and non-impulsive sounds. The level of human activity and corresponding noise production in the marine environment is predicted to rise over the coming decades as maritime transportation and the exploration and extraction of marine resources continues to grow.

2. **Anthropogenic noise in the marine environment has increased markedly over the last 100 or so years as the human use of the oceans has grown and diversified**. Technological advances in vessel propulsion and design, the development of marine industry and the increasing and more diverse anthropogenic use of the marine environment have all resulted in a noisier underwater realm. Long-term measurements of ocean ambient sound indicate that low frequency anthropogenic noise has been increased, primarily due to commercial shipping. As well as an increase in commercial shipping the last half century has also seen an expansion of industrial activities in the marine environment including oil and gas exploration and production, commercial fishing and more recently the development of marine renewable energy. In coastal areas the increase in the number of small vessels is also a cause for localised concern where they can dominate some coastal acoustic environments such as partially enclosed bays, harbours and estuaries.

3. **Anthropogenic noise has gained recognition as an important stressor for marine life and is now acknowledged as a global issue that needs addressing**. The impacts of sound on marine mammals have received particular attention, especially the military's use of active sonar, and industrial seismic surveys coincident with cetacean mass stranding events. Extensive investigation mainly over the last decade by academia, industry, government agencies and international bodies has resulted in a number of reviews of the effects of sound on marine fauna. The issue of underwater noise and its effects on marine biodiversity has received increasing attention at the international level with recognition by a number of international and regional agencies, commissions and organisations including the Convention of Migratory Species (CMS), the International Whaling Commission (IWC), the United Nations (U.N. General Assembly (UNGA) and U.N. Convention on the Law of the Sea (UNCLOS)), the European Parliament and European Union, the International Union for Conservation of Nature (IUCN), the International Maritime organization (IMO), the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic and the Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM).

The Importance of Sound to Marine Animals

4. **Sound is extremely important to many marine animals and plays a key role in communication, navigation, orientation, feeding and the detection of predators**. The distinctive properties of underwater sound and the limitations of other senses such as vision, touch, taste and smell in the marine environment in terms of range and speed of signal

transmission mean that sound is the preferential sensory medium for a large proportion of marine animals. Almost all marine vertebrates rely to some extent on sound for a wide range of biological functions. Marine mammals use sound as a primary means for underwater communication and sensing. They emit sound to communicate about the presence of danger, food, a conspecific or other animal, and also about their own position, identity, and reproductive or territorial status. Many other marine taxa also rely on sound on a regular basis including teleost fish and invertebrates such as decapod crustaceans. Fish utilize sound for navigation and selection of habitat, mating, predator avoidance and prey detection and communication. Impeding the ability of fish to hear biologically relevant sounds might interfere with these critical functions. Although the study of invertebrate sound detection is still rather limited, based on the information available it is becoming clear that many marine invertebrates are sensitive to sounds and related stimuli. However, the importance of sound for many marine taxa is still rather poorly understood and in need of considerable further investigation.

<u>The Impacts of Underwater Noise on Marine Biodiversity</u>

5. **A variety of marine animals are known to be affected by anthropogenic noise**. Negative impacts for least 55 marine species (cetaceans, teleost fish, marine turtles and invertebrates) have been reported in scientific studies to date.

6. **A wide range of effects of increased levels of sound on marine fauna have been documented** both in laboratory and field conditions. The effects can range from mild behavioural responses to complete avoidance of the affected area, masking of important acoustic cues, and in some cases serious physical injury or death. Low levels of sound can be inconsequential for many animals. However, as sound levels increase the elevated background noise can disrupt normal behaviour patterns leading to less efficient feeding for example. Masking of important acoustic signals or cues can reduce communication between con-specifics and may interfere with larval orientation which could have implications for recruitment. Some marine mammals have tried to compensate for the elevated background noise levels by making changes in their vocalisations. Intense levels of sound exposure have caused physical damage to tissues and organs of marine animals, and can lead to mortality, with lethal injuries of cetaceans documented in stranded individuals caught up in atypical stranding events. Lower sound levels have been shown to cause permanent or temporary loss of hearing in marine mammals and fish. Behavioural responses such as strong avoidance of the sound source can lead to habitat displacement. Some marine animals, such as beaked whales are particularly susceptible to anthropogenic sound, and some populations have experienced declines for years after a sonar-induced stranding event.

7. **There are increasing concerns about the long-term and cumulative effects of noise on marine biodiversity**. The long-term consequences of chronic noise pollution for individuals and populations are still mainly unknown. Potential long-term impacts of reduced fitness and increased stress leading to health issues have been suggested. There is also growing concern of the cumulative effects of anthropogenic sound and other stressors and how this can affect populations and communities. Although there is currently little empirical evidence for noise effects on marine populations, acoustic studies for terrestrial vertebrates indicate that features such as fitness and reproductive success can be compromised. The additional threat of living in a noisy environment may push already highly stressed marine animals into population decline with subsequent effects on marine communities and biodiversity.

<u>Acoustic Research and Future Research Needs</u>

8. **Research is required to better understand the impacts of anthropogenic sound on marine biodiversity.** The lack of scientific knowledge regarding the issue is also one of the most important limitations for effective management at the present time. There are high levels of uncertainty for noise effects on all marine taxa,. Detailed research programmes of noise effects on species, populations, habitats and ecosystems plus also cumulative effects with other stressors need to be put in place or consolidated where they already exist. However, the extensive knowledge gaps also mean that prioritisation will be required. Recommended priorities for research include species that are already highly threatened, endangered or particularly vulnerable through a combination of multiple stressors and intrinsic characteristics, but also representative groups of understudied taxa. Current knowledge for some faunal groups such as teleost fish, elasmobranch fish, marine turtles, seabirds and invertebrates is particularly lacking. Other priorities for acoustic-related research are the identification and protection of critical habitats that endangered or threatened marine species depend upon for important activities such as foraging or spawning. Marine species that support commercial fisheries should also be assessed for susceptibility to noise pollution and the issue of anthropogenic noise considered for fisheries management plans.

Management and Mitigation of Underwater Noise

9. **There is a need to scale up the level of research and management efforts, to significantly promote greater awareness of the issue and to take measures minimise our noise impacts on marine biodiversity**. A number of current or proposed large-scale research programmes are addressing a range of issues with a focus on marine mammals. Existing or proposed management frameworks involving noise pollution also need to be tested and refined accordingly in a range of scenarios.

10. **Effective management of anthropogenic noise in the marine environment should be regarded as a high priority for action at the national and regional level** through the use of up to date mitigation measures based on the latest scientific understanding of the issue for marine species and habitats. Mitigation and management of anthropogenic noise through the use of spatio-temporal restrictions (STR) of activities has been recommended as the most practical and straightforward approach to reduce effects on marine animals. A framework for the implementation of STR's is available for use by national and regional bodies to ensure that acoustic issues are considered in future marine spatial planning.

11. **Mitigation of marine noise in the oceans** is in place for industrial and military activities in some regions of the world through the use of measures and guidelines. However, critical analysis of this guidance has identified a number of significant limitations including the considerable variation in standards and procedures between regions or navies. Mitigation of anthropogenic sound levels in the marine environment require regular updating to keep in touch with changes in acoustic technology and the latest scientific knowledge of marine species such as acoustic sensitivity and population ecology. There have been calls for the setting of global standards for the main activities responsible for producing anthropogenic sound in the oceans. Progress is being made with regard to commercial shipping and quieting but standards for naval sonar or seismic surveys are also required to reduce impacts on marine species.

New Challenges

12. **New challenges such as global changes in ocean parameters** (e.g. acidity and temperature) are also likely to have consequences for marine noise levels at a range of geographic scales through changes in sound absorption and the retreat of Arctic sea ice opening up waters for exploration and resource extraction. Preliminary modelling of projected changes in acidity caused by ocean acidification suggests that particularly noisy regions that are also prone to reduced sound absorption should be recognised as hotspots where mitigation and management

is probably most needed. Further research is needed to confirm these predictions. Previously relatively quiet areas of the oceans such as the Arctic are also highly likely to be exposed to increased levels of anthropogenic sound as the sea ice coverage decreases, through exploration and exploitation, with potentially significant effects on marine biodiversity. Management frameworks for the Arctic need to consider anthropogenic noise as an important stressor alongside others when deciding the extent of activities permitted in these waters.

I BACKGROUND AND INTRODUCTION

As human populations have grown and become more industrialised over the last two centuries the marine environment has been subjected to increasing levels of underwater noise from anthropogenic sources. Technological advances in vessel propulsion and design, the development of marine industry and the increasing and more diverse anthropogenic use of the marine environment have all resulted in a noisier underwater realm. Increased levels of underwater noise can have significant effects on marine biodiversity and have been shown to cause physical injury, alter animal behaviour and have more subtle physiological effects on marine organisms. The rising levels of anthropogenically enhanced background or ambient noise can also mask important acoustic cues and signals between conspecific marine fauna. Detecting and emitting underwater sound is extremely important for marine mammals[1][2] and many fish[3] but also for some invertebrates[4].

Initial concerns of the potential negative effects of anthropogenic noise on marine life were raised by the scientific community in the 1970's and research on the subject expanded in the 1980's[5]. The impacts of sound on marine mammals have received particular attention, especially the military's use of active sonar, and industrial seismic surveys coincident with cetacean mass stranding events[6]. Extensive investigation mainly over the last decade by academia, industry, government agencies and international bodies has resulted in a number of reviews of the effects of sound on marine fauna, and for mammals and fish in particular [7] [8] [9] [10]. Over the last decade the issue of underwater noise and its effects on marine biodiversity have received increasing

1 Berta, A., Sumich, J.L. and Kovacs, K.M. (2006). Marine mammals - evolutionary biology 2nd edition. Elsevier and Academic Press, San Diego, 547 pp.

2 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp.

3 Popper, A.N. 2003. Effects of Anthropogenic Sounds on Fishes. Fisheries, 28 no 10: 24-31.

4 Popper, A.N., Salomon, M. and Kenneth, W.H. (2001). Acoustic detection and communication by decapod crustaceans. J. Comp. Physiol. A., 187: 83-89.

5 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

6 NRDC, 2005. Sounding the depths II: The rising toll of sonar, shipping and industrial ocean noise on marine life. Natural Resources Defense Council November 2005.

7 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp.

8 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

attention at the international level. The Convention on the Conservation of Migratory Species of Wild Animals (CMS), the International Whaling Commission (IWC), the United Nations General Assembly (UNGA), the European Parliament and European Union, the International Union for Conservation of Nature (IUCN), the International Maritime Organization (IMO), the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, the Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM), the Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) and the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) have all considered the negative effects of anthropogenic underwater noise through the adoption of resolutions or recognition of the issue for the marine environment.

However, although there have been major advances in the knowledge of the main types of anthropogenic sound in the ocean and the effects of these sounds on marine biodiversity over the last few decades there are still large and substantial gaps in our knowledge of underwater noise and the impacts it has on marine species and populations. Existing mitigation measures used by marine industries and the military may therefore not be very effective and are essentially still at a developmental stage. The use of the precautionary principle is therefore regarded as the most sensible and best-practice approach when dealing with a situation with insufficient data available. Although noise is a recognized form of pollution, sources of noise in the marine environment are not regulated at an international level. There has been progress made at the regional level (e.g., OSPAR, ASCOBANS, ACCOBAMS, HELCOM) in terms of regulatory frameworks for the prevention of pollution and preservation of biodiversity that provide an existing mandate for the control of noise pollution[11]. The development of indicators and standards for underwater noise is also currently receiving attention in some regions[12].

This study was undertaken, with the financial support from the Government of Japan through Japan Biodiversity Fund, pursuant to the request made by the Conference of the Parties to the Convention at its tenth meeting in decision X/29 (paragraph 12) with the kind financial support of the Japan Biodiversity Fund. In this decision, the Conference of Parties to the Convention on Biological Diversity, "*...requests the Executive Secretary, in collaboration with Parties, other Governments, and relevant organizations, to compile and synthesize available scientific information on anthropogenic underwater noise and its impacts on marine and coastal biodiversity and habitats, and make such information available for consideration at a future meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as well as other relevant organizations prior to the eleventh meeting of the Conference of the Parties"* [13].

---

9 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

10 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

11 Scott, K. 2007. Sound and Cetaceans: A Regional Response to Regulating Acoustic Marine Pollution. Journal of International Wildlife Law and Policy, 10:175–199

12 Tasker, M.L, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

13 See http://www.cbd.int/decision/cop/?id=12295

Likewise, in decision X/13 (paragraph 2 (b)), the Conference of the Parties requested the Subsidiary Body on Scientific, Technical and Technological Advice to take into account, in the implementation of the programmes of work on protected areas and on marine and coastal biodiversity, the impact of ocean noise on marine protected areas and to consider the scientific information on underwater noise and its impacts on marine and coastal biodiversity and habitats that will be made available by the Executive Secretary prior to the eleventh meeting of the Conference of the Parties.

OVERVIEW OF UNDERWATER SOUND

Sound is a mechanical disturbance that travels through an elastic medium (e.g., air, water or solids)[14]. Sound is created if particles in such a medium are displaced by an external force and start oscillating around their original position. These oscillating particles will also set neighbouring particles in motion as the original disturbance travels through the medium. This oscillation can be slow or fast producing what we perceive as low pitch sounds (slow oscillation) or high pitch sounds (fast oscillation). The concept of frequency is used to put values on these oscillations which establish the oscillations per second that are produced in the particles. The units for measuring oscillations are Hertz (Hz). Humans can hear frequencies between 20 Hz to 20 kHz, but the audible spectrum for marine mammals and other species can extend far beyond the human hearing range. Sounds outside the human hearing range are referred to as infrasound (below 20 Hz) and ultrasound (above 20 kHz).

While the ears of mammals primarily sense pressure changes, the lateral line systems and ears of fish can also sense movement of particles directly. Particle motion refers to the vibrations of the molecules around an equilibrium state and can be quantified by measuring either velocity or acceleration of the particles.

Water is an excellent medium for sound transmission because of its high molecular density. Sound travels almost five times faster through sea water than through air (about 1500 vs. 300 m/s), and low frequencies can travel hundreds of kilometres with little loss in energy[15], thereby enabling long distance communication, but also a long-distance impact of noise on aquatic animals[16]. Sound propagation is affected by four main factors: the frequency of the sound, water depth, and density differences within the water column, which vary with temperature and pressure. Therefore the sound arriving at an animal is subject to propagation conditions that can be quite complex, which can in turn significantly affect the characteristics of arriving sound energy[17].

---

14 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

15 Urick, R.J. 1983. Principles of Underwater Sound. McGraw-Hill Co, New York.

16 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

17 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

Sound levels or sound pressure levels (SPL) are referred to in decibels (dB). However, the dB is not an absolute unit with a physical dimension, but is instead a relative measure of sound pressure with the lower limit of human hearing corresponding to 0 dB in air. Underwater dB-levels are different from above water dB-levels[18]. Sound pressure levels above water are referenced to 20 µPa, while underwater they are referenced to 1 µPa[19]. There are different measurements and units to quantify the amplitude and energy of the sound pressure level[20] [21]:

- **Peak-to-peak** (p-p) is the difference of pressure between the maximum positive pressure and the maximum negative pressure in a sound wave. Peak-to-peak SPLs are usually used to describe short, high intensity sounds where the rms-sound pressure value could underestimate the risk of acoustic trauma;
- The **root-mean-square**-(RMS) value is calculated as the square-root of the mean-squared pressure of the waveform. RMS sound values can change significantly depending on the time duration of the analysis. The values of a continuous signal measured in RMS or in peak value usually differ by 10-12 dB;
- The **Spectrum** of a sound, provides information on the distribution of the energy contained in the signal or the 'frequency content' of a sound. The term bandwidth describes the frequency range of sound. A normalised bandwidth of 1 Hz is standard practice in mathematical analysis of sound, while 1/3 octave bandwidths are most common in physical analysis. Spectra therefore need some indication of the analysis bandwidth;
- The **Sound Exposure Level** (SEL) is a measure of the energy of a sound and depends on both amplitude and duration. SELs are considered useful when making predictions about the physiological impact of noise.
- **Transmission loss** refers to the loss of acoustic power with increasing distance from the sound source. Sound pressure diminishes over distance due to the absorption and geometrical spreading of waves. In an ideal scenario, without reflections or obstacles, the sound pressure diminishes by a factor of 1 over the considered distance (1/r, where r = radius from the source). In realistic scenarios, due to differing layers of water, the propagation of sound and its attenuation may be very different. For example, the reduction of sound pressure could diminish if the sound is channelled due to seabed topography and/or water column stratification. The effects of topography and the characteristics of the water column can induce very complex situations[22], which should be taken into account when establishing

18 Finfer, D.C. et al. (2008) Issues relating to the use of 61.5 conversion factor when comparing airborne and underwater anthropogenic noise levels. Appl. Acoust. 69, 464–471

19 micro-Pascal or one millionth of one Pascal (1 Pascal is equal to the force of 1 Newton applied uniformly over the surface of 1 square metre and is abbreviated 1 Pa)

20 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp.

21 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029.

22 Bain, D.E. & Williams, R. 2006: Long-range effects of airgun noise on marine mammals: Responses as a function of received sound level and distance. – IWCSC/ 58E35.

correct measurements of sound impacts. Absorption losses are negligible for low frequencies (<1 kHz) but can be significant for high frequencies;

- **Source Levels** (SL) describe the level of sound pressure referred to the nominal distance of 1 metre from the source[23].

There is currently no scientific consensus for expressing sound levels in marine acoustics. Ideally all values should be converted to the same values (points) of reference, averaged in the same time intervals and this should be expressed in all measures[24]. RMS values are useful for relatively long sounds but less effective for brief sounds such as pile-driving strikes and echolocation clicks of whales[25]. Peak-to-peak values in the amplitude waveform provide an alternative measure, but comparisons between peak-to-peak and RMS levels are difficult[26].

Lastly, it is important to define the terms 'sound', 'noise' and 'signal'. Sound is an allusive term for any acoustic energy. Noise is a type of unwanted sound for the receiver. The opposite of noise is a signal; i.e. a sound that contains some useful or desirable information. A particular sound can therefore be noise to one receiver and a signal to others[27].

NATURAL UNDERWATER NOISE

There is a range of natural sound sources in the marine environment which can be of physical or biological origin. Natural physical phenomena that contribute to underwater ambient noise include wind, waves, and swell patterns; bubbles; currents and turbulence; earthquakes; precipitation and ice cover and activity[28]. There are also specific acoustic events such as sub-sea volcanic eruptions, earthquakes and lightning strikes with the potential to affect marine life. Wind-driven waves are the dominant natural physical noise source in the marine environment. In the absence of anthropogenic and biological sound ambient noise is wind dependent over an extremely broad frequency band from below 1 Hz to at least 100 kHz[29]. In the open ocean underwater noise levels can be increased by more than 20 dB (10 Hz to 10 kHz band) by spilling

---

23 Urick, R.J. 1983. Principles of Underwater Sound. McGraw-Hill Co, New York.

24 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

25 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

26 Madsen, R.T. (2005) Marine mammals and noise: Problems with root mean square sound pressure levels for transients. J. Acoust. Soc. Am. 117, 3952–3957

27 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

28 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124.

29 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124.

and plunging breakers[30] while precipitation can raise ambient noise levels by up to 35 dB across a broad band of frequencies (100 Hz to more than 20 kHz)[31]. Closer to shore sounds from pack ice cracking may increase underwater noise levels by as much as 30 dB. Seismic waves from undersea earthquakes can be up to 30–40 dB above ambient noise levels, with a sharp onset, and can last from a few seconds to several minutes[32].

Marine mammals (cetaceans and pinnipeds) produce sounds that are used for communication, orientation and navigation, and foraging. Sounds range from the 10 Hz low-frequency calls of blue whales to the ultrasonic clicks of more than 200 kHz in certain offshore dolphins[33]. Source levels of click sounds used by sperm whales in navigation and foraging can be as high as 235 dB re 1µPa peak-to-peak[34]. Baleen whales use low frequency sound for long distance communication[35] over hundreds of kilometres[36][37]. Most toothed whales (odontocetes) emit three main types of sounds; tonal whistles, short duration pulsed sounds used for echolocation and less distinct pulsed sounds such as cries, grunts or barks[38]. Odontocete echolocation clicks are highly directional forward-projecting pulsed sounds of high intensity and frequency. Some species of seal produce strong underwater sounds that may propagate for great distances[39]. Many marine fish species produce sound for communication[40]. The low frequency sounds created by fish can make a significant contribution to ambient noise[41]. Fish can produce sounds as individuals, but

30 Wilson, O.B. Jr., Wolf, S.N. and Ingenito, F. 1985. Measurements of ambient noise in shallow water due to breaking surf. J. Acoust. Soc. Am. 78: 190-195.

31 Nystuen, J.A. and Farmer, D.M. 1987. The influence of wind on the underwater sound generated by light rain. J. Acoust. Soc. Am. 82: 270-274

32 Shreiner et al., 1995

33 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

34 Møhl , B., Wahlberg, M., Madsen, P.T., Heerfordt, A., and Lundt, A. (2003). The mono-pulse nature of sperm whale clicks. J. Acoust. Soc. Am., 114: 1143-1154.

35 Tyack, P. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. Journal of Mammalogy 89: 549-558.

36 Stafford, K. M., C. G. Fox, and D. S. Clark. 1998. Long-range acoustic detection and localization of blue whale calls in the northeast Pacific. Journal of the Acoustical Society of America 104:3616–3625

37 Watkins, W. A., et al.,. 2000. Whale call data for the North Pacific: November 1995 through July 1999 occurrence of calling whales and source locations from SOSUS and other acoustic systems. Woods Hole Oceanographic Institution Technical Report 2000– 02:1–156.

38 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp (Table 7.2)

39 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

40 Bass, A. H. & Ladich, F. (2008). Vocal–acoustic communication: From neurons to brain. In Fish Bioacoustics (Webb, J. F., Fay, R. R. & Popper, A. N., eds), pp. 253–278. New York: Spinger Science+Business Media, LLC.

41 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

also in choruses[42] and the increase in low-frequency noise can be as much as 20 - 30 dB in the presence of chorusing fishes[43]. The dominant source of ambient noise in tropical and sub-tropical waters are snapping shrimp, which can increase ambient noise levels by 20 dB in the mid-frequency band[44]. In addition to shrimp a number of other invertebrates contribute to ambient reef noise, including squid[45], crabs[46], lobsters[47] and urchins[48].

THE IMPORTANCE OF SOUND FOR MARINE ORGANISMS

Sound is an important sensory modality for many marine animals[49]. The distinctive properties of underwater sound mentioned previously and the limitations of other senses such as vision, touch, taste and smell in the marine environment in terms of range and speed of signal transmission mean that sound is the preferential sensory medium for a large proportion of marine animals. A range of marine taxa, including marine mammals, many fish and some invertebrates has developed special organs and mechanisms for detecting and emitting underwater sound. To maximise the use of the underwater acoustic environment marine mammals have developed broader hearing frequency ranges than are typically found in terrestrial mammals[50]. Marine fish possess two sensory systems for acoustic and water motion detection; the inner ear and the lateral line system. Marine fauna utilise and hear underwater sound in different ways[51]. Baleen whales, most fishes, sea turtles, and invertebrates hear best at lower frequencies, while the dolphins and porpoises, those species that have been studied, can hear ultrasonic frequencies

42 Cato DH, McCauley RD. 2002. Australian research in ambient sea noise. Acoust Aust 30:13–20

43 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

44 Ibid

45 Iversen, R.T.B., Perkins, P.J., Dionne, R.D. 1963. An indication of underwater sound production by squid. Nature 199, 250–251.

46 Burkenroad, M.D., 1947. Production of sound by the Fiddler Crab, Uca pugilator Bosc, with remarks on its nocturnal and mating behavior. Ecology 28, 458–462.

47 Patek, S.N., 2001. Spiny lobsters stick and slip to make sound. Nature 411, 153.

48 Radford, C., Jeffs, A., Tindle, C., Montgomery, J.C., 2008. Resonating sea urchin skeletons create coastal choruses. Mar. Ecol. Prog. Ser. 362, 37–43.

49 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

50 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124.

51 Tasker, M.L, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

above human hearing range[52 53 54 55 56]. Marine fishes and invertebrates are also sensitive to acoustic particle motion, in addition to acoustic pressure, to assess their environment[57 58].

Almost all marine vertebrates rely to some extent on sound for a wide range of biological functions, including the detection of predators and prey, communication and navigation[59 60]. Marine mammals use sound as a primary means for underwater communication and sensing[61]. They emit sound to communicate about the presence of danger, food, a conspecific or other animal, and also about their own position, identity, and reproductive or territorial status[62]. Underwater sound is especially important for odontocete cetaceans that have developed sophisticated echolocation systems to detect, localise and characterise underwater objects[63], for example, in relation to coordinated movement between conspecifics and feeding behaviour.

Fish utilize sound for navigation and selection of habitat, mating, predator avoidance and prey detection and communication[64]. Impeding the ability of fish to hear biologically relevant sounds might interfere with these critical functions and use of the 'acoustic scene' or 'soundscape'[65] to learn about the overall environment[66]. Larval stages of coral reef fish can detect and are attracted

52 Budelmann, B.U. 1992. Hearing in crustaceans. Pp. 131 – 139 in D.B. Webster, R.R. Fay, and A.N.Popper, eds. The Evolutional Biology of Hearing. New York, New York: Springer-Verlag.

53 Wartzok, D., and Ketten, D.R. 1999. Marine mammal sensory systems. Pp. 117-175 in J.E. Reynolds and S.A. Rommel (eds.) Biology of Marine Mammals. Washington, D.C., Smithsonian Institution Press.

54 Bartol, S.M., and Musick, J.A. 2003. Sensory biology of sea turtles. Pages 79 – 102 in P.L. Lutz, J.A. Musick, and J. Wyneken , (eds.) The biology of sea turtles, Volume II. Washington, D.C, CRC Press.

55 Au, W.W.L., and Hastings, M.C. 2008. Principles of Marine Bioacoustics. New York, New York: Springer. 679pp

56 Webb, J.F., Popper, A.N. and Fay, R.R. (eds.) 2008. Fish bioacoustics. New York, New York: Springer. 318pp.

57 Packard, A., Karlsen, H.E. and Sand, O. 1990. Low frequency hearing in cephalopods. Journal of Comparative Physiology, Part A, 166: 501 – 505.

58 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

59 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

60 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

61 Wartzok, D., and Ketten, D.R. 1999. Marine mammal sensory systems. Pp. 117-175 in J.E. Reynolds and S.A. Rommel (eds.) Biology of Marine Mammals. Washington, D.C., Smithsonian Institution Press.

62 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

63 Au, W.W.L. 1993. The sonar of dolphins. Springer-Verlag, New York. 277p.

64 Simpson, S.D., Meekan, M.G., Montgomery, J., McCauley, R.D., Jeffs, A., 2005a. Homeward sound. Science 308, 221–228

65 Slabbekoorn, H. and Bouton, N. (2008) Soundscape orientation: a new field in need of sound investigation. Anim. Behav. 76, e5–e8.

to the sound of coral reefs thereby using reef noise as an acoustic cue for orientation[67]. Although the study of invertebrate sound detection is still rather limited, many species have mechano-sensors that have some resemblance to vertebrate ears[68] and based on the information available it is becoming clear that many marine invertebrates are sensitive to sounds and related stimuli[69]. This has been demonstrated in tropical waters where crustacean and coral larvae can respond to acoustic cues (reef noise)[70] [71]. It is also emerging that different habitats within shallow coastal environments can be characterised by the acoustic signals they produce[72] and that juvenile fish can use these signals to detect different habitats within coral reefs[73].

THE INCREASE IN ANTHROPOGENIC UNDERWATER SOUND

Over the past one hundred years there has been an unprecedented increase in the amount of anthropogenic noise emitted within the marine environment[74]. During this time the oceans have become more industrialised and noise levels associated with human activities have increased[75]. Long-term measurements of ocean ambient sound have revealed that low frequency anthropogenic noise has been increasing (Figure 1) and has been primarily attributed to commercial shipping noise[76] [77]. Combining this information with data from other studies[78], it has

66 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243

67 Simpson, S.D.,Meekan, M.G.,McCauley, R.D., Jeffs, A., 2004. Attraction of settlement-stage coral reefs fishes to ambient reef noise. Mar. Ecol. Prog. Ser. 276, 263–268

68 Popper, A.N. 2003. Effects of Anthropogenic Sounds on Fishes. Fisheries, 28 no 10: 24-31.

69 Moriyasu et al., 2004. Effects of seismic and marine noise on invertebrates: A literature review. Canadian Science Advisory Secretariat. Research document 2004/126

70 Vermeij MJA, Marhaver KL, Huijbers CM, Nagelkerken I, Simpson SD (2010) Coral Larvae Move toward Reef Sounds. PLoS ONE 5(5): e10660. doi:10.1371/ journal.pone.0010660

71 Simpson SD, Radford AN, Tickle EJ, Meekan MG, Jeffs AG (2011) Adaptive Avoidance of Reef Noise. PLoS ONE 6(2): e16625. doi:10.1371/ journal.pone.0016625

72 Kennedy EV, Guzman HM, Holderied MW, Mair JM, Simpson SD (2010) Reef generated noise provides reliable information about habitats and communities: evidence from a Panamanian case study. J Exp Mar Biol Ecol 395: 85–92

73 Radford CA, Stanley JA, Simpson SD, Jeffs AG (2011) Juvenile coral reef fishes use sound to locate habitats. Coral Reefs, 30:295-305

74 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

75 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

76 Andrew RK, Howe BM, Mercer JA, Dzieciuch MA (2002) Ocean ambient sound: comparing the 1960s with the 1990s for a receiver off the California coast. Acoust Res Lett Online 3:65–70

77 McDonald MA, Hildebrand JA, Wiggins SM, Ross D (2008) A fifty year comparison of ambient ocean noise near San Clemente Island: a bathymetrically complex coastal region off southern California. J Acoust Soc Am 124:1985–1992

78 Ross D. 1976. Mechanics of underwater noise. Pergamon Press, New York

been suggested that low frequency ambient noise has increased by at least 20 dB from pre-industrial conditions to the present[79]. Over the past 50 years the size of the global commercial shipping fleet has almost tripled while the total gross tonnage has increased by a factor of six[80]. In terms of the volume of cargo transported by sea, this has been approximately doubling every 20 years[81]. As well as an increase in commercial shipping the last half century has also seen an expansion of industrial activities in the marine environment including oil and gas exploration and production, commercial fishing and more recently the development of marine renewable energy.

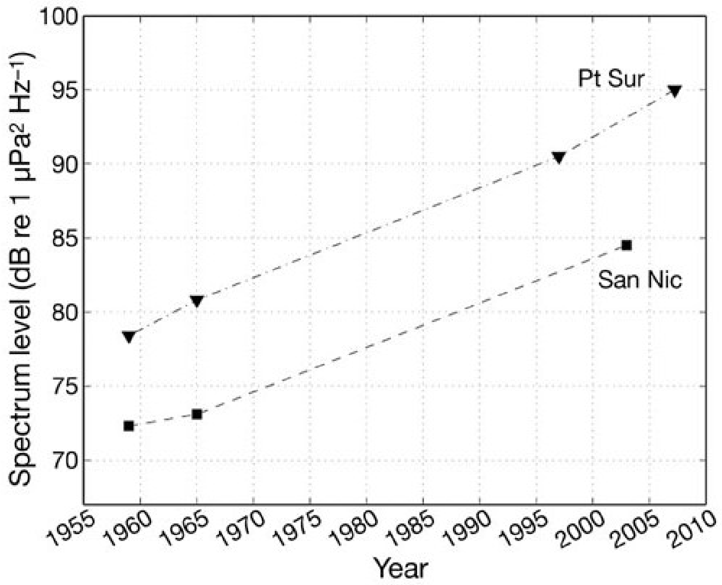


Figure 1. Historical ambient noise data from the North-eastern Pacific at 40 Hz suggest an increase of about 3 dB decade^{-1} averaged over the past 40 years. Data from the United States Navy hydrophone arrays near Point Sur and San Nicolas Island[82] [83] [84] and from recent measurements at these sites[85] [86] [87] (Adapted from Hildebrand, 2009)

---

79 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

80 Ibid

81 http://www.marisec.org/shippingfacts/worldtrade/volume-worldtrade-sea.php

82 Wenz GM. 1961. Periodic variations in low-frequency underwater ambient noise levels. Report 1014, Navy Electronic Laboratory, San Diego, CA

83 Wenz GM (1968) Properties of deep-water, low-frequency, ambient noise west of San Diego, California. TP 39, Naval Undersea Warfare Center, San Diego, CA

84 Wenz GM (1969) Low-frequency deep-water ambient noise along the Pacific Coast of the United States. US Navy J Underw Acoust 19:423–444

85 Andrew RK, Howe BM, Mercer JA, Dzieciuch MA (2002) Ocean ambient sound: comparing the 1960s with the 1990s for a receiver off the California coast. Acoust Res Lett Online 3:65–70

86 McDonald MA, Hildebrand JA, Wiggins SM (2006) Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. J Acoust Soc Am 120: 711–718

In coastal areas the increase in the number of small vessels is also a cause for localised concern where they can dominate some coastal acoustic environments such as partially enclosed bays, harbours and estuaries[88].The vast majority of these vessels also use high-frequency sonar for navigation and fish-finding. The use of mid and low frequency active sonar during military exercises has expanded since their introduction in the 1960's and 1980's respectively.

87 Cocker P (2008) Observations of ocean ambient noise (10 Hz to 10 kHz) at the site of a former navy listening station to the west of Point Sur, California, from January to July of 2007. Masters of Science, Naval Postgraduate School, Monterey, CA

88 Kipple B, Gabriele C (2003) Glacier Bay watercraft noise. Technical Report NSWCCDE-71-TR-2003/522, prepared for Glacier Bay National Park and Preserve, Naval Surface Warfare Center, Bremerton, WA

II. SOURCES AND TYPES OF UNDERWATER ANTHROPOGENIC NOISE

Human activity in the marine environment is an important component of oceanic background noise[89] and can dominate the acoustic properties of coastal waters and shallow seas. Human activities introduce sound into the marine environment either intentionally for a specific purpose (e.g., seismic surveys using air guns for deep sub-bottom imaging of geological structures) or unintentionally as a by-product of their activities (e.g., shipping or construction)[90]. The main sources of anthropogenic sound in the marine environment and their acoustic properties are provided in Table 1.

Table 1. Main Sources of Anthropogenic Sound in the Marine Environment (Adapted from Hildebrand 2009 and OSPAR 2009) (Omni = omnidirectional; CW = Continuous Wave; rms = root mean square; ADD = Acoustic Deterrent Device; AHD = Acoustic Harassment Device)

Sound Source	Source Level (dB re 1 µPa-m)	Bandwidth (Hz)	Major amplitude (Hz)	Duration (ms)	Directionality
Ship shock trials (10000 lb	304	0.5 - 50	-	2000	Omni
TNT	272 – 287 Peak	2 - 1000	6 - 21	~ 1 - 10	Omni
Air-gun array	260 – 262 P-to-P	10 – 100 000	10 - 120	30 - 60	Vertically focused
Military sonar mid-frequency	223 – 235 Peak	2800 - 8200	3 500	500 - 2000	Horizontally focused
Pile driving	228 peak / 243 – 257 P-	20 - >20 000	100 - 500	50	Omni
Military sonar low-frequency	235 Peak	100 - 500	-	600 - 1000	Horizontally focused
Echosounders	235 Peak	Variable	Variable 1500 – 36	5 - 10	Vertically focused
ADDs / AHDs	132 – 200 Peak	5000 – 30 000	5000 – 30 000	Variable 15 –	Omni
Large vessels	180 – 190 rms	6 - > 30 000	> 200	CW	Omni
Small boats and ships	160 – 180 rms	20 - > 1000	> 1000	CW	Omni
Dredging	168 – 186 rms	30 - > 20 000	100 - 500	CW	Omni
Drilling	145 – 190 rms	10 – 10 000	< 100	CW	Omni
Acoustic telemetry SIMRAD HTL 300	190	25000 – 26500	-	CW	90 x 360°
Wind turbine	142 rms	16 – 20 000	30 - 200	CW	Omni

89 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

90 Tasker, M.L, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

Tidal and wave energy	165 – 175 rms	10 – 50 000	-	CW	Omni

At the source, anthropogenic noise can be broadly split into two main types: impulsive and non-impulsive sounds[91]. Impulsive sound sources are typically brief, have a rapid rise time (large change in amplitude over a short time), and contain a wide frequency range, which is commonly referred to as broadband[92]. Impulsive sounds can either be a single event or are repetitive and sometimes as a complex pattern. Non-impulsive signals can be broadband or more tonal (containing one or few frequencies), brief or prolonged, continuous or intermittent, and do not have the rapid rise time (typically only small fluctuations in amplitude) characteristic of impulsive signals[93]. Examples of impulsive sounds are those from explosions, air guns, or impact pile driving, while non-impulsive sounds result from activities such as shipping, construction (e.g., drilling and dredging), or renewable energy operations. There have been a number of reviews of the physics associated with the various sound sources[94] [95] and also of the acoustic and other characteristics of each source[96] [97] [98]. A summary of each type of anthropogenic sound source is presented below.

EXPLOSIVES

Explosives are used for several purposes in the marine environment including construction, the removal of unwanted structures, ship shock trials, military warfare or practise and small charges to deter marine mammals (seal bombs), catch fish (blast fishing) or for coral mining[99]. Underwater explosions are one of the strongest point sources of anthropogenic sound in the marine environment. For example the large amount of explosives used in naval ship shock trials can produce a total Source Level of more than 300 dB (Table 1). Sound from explosions propagates equally in all directions and can be detected over great distances, sometimes across

91 Ibid

92 ANSI (American National Standards Institute) 1986. Methods of Measurement for Impulse Noise (ANSI S12.7-1986). New York: Acoustical Society of America. 14pp

93 ANSI (American National Standards Institute). 1995. Bioacoustical Terminology (ANSI S3.20-1995). New York: Acoustical Society of America.

94 Urick, R.J. 1983. Principles of Underwater Sound. McGraw-Hill Co, New York.

95 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

96 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

97 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

98 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

99 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

ocean basins. Underwater transmission of explosions is complex with an initial shock pulse followed by a succession of oscillating bubble pulses. Source levels can vary with the type and amount of explosives used, the water depth at which the explosion occurs and usually range from 272 to 287 dB re 1 µPa zero to peak at 1 m distance (1 - 100 lb. TNT)[100].

INDUSTRIAL ACTIVITIES

Marine construction and industrial activities include pile driving, dredging, cable laying, drilling, the operation of offshore wind farms and hydrocarbon production facilities, and the use of explosives in construction and decommissioning[101]. These activities typically produce noise that has the most energy at low frequencies (20 – 1000 Hz)[102].

Pile driving is used for harbour works, bridge construction, oil and gas platform installations, and in the construction of offshore wind farm foundations. The noise produced enters the water column directly but also travels through the seabed with sound propagation varying according to the type of seabed[103]. Source levels can vary depending on the diameter of the pile and the method of pile driving (impact or vibropiling) and can reach 250 dB re 1 µPa peak to peak at 1m[104]. The frequency spectrum ranges from less than 20 Hz to more than 20 kHz with most energy around 100 - 200 Hz (Table 1).

Drilling is done from natural or man-made islands, platforms, and drilling vessels (semi-submersibles and drilling ships), producing almost continuous noise. Underwater noise levels from natural or manmade islands have been reported to be moderate (SL ~ 145 dB re 1 µPa at 1 m or less) with the main frequency content below 100 Hz[105]. Noise from fixed drilling platforms is slightly lower; e.g., 115 - 117 dB re 1 µPa at 405 and 125 metres respectively[106]. Drilling from drill-ships produces the highest levels with a maximum broadband source level of about 190 dB re 1 µPa rms at 1 m (10 Hz - 10 kHz)[107]. The ships use thrusters to remain in position, resulting in a mixture of propeller and drilling noise[108].

100 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

101 Ibid

102 Greene CR Jr (1987) Characteristics of oil industry dredge and drilling sounds in the Beaufort Sea. J Acoust Soc Am 82:1315–1324

103 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

104 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

105 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

106 McCauley (1998). Radiated underwater noise measured from the drilling rig 'Ocean General', rig tenders 'Pacific Ariki' and 'Pacific Frontier', fishing vessel 'Reef Venture' and natural sources in the Timor Sea, Northern Australia. Report prepared for Shell Australia, 54 pp.

107 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

108 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

Dredging in the marine environment is undertaken to maintain shipping lanes, extract geological resources such as sand and gravel and to route seafloor pipelines. The activity emits continuous broadband sound during operations, mostly in the lower frequencies. One study estimated source levels ranged from 160 to 180 dB re 1 μPa at 1 m (maximum ~ 100 Hz) with a bandwidth between 20 Hz and 1 kHz[109]. Measurement of the sound spectrum levels emitted by an aggregate dredger indicated that most energy was below 500 Hz[110].

Offshore wind farms create low-frequency noise at high source levels during their construction (e.g., pile driving), but at moderate source levels during their operation[111]. Operational source levels of offshore wind farms depend on construction type, size, environmental conditions (i.e. depth, topography, sediment structure, hydrography), wind speed, and probably also the size of the wind farm[112]. Noise produced during operations has been measured from single turbines (maximum power 2 MW). Most of the sound generated was pure tones below 1 kHz, and mainly below 700Hz[113]. Operational sounds of an offshore turbine (1.5 MW) in shallow (5-10 m) waters at moderate to strong wind speeds of 12 m s^{-1} were sound pressure levels between 90 and 112 dB re 1 μPa at 110 m with most energy at 50, 160 and 200 Hz[114]. Recent measurements on four offshore wind farms (2 - 3 MW) confirmed rather low broadband received sound pressure levels (114 - 130 dB re 1 μPa) inside wind farm areas with a maximum difference in SPL to outside the wind farm of 8 dB re 1 μPa[115]. The highest source level reported for the tonal noise component during turbine operation is 151 dB re 1 μPa at 1 m, for a wind speed of 13 m s^{-1}, and at a frequency of 180 Hz[116]. There will also be some noise from maintenance (including vessels) and repair work.

Offshore tidal and wave energy turbines are a relatively recent technological development and there is currently limited information available on the acoustic signatures of these activities. Tidal turbines appear to emit broadband noise covering a frequency range from 10 Hz up to 50

109 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

110 Defra/Department for Environment, Food and Rural Affairs (2003). Preliminary investigation of the sensitivity of fish to sound generated by aggregate dredging and marine construction. Project AE0914 Final Report.

111 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

112 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

113 Madsen, P.T., Wahlberg, M., Tougaard, J., Lucke, K. and Tyack, P. (2006). Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. Mar. Ecol. Progr. Ser. 309, 279-295

114 Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006). Effects of offshore wind farm noise on marine mammals and fish, COWRIE Ltd, Newbury, U.K.

115 Nedwell, J.R. Parvin, S.J., Edwards, B., Workman, R., Brooker, A.G. and Kynoch, J.2010. Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Report for COWRIE, Newbury, UK

116 Wahlberg M, Westerberg H (2005) Hearing in fish and their reactions to sounds from offshore wind farms. Mar Ecol Prog Ser 288:295-309

kHz with significant narrow band peaks in the spectrum[117]. Depending on size, it is likely that tidal current turbines will produce broadband source levels of between 165 and 175 dB re 1μ Pa[118].

SEISMIC EXPLORATION

Marine seismic surveys are primarily used by the oil and gas industry for exploration but are also used to gather data for academic and governmental needs. There are >90 seismic vessels available globally[119], and roughly 20% of them are conducting field operations at any one time[120].

Essentially, a seismic or seabed survey involves directing a high energy sound pulse into the sea floor and measuring the pattern of reflected sound waves. A range of sound sources may be used depending, amongst other things, on the depth of penetration required; these include: air guns, 'sparkers', 'boomers', 'pingers' and 'chirp sonar'[121]. The main sound-producing elements used in oil exploration are air-gun arrays, which are towed from marine vessels[122]. Air guns release a volume of air under high pressure, creating a sound wave from the expansion and contraction of the released air bubble[123]. To yield high acoustic intensities, multiple air guns (typically 12 to 48) are fired with precise timing to produce a coherent pulse of sound. During a survey, guns are fired at regular intervals (e.g., every 10 to 15 seconds), as the towing source vessel moves ahead. Seismic air guns generate low frequency sound pulses below 250 Hz with the strongest energy in the range 10-120 Hz and peak energy between 30 to 50 Hz. Air guns also release low amplitude high-frequency sound, and acoustic energy has been measured up to 100 kHz[124]. The low frequency energy (10 to 120 Hz) is mainly focused vertically downwards, but higher frequency components are also radiated in horizontal directions.

The power of air-gun arrays has generally increased during the past decades, as exploration has moved into deeper waters. The nominal source level of an air-gun array can reach up to 260-262 dB (p-p) re 1 μPa @ 1m[125]. Sound signals from seismic air-gun surveys can be received thousands of kilometres away from the source if spread in a sound channel. Autonomous acoustic seafloor recording systems on the central mid-Atlantic Ridge showed year-round

117 Parvin, S. J., R. Workman, P. Bourke, and J. R. Nedwell. 2005. Assessment of tidal current turbine noise at Lybmouth site and predicted impact of underwater noise in Strangford Lough

118 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

119 Schmidt V (2004) Seismic contractors realign equipment for industry's needs. Offshore 64:36–44

120 Tolstoy M, Diebold JB, Webb SC, Bohnenstiehl DR, Chapp E, Holmes RC, Rawson M (2004) Broadband calibration of R/V Ewing seismic sources. Geophys Res Lett 31:L14310

121 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

122 Dragoset W (2000) Introduction to air guns and air-gun arrays. Geophys Lead Edge Explor 19:892–897

123 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

124 Goold, J.C. & Coates, R.F.W. 2006: Near Source, High Frequency Air-Gun Signatures. IWCSC/ 58/E30.

125 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

recordings of air-gun pulses from seismic surveys conducted more than 3000 km away[126]. Low-frequency energy can also travel long distances through bottom sediments, re-entering the water far from the source[127].

Sparkers and boomers are high-frequency devices that are generally used to determine shallow features in sediments. These devices may also be towed behind a survey vessel, with their signals penetrating several hundred (sparker) or tens (boomer) of metres of sediments due to their relatively higher frequency spectrum and lower transmitted power. Typical source levels can be 204 - 210 dB (rms) re 1 µPa @ 1 m[128]. Chirp sonars also produce sound in the upper frequency range of seismic devices (approx. 0.5 to 12 kHz). The peak source level for these devices is about 210 – 230 dB re 1 µPa @ 1 m[129].

SONAR

The use of acoustic energy for locating and surveying is described as active sonar. Sonar was the first anthropogenic sound to be deliberately introduced into the oceans on a wide scale. There are a variety of types of sonars that are used for both civilian and military purposes. They can occur across all sound frequencies and are divided in this section into low (<1 kHz), mid (1 to 10 kHz) and high frequency (>10 kHz). Military sonars use all frequencies while civilian sonar uses some mid but mostly high frequencies. Most types of sonar operate at one frequency of sound, but generate other unwanted frequencies (e.g., harmonics of the fundamental frequency due to non-linear processes). These extraneous lower intensity frequencies are rarely described but may have wider effects than the main frequency used, especially if they are at low frequencies which propagate further underwater[130].

Low-frequency sonar

Low-frequency active (LFA) sonars are used for broad-scale military surveillance, designed to provide the sound source over scales of hundreds of kilometres for other passive listening platforms to detect submarines[131]. Specialized support ships are used to deploy LFA sonars, which consist of arrays of source elements suspended vertically below the ship. The United States Navy's Surveillance Towed Array Sensor System (SURTASS) LFA sonar uses an array of up to 18 projectors operating in the frequency range from 100 to 500 Hz, with a 215 dB re 1 µPa

126 Nieukirk, S.L., Stafford, K.M., Mellinger, D.K., Dziak, R.P. & Fox, C.G. 2004: Low-frequency whale and seismic airgun sounds recorded from the mid-Atlantic Ocean. – J. Acoust. Soc. Am., 115(4), 1832–184.

127 McCauley, R.D., Hughes, J.R. 2006: Marine seismic mitigation measures – perspectives in 2006. IWC SC/58/E44. 10 pp.

128 CCC/California Coastal Commission 2002: Consistency Determination. No. CD-14-02, USGS,2002 Southern California seismic survey. (In OSPAR 2009)

129 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

130 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

131 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

@ 1 m source level for each projector[132]. These systems are designed to project beams of energy in a horizontal direction, with a vertical beam width that can be steered above or below the horizontal. The effective source level of an LFA array can be 235 dB re 1 μPa @ 1 m or higher[133]. The signal includes both constant-frequency (CF) and frequency-modulated (FM) components with bandwidths of approximately 30 Hz[134]. A ping sequence can last 6 to 100 s, with a time between pings of 6 to 15 min and a typical duty cycle of 10%. Signal transmissions are emitted in patterned sequences that may last for days or weeks. In 2009 there were 2 LFA source ships, with a proposed expansion to 4 ships in 2011[135].

Mid-frequency sonar

Military mid-frequency sonars at high source levels are used for detecting submarines at moderate range (<10 km). There are about 300 mid-frequency sonars in active service in the world's navies[136] (Watts 2003). A US Navy hull-mounted system (AN/SQS-53C) sonar system uses pulses in the 2 – 10 kHz range (normally 3.5 kHz) and can operate at source levels of 235 dB re 1 μPa @ 1m. Another system (AN/SQS-56) uses this same frequency band but with lower source levels (223 dB re 1 μPa @ 1m)[137]. These systems were formerly used mainly in offshore waters, but now also scan shallower inshore environments to detect submarines that are able to operate closer to shore[138].

Some non-military sonars also operate in the mid-frequency band. Bathymetric sonars use these frequencies for wide-area, low resolution surveys. For example, the Fugro Seafloor survey model SYS09 uses both 9 and 10 kHz transducers operated at 230 dB re 1 μPa at 1m[139]. Sub-bottom profilers produce a mid-frequency (3 to 7 kHz) and high source level (230 dB re 1 μPa at 1 m) pulse, to map seafloor sediment layers and buried objects[140].

High-frequency sonar

132 Anonymous (2007) Final supplemental environmental impact statement for surveillance towed array sensor system low frequency active (SURTASS LFA) sonar, Vols 1 and 2. Department of the Navy, Chief of Naval Operations, Arlington, VA

133 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy. Available at: www.nmfs.noaa.gov/prof_res/overview/Interim_BahamasReport.pdf

134 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

135 DoN (Department of the Navy) (2009) Notice of intent to prepare a Supplemental Environmental Impact Statement/ Supplemental Overseas Environmental Impact Statement for employment of surveillance Towed Array Sensor System Low Frequency Acrive (SURTASS LFA) sonar. Federal Register 74(12):3574–3575 (microfiche) – in Hildebrand 2009

136 Watts AJ (2003) Jane's underwater warfare systems, 15th edn. IHS Jane's, Berkshire, UK

137 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy. Available at: www.nmfs.noaa.gov/prof_res/overview/Interim_BahamasReport.pdf

138 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

139 Ibid

140 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

Military high-frequency sonars are used in attacking or defending systems and are designed to work over hundreds of metres to a few kilometres[141]. These sonars use a wide range of modes, signal types and strengths. As with other military sonars, their usage is generally confined to exercise areas. Scanning sonars and synthetic aperture sonars are used for harbour defence, underwater search and recovery[142] and high intensity seabed mapping (side-scan sonar). Frequencies between 85 and 100 kHz are used for diver/swimmer detection while 100 kHz is optimal for obtaining a high resolution of seabed features including benthic cover. Hydroacoustic sonars are used to detect the presence of living organisms and particles in oceans, lakes, and rivers[143] (Simmonds & MacLennan 2005). By transmitting sound at high frequencies (20 to 1000 kHz), hydroacoustic sonars can detect individual objects or aggregates, such as schools of fish, in the water column[144].

Civilian and commercial sonars operating at high frequencies are used for detection, localization, and classification of various underwater targets (e.g., the seabed, plankton, fish, divers)[145]. These sonars generally produce sound at lower source levels with narrower beam patterns and shorter pulse lengths than military sonars, but are more widespread due to the large number of commercial and recreational vessels that are equipped with sonar[146]. Such vessels operate mostly in shallow shelf-seas and sonar usage occurs continuously throughout the year and at both day and night. Most of the systems focus sound downwards, though some horizontal fish finders are available. Fish finding sonars operate at frequencies typically between 24 and 200 kHz, which is within the hearing frequencies of some marine mammals, but above that of most fish[147] (Figure 2). Some horizontally-acting fish finding sonars are thought to be relatively powerful. For example, the Furuno FSV-24 sonar operates at 24 kHz and can detect and track shoals of tuna up to 5 km away[148]. Bathymetric mapping sonars use frequencies ranging from 12 kHz for deep-water systems to 70-100 kHz for shallow water mapping systems[149]. Multibeam sonars operate at high source levels (e.g., 245 dB re 1 μPa at 1 m) but have highly directional beams[150].

141 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

142 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

143 Simmonds EJ, MacLennan DN (2005) Fisheries acoustics: theory and practice. Blackwell Publishing, London

144 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

145 Ibid

146 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

147 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

148 Ibid

149 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

150 Ibid

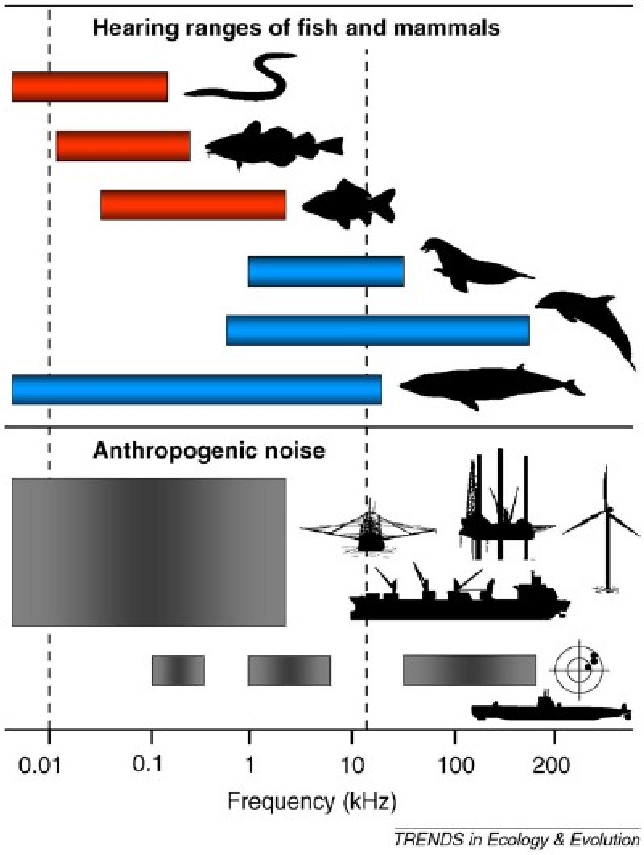


Figure 2. The main frequencies of anthropogenic noise sources and the hearing ranges of marine mammals and fish (from Slabbekorn et al., 2010)

SHIPS AND SMALLER VESSELS

Large commercial vessels

Large commercial vessels produce relatively loud and predominately low-frequency sounds. Source levels are generally in the 180 - 195 dB (re: 1µPa) range with peak levels in the 10 – 50 Hz frequency band[151 152 153]. The propulsion systems of large commercial ships are a dominant source of radiated underwater noise at frequencies <200 Hz[154]. Individual vessels produce unique acoustic signatures, although these signatures may change with ship speed, vessel load, operational mode and any implemented noise-reduction measures[155 156].

151 Arveson, P. T. and D. J. Vendittis. 2000. Radiated noise characteristics of a modern cargo ship. Journal of the Acoustical Society of America 107, 118-129.

152 Heitmeyer, R. M., S. C. Wales and L. A. Pflug. 2004. Shipping noise predictions: capabilities and limitations. Marine Technology Society Journal 37, 54-65.

153 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

154 Ross D (1976) Mechanics of underwater noise. Pergamon Press, New York

155 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

Most of the acoustic field surrounding large vessels is the result of propeller cavitation (when vacuum bubbles created by the motion of propellers collapse), causing ships at their service speed to emit low-frequency tonal sounds and (high-frequency) noise spectra up to tens of kHz quite close to vessels[157]. Smaller, but potentially significant, amounts of radiated noise can arise from on-board machinery (engine room and auxiliary equipment)[158]. Hydrodynamic flow over the ship's hull and hull attachments is an important broadband sound-generating mechanism, especially with increased ship speed[159]. There are also significant depth and aspect-related elements of radiated vessel sound fields as a function of shadowing and the Lloyd mirror effect near the surface of the water[160]. Source (propeller) depth is also important in terms of long-range propagation. Large vessels are loud near-field sources in both offshore (in shipping routes and corridors) and coastal waters (mainly in traffic lanes, waterways/canals or ports). Due to their loud and low-frequency signatures, large vessels dominate low-frequency background noise in many marine environments worldwide[161] [162].

Concerns of the acoustic impacts of noise from large vessel have focused mainly on marine animals that use low frequencies for hearing and communication (see Chapter 3). Modern cargo ships can also radiate sound at high frequencies, with source levels over 150 dB re 1µPa at 1m around 30 kHz[163]. Noise in these frequency bands has the potential to interfere (over relatively short ranges) with the communication signals of many marine mammals, including toothed whales not commonly thought of in terms of shipping noise masking[164].

Medium sized vessels

Tugboats, crewboats, supply ships, and many research vessels in the medium-sized category typically have large and complex propulsion systems, often including bow-thrusters[165]. Many

156 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

157 Ibid

158 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

159 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

160 Heitmeyer, R. M., S. C. Wales and L. A. Pflug. 2004. Shipping noise predictions: capabilities and limitations. Marine Technology Society Journal 37, 54-65.

161 Wenz, G. M. 1962. Acoustic ambient noise in the ocean: spectra and sources. Journal of the Acoustical Society of America 34, 1936-1956.

162 Greene, J., C. R. and S. E. Moore. 1995. Man-made Noise. Pp. 101-158. In J. W. Richardson, J. Greene, C.R., C. I. Malme and D. H. Thomson (eds.), Marine Mammals and Noise (Academic Press, New York).

163 Arveson, P. T. and D. J. Vendittis. 2000. Radiated noise characteristics of a modern cargo ship. Journal of the Acoustical Society of America 107, 118-129.

164 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

165 Ibid

fishing vessels also fall within this category. Typical broadband source levels for small to mid-size vessels are generally in the 165 - 180 dB (re: 1µPa) range[166 167]. Most medium-sized ships are similar to large vessels in that most of the sound energy is low-frequency band (<1 kHz). While broadband source levels are usually slightly lower for medium-sized vessels than for the larger commercial vessels, there are some exceptions (e.g., as a function of age or maintenance of the ship), and medium-sized ships can produce sounds of sufficient level and frequency to contribute to marine ambient noise in some areas[168]. Mid-sized vessels spend most of their operational time in coastal or continental shelf waters, and overlap in time and space with marine animals, many of which prefer these waters for important activities such as breeding or feeding.

Small vessels

Small boats with outboard or inboard engines produce sound that is generally highest in the mid-frequency (1 to 5 kHz) range and at moderate (150 to 180 dB re 1 µPa @ 1 m) source levels although the output characteristics can be highly dependent on speed[169 170 171]. Source spectra for small craft and boats include tonal harmonics at the resonant vibrational frequencies of propeller blades, engines, or gearboxes below about 1 kHz, as well as significant energy resulting from propeller cavitation extending up to and above 10 kHz. Due to the generally higher acoustic frequency and near-shore operation, noise from smaller vessels is regarded as having more geographically-limited environmental impacts. Small craft and boats are of less concern in terms of overall increases in low-frequency marine ambient noise from so-called ‘distant shipping’, but can dominate some coastal acoustic environments, particularly partially-enclosed bays, harbours and/or estuaries[172.] In fact, recreational vessels have been identified as the most important contributor to mid-frequency ambient noise in some coastal habitats[173]. Small vessels are also becoming faster and more common in inshore and coastal waters. When small vessel traffic spatially or temporally overlaps with marine animal distributions, particularly during sensitive life history stages, acoustic impacts from small craft may have a significant impact on populations.

166 Kipple B, Gabriele C (2004) Glacier Bay watercraft noise— noise characterization for tour, charter, private, and government vessels. Technical Report NSWCCDE-71-TR- 2004/545, prepared for Glacier Bay National Park and Preserve, Naval Surface Warfare Center, Bremerton, WA

167 Heitmeyer, R. M., S. C. Wales and L. A. Pflug. 2004. Shipping noise predictions: capabilities and limitations. Marine Technology Society Journal 37, 54-65.

168 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

169 Erbe C (2002) Underwater noise of whale-watching boats and potential effects on killer whales (*Orcinus orca)*, based on an acoustic impact model. Mar Mamm Sci 18:394–418

170 Kipple B, Gabriele C (2004) Glacier Bay watercraft noise— noise characterization for tour, charter, private, and government vessels. Technical Report NSWCCDE-71-TR- 2004/545, prepared for Glacier Bay National Park and Preserve, Naval Surface Warfare Center, Bremerton, WA

171 Jensen, F.H., et al., 2009. Vessel noise effects on delphinid communication. Mar Ecol Prog Ser 395:161-175

172 Kipple B, Gabriele C (2003) Glacier Bay watercraft noise. Technical Report NSWCCDE-71-TR-2003/522, prepared for Glacier Bay National Park and Preserve, Naval Surface Warfare Center, Bremerton, WA

173 Haviland-Howell G, Frankel AS, Powell CM, Bocconcelli A, Herman RL, Sayigh LS (2007) Recreational boating traffic: a chronic source of anthropogenic noise in the Wilmington, North Carolina Intracoastal Waterway. J Acoust Soc Am 122:151–160

ACOUSTIC DETERRENT AND HARRASSMENT DEVICES

Acoustic Harassment Devices (AHDs) have been defined as high power devices operating at broadband source levels above 185 dB re 1μPa @1m while those operating at a lower source level are termed Acoustic Deterrent Devices (ADDs)[174]. ADDs or "pingers" are generally used to deter small cetaceans from bottom-set gillnets or other fisheries in order to reduce bycatch and incidental mortality. Pingers operate at much lower source levels than AHDs; usually 130 to 150 dB re 1 μPa[175]. Acoustic characteristics of ADDs differ particularly with respect to randomisation of pulse intervals and pulse duration. However, the signal structure and source levels of pingers can be relatively consistent when they have to comply with national or regional guidelines (e.g., EU Council regulation (EC) No 812/2004). Devices falling under this regulation are known to produce either 10 kHz tones or wide-band sweeps covering a frequency range from 20 to 160 kHz. Such pingers that are based on analogue signal generation emit tones (10 kHz) at source levels (broadband) between 130 and 150 dB re 1 μPa while digital devices can either have the same specifications or produce wideband sweeps at broadband source levels of 145 dB 1 μPa[176].
Acoustic Harassment Devices (AHDs) were originally developed to prevent pinniped predation on finfish farms, fisheries or salmon runs through the production of high source level acoustic signals. AHDs emit tone pulses or pulsed frequency sweeps at high source levels and there are a wide range of AHD specifications[177] [178]. A common feature of most AHDs is that they produce substantial energy in the ultrasonic range in addition to the main frequency band. The broadband source level of most AHDs is approximately 195 dB re 1 μPa. Due to their relatively high source level and often broadband characteristics AHDs can potentially be a significant source of noise in areas of dense fish farming[179].

Fish deterrent devices (FDDs) are mainly used in coastal or riverine habitats to temporarily displace fish from areas of potential harm (e.g., guiding fish away from water intakes of power plants)[180]. There is considerable variation between devices in terms of the frequency range which depends on the fish species to be targeted. If the device needs to be effective against a broad

---

174 Reeves, R. R., R. J. Hofman, G. K. Silber, and D. Wilkinson. 1996. Acoustic deterrence of harmful marine mammal-fishery interactions: proceedings of a workshop held in Seattle Washington, 20- 22 March 1996. US Dept. Commer.

175 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

176 Ibid

177 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115 (Table 2)

178 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission (Table 8.1)

179 Johnston, D. W., and T. Woodley. 1997. A survey of Acoustic Harrassment Device (AHD) Use at Salmon Aquaculture Sites in The Bay of Fundy , New Brunswick, Canada. Aquatic Mammals 24:51-61.

180 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

range of species, relatively low or infrasonic frequencies are generally used. For example, some devices produce infrasound at frequencies of about 10 Hz[181] or between 20 and 600 Hz[182]. Other devices produce primarily ultrasonic frequencies and are specifically designed to deter high-frequency hearing specialists. FDDs for some clupeid species which have ultrasonic hearing operate at frequencies between 120 kHz and 130 kHz, with source levels up to 190 dB[183]. FDDs generally produce sequences of short pulses (e.g., 100 - 1000 ms) at intervals of one to several seconds and duty cycles up to 50%[184].

OTHER ANTHROPOGENIC SOURCES

Research sound

Ocean science studies use a variety of different sound sources to investigate the physical structure of the ocean. Ocean tomography studies measure the physical properties of the ocean using sound sources with frequencies between 50 and 200 Hz and high source levels (165 - 220 dB re 1 µPa). The "Heard Island Feasibility Test" projected signals with centre frequencies of 57 Hz in the 'SOFAR channel' (175 m depth) at source levels up to 220 re 1 µPa[185]. The signals could be detected across ocean basins with received levels up to 160 dB re 1 µPa at 1 km distance. The experiment was thought to alter the distribution and vocalisation of some cetaceans but this could not be confirmed statistically due to a small sample size[186].

Another ocean-wide experiment was the "Acoustic Thermometry of Ocean Climate" (ATOC) research programme was initiated in the early 1990s to study ocean warming across the North Pacific basin[187]. The ATOC sound source emitted coded signals at four hour intervals at source levels of 195 dB re 1 µPa for up to 20 min with a 5 minute ramp-up period[188].The research programme received considerable attention from regulatory agencies, the public, and the scientific community because of concerns about the potential impact of the sound source on

181 Knudsen, F. R., P. S. Enger, and O. Sand. 1994. Avoidance responses to low frequency sound in downstream migrating atlantic aalmon smolt, Salmo salar. Journal of Fish Biology 45:227-233.

182 Maes, J., A. W. H. Turnpenny, D. R. Lambert, J. R. Nedwell, Parmentier, and F. Ollevier. 2004. Field evaluation of a sound system to reduce estuarine fish intake rates at a power plant cooling water inlet. Journal of Fish Biology 64:938-946

183 Ross, Q. E., D. J. Dunning, J. K. Menezes, M. J. Kenna Jr., and G. Tiller. 1996. Reducing Impingement of Alewives with High Frequency Sound at a Power Plant on Lake Ontario. American Journal of Fisheries Management 16:548–559.

184 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

185 Bowles, A. E., M. Smulrea, B. Wursig, D. P. DeMaster, and D. Palka. 1994. Relative abundance and behaviour of marine mammals exposed to transmissions from the Heard Island Feasibility Test. Journal of the Acoustical Society of America 96: 2469-2484.

186 Ibid

187 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

188 HOWE, B. M. 1996. Acoustic Thermometry Of Ocean Climate (ATOC): Pioneer Seamount Source Installation. U.S. Government Technical Memo. Report Number A346903. 84 PP.

marine mammals[189]. The long time frame for operation of this experiment was a key aspect that led to concerns regarding its potential impact on marine mammals[190] [191].

Research projects also use sound to estimate current speed and direction by using drifting sources called SOFAR floats[192]. These devices drift at depth and periodically emit a high-intensity tone (195 dB re 1 µPa at 1 m) between 185 and 310 Hz. The sounds are detected by distant receivers and their timing is used to determine the float location and therefore its drift, as a proxy for deep currents[193].

Icebreakers

Ice-breaking ships are a source of noise in Polar Regions[194]. Two types of noise have been identified during ice breaking: bubbler system noise and propeller cavitation noise[195]. Some ships are equipped with bubbler systems that blow high-pressure air into the water around the ship to push floating ice away. The noise is continuous while the bubbler system is operating, with a broadband spectrum below 5 kHz. A source level of 192 dB re 1 µPa at 1 m has been reported for bubbler system noise. Icebreaker propeller cavitation noise occurs when the ship rams the ice with its propeller turning at high speed. The spectrum of propeller cavitation noise is broadband up to at least 20 kHz, and has a source level of 197 dB re 1 µPa at 1 m[196].

Acoustic telemetry

Acoustic telemetry is used for underwater communications, remote vehicle command and control, diver communications, underwater monitoring and data logging, trawl net monitoring and other industrial and research applications requiring underwater wireless communications[197].

189 NRC 2000. Marine mammals and low-frequency sound: progress since 1994. Committee to Review Results of ATOC's Marine Mammal Research Program, Ocean Studies Board, National Research Council. 160 pp.

190 Herman 1994. Hawaiian Humpback Whales and ATOC: A Conflict of Interests. The Journal of Environment Development. 3: 263-76

191 Potter, JR. 1994. ATOC: Sound Policy or Enviro-Vandalism? Aspects of a modern media-fueled policy issue. The Journal of Environment Development. 3: 47-62

192 Rossby, T., Price, J. and Webb, D.. 1986. The spatial and temporal evolution of a cluster of SOFAR floats in the POLYMODE local dynamics experiment (LDE). Journal of Physical Oceanography 16: 428-442.

193 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

194 Erbe, C and Farmer, D.M. 2000. Zones of impact around icebreakers affecting Beluga whales in the Beaufort Sea. J. Acoust. Soc. Am. 108

195 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

196 Ibid

197 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

For seafloor monitoring, acoustic modems are used as an interface for subsurface data transmissions, sending data using modulated acoustic signals between seafloor instruments and surface buoys. Long-range systems can operate over distances of up to 10 km using frequencies of 7 to 45 kHz, at source levels of up to 190 dB re 1 μPa @ 1 m. A relatively new integrated communications project is the "Acoustic Communication Network for Monitoring of Underwater Environment in Coastal Areas (ACME)". This system uses chirps of continuously varying frequencies and frequency-shift keying noise covering a frequency range of 5 - 15 kHz[198].

198 Kastelein, R. A., W. C. Verboom, M. Muijsers, N. V. Jennings, and S. van der Heul. 2005. The influence of acoustic emissions for underwater data transmission on the behaviour of harbour porpoises (*Phocoena phocoena*) in a floating pen. Marine Environmental Research 59:287-307.

III. SYNTHESIS OF SCIENTIFIC INFORMATION ON KNOWN AND POTENTIAL IMPACTS OF UNDERWATER NOISE

Underwater sound is an extremely important constituent of the marine environment and plays an integral part of the lives of most marine vertebrates[199] and also many invertebrates[200] [201]. This chapter provides a synthesis of current scientific information and thinking concerning the impacts of anthropogenic sound on marine life. Most of the information available is concerned with the effects of sound and noise on marine mammals, particularly cetaceans. Considerably less research has been completed for marine fish, other vertebrates (e.g., marine turtles) and particularly marine invertebrates.

Anthropogenic underwater noise is known to have a variety of impacts on marine species, ranging from exposures that cause no adverse impacts, to significant behavioural disturbances, to hearing loss, physical injury and mortality (Annex 1). The potential effects depend on a number of factors, including the duration, nature and frequency content of the sound, the received level (sound level at the animal), the overlap in space and time with the organism and sound source, and the context of exposure (i.e., animals may be more sensitive to sound during critical times, like feeding, breeding/spawning/, or nursing/rearing young)[202]. Adverse impacts can be broadly divided into three categories: masking, behavioural disturbance and physiological changes (hearing loss, discomfort, injury)[203] although there is some overlap between these categories. In extreme cases, where there are very high received sound pressure levels often close to the source, the intense sounds can lead to death. There have been a number of extensive reviews of the

199 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

200 Montgomery, J.C., Jeffs, A., Simpson, S.D., Meekan, M., Tindle, C., 2006. Sound as an orientation cue for the pelagic larvae of reef fishes and decapod crustaceans. Adv. Mar. Biol. 51, 143–196.

201 Simpson SD, Radford AN, Tickle EJ, Meekan MG, Jeffs AG (2011) Adaptive Avoidance of Reef Noise. PLoS ONE 6(2): e16625. doi:10.1371/ journal.pone.0016625

202 Tasker, M.L, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

203 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

impacts of anthropogenic sound on marine organisms during the last two decades[204] [205] [206] [207] [208] [209] [210] [211] [212] [213] [214]. In addition, the potential for further more subtle biological effects (e.g., physiological, developmental, cellular and genetic responses) of anthropogenic noise on mainly terrestrial animals has been suggested[215] and should be taken into consideration for the marine environment. The chronic and cumulative effects of anthropogenic noise exposure on marine species and populations also require attention[216].

This chapter will summarise current scientific knowledge and thinking on the observed and potential effects of anthropogenic noise on marine biodiversity and is divided into three main sections comprised of marine mammals, marine fish and other fauna such as further vertebrate taxa and invertebrates.

IMPACTS ON MARINE MAMMALS

---

204 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

205 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

206 NRC (2005) Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. National Research Council of the National Academies of Science, Washington, DC.

207 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

208 Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, C.R. Jr., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals, 33: 411 – 521.

209 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

210 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

211 Popper, A.N., and Hastings, M.C. 2009b. The effects of human-generated sound on fish. Integrative Zoology, 4: 43 – 52.

212 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

213 Ibid

214 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

215 Kight, C.R. and Swaddle, J.P. 2011. How and why environmental noise impacts animals: an integrative, mechanistic review. Ecology Letters doi: 10.1111/j.1461-0248.2011.01664.x

216 Wright, J.W., Deak, T. and Parsons, E.C.M. 2009. Concerns Related to Chronic Stress in Marine Mammals. IWC SC/61/E16 7 pp.

The theoretical zones of underwater noise influence on marine mammals have been defined and are mainly based on the distance between the source of the sound and the receiver[217] (Figure 3).

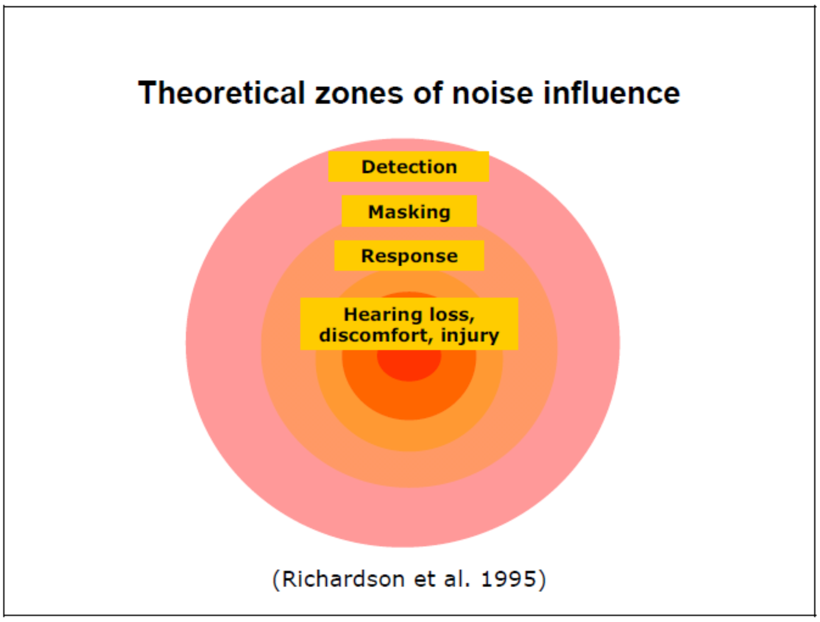


Figure 3. Theoretical zones of noise influence (after Richardson et al. 1995)

This model has been used extensively for impact assessments where the zones of noise influence are determined, based on a combination of sound propagation modelling or sound pressure level measurements and information on the hearing capabilities of marine species. However, the model gives only a very rough estimate of the zones of influence as sound in the marine environment is always three-dimensional. Interference, reflection and refraction patterns within sound propagation will also lead to considerably more complex sound fields than those based on the above model. This complexity may result in particular effects such as an increase in received sound energy with distance, especially when multiple sound sources are used simultaneously, for example during seismic surveys[218].

A INJURY AND PHYSICAL EFFECTS

Marine mammals are known to be susceptible to a range of physiological effects and injuries that have been attributed to sources of anthropogenic sound (Annex 1). The most striking evidence of serious injury to marine mammals has been accumulated in the last decade and is concerned with the impact of naval sonar on cetaceans, particularly deep diving beaked whales of the genera *Ziphius* and *Mesopolodon*, and the occurrence of mass stranding events[219 220]. Atypical mass stranding events of mainly beaked whales first began to be reported in the mid 1980's and

217 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

218 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

219 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy.

usually coincided with the use of mid-frequency active sonar by the military[221 222 223]. Necropsies of beaked whales stranded in the Bahamas in 2000 clearly revealed that the animals had suffered acoustic trauma resulting in haemorrhaging around the brain, in the inner ears and in the acoustic fats (fats located in the head which are involved in sound transmission)[224]. The official interim report for the mass stranding event concluded that an acoustic or impulse injury caused the animals to strand and that mid-frequency active sonar used by the navy while transiting was the most plausible source of the acoustic trauma or impulse[225]. Analysis of subsequent mass stranded beaked whales found acute systemic micro-haemorrhages and gas and fat emboli in individuals that mass-stranded during a naval exercise in the Canary Islands in 2002[226 227]. Similarly, four species of stranded cetacean (one beaked whale, two dolphin and one porpoise species) had acute and chronic lesions in liver, kidney and lymphoid tissue (lymph nodes and spleen) associated with intravascular gas bubbles (emboli)[228]. The mechanism for gas bubble generation (gas bubble disease) in supersaturated tissue of diving marine mammals (that leads to symptoms similar to decompression sickness (DCS) in humans) is thought to be an adverse behavioural response to exposure to noise[229], or a direct physical effect of sound energy on gas bubble precursors in the animal's body[230] (see Figure 4). In the case of beaked whales, if individuals change behaviour to

220 Fernández, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herráez, P., Castro, P., Jaber, J.R., Martín, V., and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57.

221 Cox, T. M., Ragen, T. J., Read, A. J., Vos, E., Baird, R. W., Balcomb, K., Barlow, J. Caldwell, J., Cranford, T., Crum, L., D'Amico, A., D'Spain, G., Fernández, A. Finneran, J., Gentry, R., Gerth, W., Gulland, F., Hildebrand, J., Houser, D., Hullar, T., Jepson, P. D., Ketten, D., MacLeod, C. D., Miller, P., Moore, S., Mountain, D., Palka, D., Ponganis, P., Rommel, S., Rowles, T., Taylor, B., Tyack, P., Wartzok, D., Gisiner, R., Mead, J., Lowry, L. and Benner, L. 2006. Understanding the impacts of anthropogenic sound on beaked whales? Journal of Cetacean Research and Management 7: 177–187.

222 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

223 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

224 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy.

225 Ibid

226 Jepson, P. D., Arbelo, M., Deaville, R., Patterson, I. A. P., Castro, P., Baker, J. R., Degollada, E., Ross, H. M., Herraez, P., Pocknell, A. M., Rodriguez, F., Howie, F. E., Espinosa, A., Reid, R. J., Jaber, J. R., Martin, V., Cunningham, A. A. and Fernández A. 2003. Gas-bubble lesions in stranded cetaceans. Nature 425: 575–576.

227 Fernández, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herráez, P., Castro, P., Jaber, J.R., Martín, V., and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57.

228 Jepson, P. D., Deaville, R., Patterson, I. A. P., Pocknell, A. M., Ross, H. M., Baker, J. R., Howie, F. E., Reid, R. J., Colloff, A. and Cunningham, A. A. 2005. Acute and chronic gas bubble lesions in cetaceans stranded in the United Kingdom. Veterinary Pathology 42: 491–305.

229 Cox, T. M., et al. 2006. Understanding the impacts of anthropogenic sound on beaked whales? Journal of Cetacean Research and Management 7: 177–187.

230 Crum, L.A., Bailey, M.R., Guan, J., Hilmo, P R., Kargl, S.G., Matula, T.J. & Sapozhnikov, O.A. (2005) Monitoring bubble growth in supersaturated blood and tissue ex vivo and the relevance to marine mammal bioeffects. Acoustics Research Letters Online. DOI: 10.1121/1.1930987

a series of shallower dives with slow ascent rates and shorter stays on the surface they could experience excessive nitrogen tissue supersaturation driving potentially damaging bubble formation in tissues[231]. However, this is currently a working hypothesis and requires testing through a specific programme of research[232]. Beaked whales are also thought to be more acoustically sensitive to active sonar than other species. A comparison of the effect of mid-frequency sonar on Blainville's beaked whale and three other non-beaked species (pilot whale, false killer whale, melon headed whale) showed that the responses of the beaked whales were stronger between affected individuals and controls than in the other species[233].

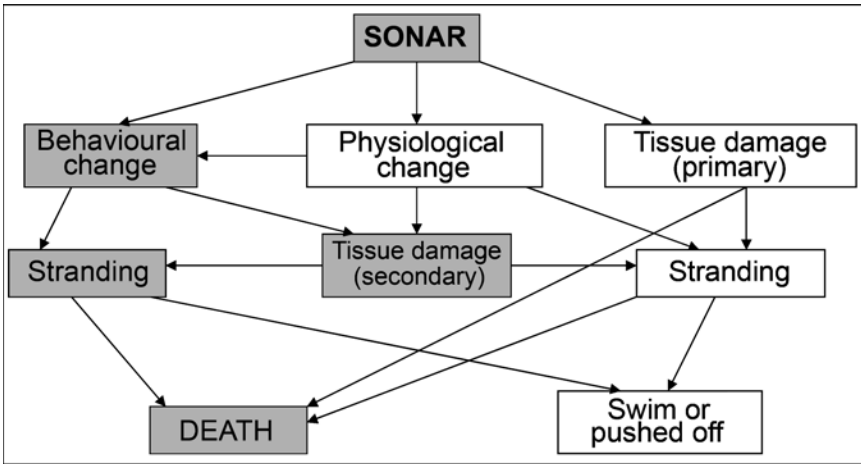


Figure 4. Potential mechanistic pathways by which beaked whales are affected by active sonar. (See Cox et al., 2006 for detailed discussion)

Further mass stranding events of beaked whales and other cetaceans have been reported in a range of locations around the world.[234 235 236]. Research for Cuvier's beaked whale indicates that there have been 40 mass stranding events of two or more individuals since 1960 and 28 of these events occurred at the same time and place as naval manoeuvres or the use of active sonar or

231 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

232 Cox, T. M., et al. 2006. Understanding the impacts of anthropogenic sound on beaked whales? Journal of Cetacean Research and Management 7: 177–187.

233 Cited from OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

234 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission (Table 6.1)

235 Wang, J.W. and Yang, S-C. 2006. Unusual stranding events of Taiwan in 2004 and 2005. J. Cetacean Res. Manage. 8(3): 283–292

236 Dolman SJ, Pinna E, Reid RJ, Barleya JP, Deaville R, Jepson PD, O'Connell M, Berrow S, Penrose RS, Stevick PT, Calderan S, Robinson KP, Brownell Jr RA and Simmonds MP (2010) A note on the unprecedented strandings of 56 deep-diving whales along the UK and Irish coast. Marine Biodiversity Records (2010), 3: e16

near naval bases[237]. A number of other (non-beaked) species such as minke whales and pygmy sperm whales have stranded concurrently with beaked whales in sonar-related stranding events, while other species including long-finned pilot whales, melon headed whales, dwarf sperm whales and harbour porpoises, have stranded in noise-related events[238]. The fact that deep diving cetaceans other than beaked whales have shown to have gas embolism disease in stranded animals suggests that sonar or other noise impacts may be more widespread than previously thought[239]. Additionally mortality may be under-estimated if based solely on stranded individuals as affected cetaceans are also highly likely to die at sea[240] and not be washed up or detected which is likely to be related to local environmental conditions[241].

There is little evidence of other sources of anthropogenic underwater noise causing direct physical damage to marine mammals. There are a few poorly documented cases of injury (organ damage and rupture of gas filled cavities such as lungs, sinuses and ears), and deaths of marine mammals have been caused by the use of explosives[242]. A dramatic pressure drop, such as occurs from blast waves, may cause air-filled organs to rupture[243]. The death of two humpback whales was attributed to acoustic trauma caused by a 5000 kg explosion through severe injury to the temporal bones[244]. There is no documented case of injury caused by pile driving for marine mammals at sea although experimental studies in captivity using simulated source levels[245] [246] suggest that the levels of intense sound produced during pile driving are strong enough to cause noise induced hearing loss in some species. Hearing losses are classified as either temporary threshold shifts (TTS) or permanent threshold shifts (PTS), where threshold shift refers to the raising of the minimum sound level needed for audibility[247]. Repeated TTS is thought to lead to PTS. Hearing losses can reduce the range for communication, interfere with foraging capacity,

237 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

238 Ibid

239 Ibid

240 International Whaling Commission Scientific Committee (IWC/SC). 2005. Report and Annex K of the 2005 Scientific Committee Report: Report of the Standing Working Group on Environmental Concerns. J. Cetacean Res. Manag. 7 (Suppl.): 267-305

241 Faerber, M.M and Baird, R.W. 2010. Does a lack of observed beaked whale strandings in military exercise areas mean no impacts have occurred? A comparison of stranding and detection probabilities in the Canary and main Hawaiian Islands. Marine Mammal Science. DOI: 10.1111/j.1748-7692.2010.00370.x

242 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

243 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

244 Ketten, D.R. (1995). Estimates of blast injury and acoustic zones fro marine mammals from underwater explosions. In: Kastelein, R.A., Thomas, J.A., and Nachtigall, P.E. (ed), Sensory Systems of Aquatic Mammals. De Spil Publishers, Woerden, NL, pp: 391-407.

245 Mooney, T.A., Nachtigall, P.E., Breese, M., Vlachos, S. & Au, W.L. (2009) Predicting temporary threshold shifts in a bottlenose dolphin (*Tursiops truncatus*): the effects of noise level and duration J. Acoust. Soc. Am. 125(3): 1816-1826.

246 Kastak, D., Southall, B. L., Schusterman, R. J. & Kastak, C. R. (2005) Underwater temporary threshold shift in pinnipeds: effects of noise level and duration. Journal of the Acoustical Society of America 118: 3154-3163.

increase vulnerability to predators, and may cause erratic behaviour with respect to migration, mating, and stranding[248]. Current research indicates that sound from pile driving has the potential to induce hearing loss in marine mammals if they remain within a certain distance of the source which has been estimated between 100 and 500 metres for PTS[249] [250]. However the most severe acoustic impacts recorded on cetaceans to date (active sonar) were due to exposures thought too low to induce TTS, according to current predictive models[251]. Hearing damage in marine mammals from shipping noise has not been reported and is thought to be unlikely to occur from the passage of a single vessel[252]. However there is the potential for permanent damage to hearing from sustained and/or repeated exposure to shipping noise over long periods[253].

B MASKING

The term masking refers to when increased levels of background or ambient noise reduces an animal's ability to detect relevant sound[254] such as important acoustic signals for communication, echolocation or of the marine environment for marine mammals. If the anthropogenic noise is strong enough relative to the received signal then the signal will be 'masked'[255]. If features within the signal convey information, it may be important to receive the full signal with an adequate signal-to-noise ratio to recognize the signal and identify the essential features[256]. As ambient noise or transmission range increases, information will be lost at the receiver, ranging from subtle features to complete failure to detect the signal[257]. Consequently, the active space in which animals are able to detect the signal of a conspecific[258] or other acoustic cue will decrease with increased masking noise.

---

247 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

248 Ibid

249 Bailey, H., Senior, B., Simmons, D., Rusin, J., Picken, G. & Thompson, P. (2010) Assessing underwater noise levels during pile-driving at an offshore wind farm and its potential effects on marine mammals. Marine Pollution Bulletin 60: 888-897.

250 De Jong, C.A.F. & Ainslie, M.A. (2008) Underwater radiated noise due to the piling for the Q7 Offshore Wind Park. Acoustics 2008 Conference (ASA-EAA), Paris, 29 June – 4 July, abstracts: 117-122.

251 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

252 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

253 Ibid

254 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

255 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

256 Brumm H, Slabbekoorn H (2005) Acoustic communication in noise. Adv Stud Behav 35:151–209

257 Gelfand SA (2004) Hearing - an introduction to psychological and physiological acoustics. Marcel Dekker, New York.

Masking in the marine environment is a regarded as a key concern for marine mammals, especially for those that communicate using low frequencies such as baleen whales, seals and sea lions and also some of the of vocalisations of toothed whales[259] (Figure 5). The principal constituent of low–frequency (5–500 Hz) ambient noise levels in the world's oceans are acoustic emissions from commercial shipping[260]. Masking can also occur at higher frequencies (1–25 kHz) when vessels are in close proximity to an animal and exposed to cavitation noise from propellers. More localised masking in the coastal and inshore zone is a growing cause for concern as the number and speed of smaller motorised vessels increase dramatically in many regions[261].

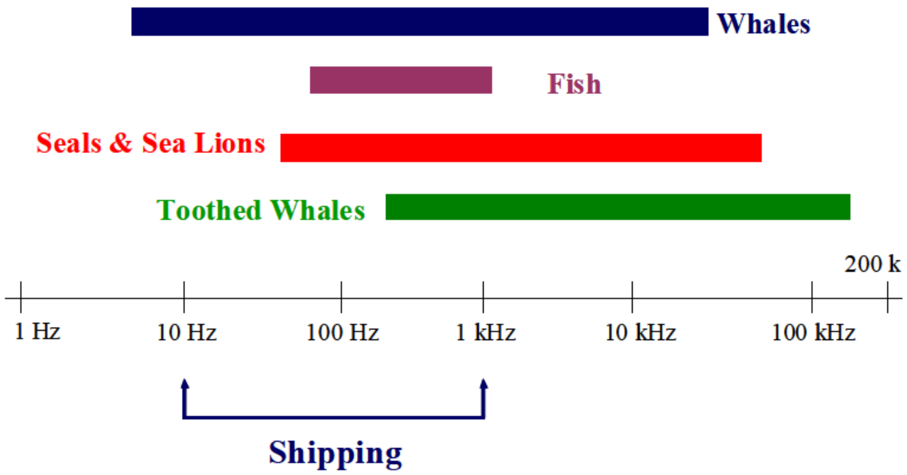


Figure 5. Typical frequency sound bands produced by marine mammals (and fish) compared with the nominal low-frequency sounds associated with commercial shipping (after OSPAR 2009)

258 Marten K, Marler P (1977) Sound transmission and its significance for animal vocalization. Behav Ecol Sociobiol 2: 271–290

259 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

260 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

261 Jensen, F.H., Bedjer. L., Wahlberg, M., Aguilar Soto, N., Johnson, M., Madsen, P.T. 2009. Vessel noise effects on delphinid communication. Mar. Ecol. Prog. Ser. 395: 161-175.

There have been numerous studies of the effects of masking from vessel noise on marine mammals including baleen whales[262], belugas[263], bottlenose dolphins[264 265 266], short-finned pilot whales[267] and killer whales[268 269]. Some of these have estimated or modelled the extent to which low-frequency noise from shipping or other vessels can dramatically reduce communication ranges for marine animals[270 271]. For example, the noise of an icebreaker vessel was predicted to mask beluga calls up to 40 km from the vessel[272] while pilot whales in deep water habitat could suffer a 58% reduction in communication range caused by the masking effect of small vessels in the coastal zone[273]. Using a metric to measure 'communication masking' the acoustic communication space for the highly endangered north Atlantic right whale has shown to be seriously compromised by noise from commercial shipping traffic[274]. Increasing anthropogenic noise levels in the oceans therefore have the potential to significantly affect threatened populations of marine mammals. Masking effects on marine mammals have also been suggested

---

262 Payne, R. and D. Webb. 1971. Orientation by means of long range acoustic signaling in baleen whales. Annals of the New York Academy of Sciences 188, 110-141.

263 Erbe, C. and D. M. Farmer. 1998. Masked hearing thresholds of a beluga whale (*Delphinapterus leucas*) in icebreaker noise. Deep Sea Research 45, 1373–1387.

264 Buckstaff KC (2004) Effects of watercraft noise on the acoustic behaviour of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Mar Mamm Sci 20:709–725

265 Morisaka, T., M. Shinohara, F. Nakahara, and T. Akamatsu. 2005. Effects of ambient noise on the whistles of Indo-Pacific bottlenose dolphin populations. Journal of Mammalogy 86, 541-546.

266 Jensen, F.H., Bedjer. L., Wahlberg, M., Aguilar Soto, N., Johnson, M., Madsen, P.T. 2009. Vessel noise effects on delphinid communication. Mar. Ecol. Prog. Ser. 395: 161-175

267 Ibid

268 Erbe, C. 2002. Underwater noise of whale-watching boats and potential effects on killer whales (*Orcinus orca*), based on an acoustic impact model. Marine Mammal Science 18, 394- 418

269 Foote AD, Osborne RW, Hoelzel AR (2004) Whale-call response to masking boat noise. Nature 428:910

270 Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33, 411-521.

271 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

272 Erbe, C. and D. M. Farmer. 2000. Zones of impact around icebreakers affecting beluga whales in the Beaufort Sea. Journal Acoustical Society of America 108, 1332-1340.

273 Jensen, F.H., Bedjer. L., Wahlberg, M., Aguilar Soto, N., Johnson, M., Madsen, P.T. 2009. Vessel noise effects on delphinid communication. Mar. Ecol. Prog. Ser. 395: 161-175

274 Clark, C.W., Ellison, W.T., Southall, B.L., Hatch L., van Parijs, S.M., Frankel, A. and Ponirakis, D. 2009. Acoustic masking in marine ecosystems: intuitions, analyses, and implication. Marine Ecology Progress Series, 395: 201 – 222.

for other anthropogenic noise sources including low-frequency sonar on Humpback whales[275 276], pile driving sound on bottlenose dolphins[277] and low-frequency wind turbine noise on harbour seals and harbour porpoises[278 279]. There is also the potential for certain Acoustic Harassment Devices to mask the communication signals of some species of Delphinid cetaceans or seals[280]. Low-frequency sounds produced by fish deterrent devices or tidal turbines have the potential to mask baleen whale communication or the vocalisations of some seal species[281].

There is increasing evidence that cetaceans are compensating for the masking effects of anthropogenic noise by changing the frequency, source level, redundancy, or timing of their signals[282 283 284 285 286 287]. This phenomenon suggests that the anthropogenic noise levels in the marine environment such as vessel noise are clearly interfering with communication in marine mammals[288]. Temporary changes in signalling may enable animals to cope with different noise levels[289]. Changes in signal parameters may adequately compensate for small increases in masking noise and are not likely to have any adverse effects during short periods of time, but

275 Miller, P.J.O., Biassoni, N., Samuels, A. and Tyack, P.L. 2000. Whale songs lengthen in response to sonar. Nature, 405: 903

276 Fristrup, K.M., Hatch, L.T. & Clark, C.W. (2003) Variation in humpack whale (*Megaptera novaengliae*) song length in relation to low-frequency sound broadcasts. *Journal of the Acoustical Society of America*, **113**, 3411–3424.

277 David, J.A. 2006. Likely sensitivity of bottlenose dolphins to pile-driving noise. Water and Environment Journal. 20: 48–54

278 Koschinski, S., Culik, B.M., Henriksen, O.D., Tregenza, N., Ellis, G., Jansen, C. & Kathe, G. (2003) Behavioural reactions of free-ranging porpoises and seals to the noise of a simulated 2MWwindpower generator. Marine Ecology Progress Series, 265, 263–273.

279 Lucke, K., Lepper, P.A., Hoeve, B., Everaarts, E., van Elk, N., and Siebert, U. (2007). Perception of low-frequency acoustic signals by a harbour porpoise (Phocoena phocoena) in the presence of simulated offshore wind turbine noise. Aquatic Mammals, 33: 55-68.

280 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

281 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

282 Buckstaff KC (2004) Effects of watercraft noise on the acoustic behaviour of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Mar Mamm Sci 20:709–725

283 Lesage, V., Barrette, C., Kingsley, M.C.S., Sjare, B. 1999. The effect of vessel noise on the vocal behaviour of Belugas in the St Lawrence river estuary, Canada. Mar Mamm Sci 15: 65-84

284 Foote AD, Osborne RW, Hoelzel AR (2004) Whale-call response to masking boat noise. Nature 428:910

285 Morisaka, T., M. Shinohara, F. Nakahara, and T. Akamatsu. 2005. Effects of ambient noise on the whistles of Indo-Pacific bottlenose dolphin populations. Journal of Mammalogy 86, 541-546.

286 Holt, M.M., Noren, D.P., Veirs, V., Emmons, C.K. and Veirs, S. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. J. Acoust. Soc. Am. 125. DOI: 10.1121/1.3040028

287 Parks, S. E., C. W. Clark, and P. L. Tyack. 2007. Short- and longterm changes in right whale calling behavior: the potential effects of noise on acoustic communication. Journal of the Acoustical Society of America 122:3725–3731.

288 Tyack, P.L. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. Journal of Mammalogy. 89: 549-558

may not be sufficient to compensate for more severe levels of masking[290]. The energetic and functional costs of making changes to vocalisations for individuals or populations are currently unknown[291].

C BEHAVIOURAL DISTURBANCE

A wide range of anthropogenic sound sources are known to elicit changes in behaviour in marine mammals[292] [293] (Table 2) and the responses elicited can be complex. Behavioural responses may range from changes in surfacing rates and breathing patterns to active avoidance or escape from the region of highest sound levels. Responses may also be conditioned by certain factors such as auditory sensitivity, behavioural state (e.g., resting, feeding, migrating), nutritional or reproductive condition, habit or desensitization, age, sex, presence of young, proximity to exposure and distance from the coast[294] [295]. Therefore, the extent of behavioural disturbance for any given acoustic signal can vary both within a population as well as within the same individual[296]. Since the first extensive review of marine mammals and anthropogenic noise was completed in the mid-nineties[297] there have been a number of further detailed appraisals that document how various sources of anthropogenic sound can affect marine mammal behaviour[298]

289 Miksis-Olds JL, Tyack PL (2009) Manatee (*Trichechus manatus*) vocalization usage in relation to environmental noise levels. J Acoust Soc Am 125:1806–1815

290 Wartzok D, Popper AN, Gordon JCD, Merrill J (2003) Factors affecting the responses of marine mammals to acoustic disturbance. Mar Technol Soc J 37:6–15

291 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

292 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

293 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

294 Richardson, W.J. & Würsig, B. 1997: Influences of man-made noise and other human actions on cetacean behaviour. Mar. Fresh. Behav. Physiol. 29: 183-209

295 Bejder L., Samuels, A., Whitehead, H., Finn, H. and Allen, S. 2009. Impact assessment research use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. Marine Ecology Progress Series. 395: 177-185

296 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

297 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

298 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

[299] [300] [301]. Many of the studies reporting behaviour up to this time were observational rather than experimental and often lacked proper controls.

The subjects of vocal plasticity and mass strandings have been covered previously in sections for masking and physiological effects of anthropogenic sound respectively. This section provides information on three broad areas of behavioural change in marine mammals: disturbance responses, interruption of normal activity and habitat displacement, and leads onto a discussion of potential population effects, physiological responses and chronic effects.

There is extensive information documenting the disturbance responses of marine mammals to anthropogenic sounds such as recreational boat noise, industrial maritime traffic activities, seismic surveys, oceanographic tests, sonar, acoustic hardware, airplanes and explosions[302] [303]. Short term reactions to man-made sounds on cetaceans include sudden dives, fleeing from sound sources, vocal behavioural change, shorter surfacing intervals with increased respiration, attempts to protect the young, increased swim speed and abandonment of the polluted area[304]. For example, both killer whales and dolphins are known to change their motor behaviour in response to small vessel presence and noise[305] [306] while baleen whales such as blue and fin whales have similarly responded to shipping movements and noise[307]. Manatees have been shown to respond to approaching vessels by changing fluke rate, heading, and dive depth[308].Cessation of humpback singing was shown with transmissions of an experimental sound 200 km away[309]. The use of air-gun arrays during seismic surveys and their impact on marine mammal behaviour has been thoroughly assessed in terms of behavioural responses. A range of conclusions have been drawn

299 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

300 Tyack, P.L. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. Journal of Mammalogy. 89: 549-558

301 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

302 Ibid (Table 6)

303 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

304 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

305 Nowacek, S. M., R. S. Wells and A. Solow. 2001. Short-term effects of boat traffic on bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Marine Mammal Science 17, 673-688

306 Williams, R., A. W. Trites and D. E. Bain. 2002. Behavioural responses of killer whales (*Orcinus orca*) to whale-watching boats: opportunistic observations and experimental approaches. Journal of Zoology London 256, 255-270

307 Edds, P.L. and Macfarlane, J.A.F. 1987. Occurrence and general behavior of balaenopterid cetaceans summering in the St Lawrence Estuary, Canada. Can. J. Zool. 65:1363-1376

308 Nowacek, S. M., R. S. Wells, E. C. G. Owen, T. R. Speakman, R. O. Flamm and D. P. Nowacek. 2004. Florida manatees, *Trichechus manatus latirostris*, respond to approaching vessels. Biological Conservation 119, 517-523

309 Risch D, Corkeron PJ, Ellison WT, and Van Parijs SM. 2012. Changes in humpback whale song occurrence in response to an acoustic source 200 km away. PLoS ONE 7(1): e29741. doi:10.1371/journal.pone.0029741

with respect to behavioural reactions to seismic surveys, and there is currently a lack of a consensus in the scientific community on the occurrence, scale and significance of such effects[310]. However, many types of marine mammals have reacted strongly to the intense sound of seismic surveys. A number of species of baleen whale on the whole show avoidance behaviour[311] as do pinniped species[312] [313]. As assessment of cetacean responses to 201 seismic surveys resulted in the suggestion that odontocetes may adopt a strategy of moving out of the affected area entirely while slower moving mysticetes move away from the seismic survey to increase the distance from the source, but do not leave the area completely[314]. Observations of sperm whales that were resident in an area with seismic surveys occurring over many years did not record any avoidance behaviour, which may indicate habituation, but did see more subtle changes in foraging behaviour at sound levels that were considerably below the threshold level used to predict a disruption of behaviour[315]. These subtle changes were only picked up because of a rigorous experimental design. Long-term in-depth studies are also important to detect subtle effects. The apparent habituation of a dolphin population to vessel noise was actually a result of more sensitive individuals avoiding the affected area whilst the less sensitive ones remained[316].

It is thought that repeated short-term changes in behaviour may lead to long-term impacts at the population level, through continual avoidance leading to habitat displacement[317] [318] or by reducing energy acquisition in terms of lost feeding opportunities[319]. The displacement of numerous cetacean species has been well documented in the scientific literature[320] [321] and, in some cases, individuals have been displaced for a number of years, only returning when the

310 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

311 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

312 Thompson, D. (ed.) (2000): Behavioural and physiological responses of marine mammals to acoustic disturbance – BROMMAD. Final Scientific and Technical Report to European Commission. MAS2 C7940098

313 Bain, D.E. & Williams, R. 2006: Long-range effects of airgun noise on marine mammals: Responses as a function of received sound level and distance. IWC-SC/58E35

314 Stone, C.J. and Tasker, M.L. 2006. The effect of seismic airguns on cetaceans in UK waters. J. Cetacean Res. Manag. 8: 255-263

315 Miller P.J.O , Johnson, M.P., Madsen, P.T., Biassoni, N., Quero, M. and Tyack, P.L. 2009. Using at-sea experiments to study the effects of airguns on the foraging behaviour of sperm whales in the Gulf of Mexico. Deep-Sea Research I. doi:10.1016/j.dsr.2009.02.008

316 Bejder., L et al. 2006. Decline in relative abundance of bottlenose dolphins exposed to long-term disturbance. Conservation Biology Volume 20, No. 6, 1791–1798

317 Lusseau, D. 2005. Residency pattern of bottlenose dolphins Tursiops spp. In Milford Sound, New Zealand, is related to boat traffic. Mar. Ecol. Prog. Ser. 295: 265–272

318 Bejder L, Samuels A, Whitehead H, Gales N and others (2006) Decline in relative abundance of bottlenose dolphins exposed to long-term disturbance. Conserv Biol 20: 1791–1798

319 Williams R, Lusseau D, Hammond PS (2006) Estimating relative energetic costs of human disturbance to killer whales (*Orcinus orca*). Biol Conserv 133:301–311

activities causing the anthropogenic noise ceased[322]. If the displacement results in the animals being excluded from important feeding, breeding or nursery habitats then this is likely to have a deleterious impact on survival and growth of the population group[323]. Similarly a prolonged disruption in normal behaviour can reduce foraging time and efficiency. For example, vessel activity is thought to reduce foraging success in killer whales[324] and dolphins[325]. Noise levels generated by vessels in close proximity may be impairing the ability to forage using echolocation by masking echolocation signals[326].

There is growing awareness of the potential problem of chronic stress in marine mammals through the prolonged or repeated activation of the physiological stress response[327], the life-saving combination of systems and events that maximises the ability of an animal to kill or avoid being killed[328]. The goal of this stress response is to enable the animal to survive the perceived immediate threat. Prolonged disturbance of marine mammals to intermittent or continuous anthropogenic noise has the potential to induce a state of chronic stress if the exposures are of sufficient intensity, duration and frequency. The stress response may be triggered repeatedly either through a direct response to sound (e.g., small vessel noise) or indirectly via one or more noise-related impacts (e.g., shipping noise masking communication, navigation or foraging abilities)[329]. Chronic stress is known to have adverse health consequences for populations of terrestrial animals by affecting fertility, mortality and growth rates. Moreover, it is known that a range of biological systems and processes in animals are impacted by exposure to noise: the neuroendocrine system, reproduction and development, metabolism, cardio-vascular health, cognition and sleep, audition and cochlear morphology, the immune system, and DNA integrity

---

320 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

321 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

322 Bryant, P.J., Lafferty, C.M., and Lafferty, S.K. (1984). Reoccupation of Laguna Guerrero Negro, Baja California, Mexico by gray whales. In: Jones, M.L., Swartz, S.L., and Leatherwood, S. (ed), the gray whale *Eschrichtius robustus*. Academic Press, Orlando, FL,pp: 375-387

323 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029

324 Lusseau, D., Bain, D.E., Williams, R. and Smith, J.C. 2009. Vessel traffic disrupts the foraging behaviour of southern resident killer whales *Orcinus orca*. Endang Species Res 6: 211-221

325 Allen MC, Read AJ (2000) Habitat selection of foraging bottlenose dolphins in relation to boat density near Clearwater, Florida. Mar. Mamm. Sci .16:815–824

326 Bain DE, Dahlheim ME (1994) Effects of masking noise on detection thresholds of killer whales. In: Loughlin TR (ed) Marine mammals and the 'Exxon Valdez'. Academic Press, San Diego, CA, p 243–256.

327 Wright, J.W., Deak, T. and Parsons, E.C.M. 2009. Concerns Related to Chronic Stress in Marine Mammals. IWC SC/61/E16 7 pp.

328 Romero, L.M. and Butler, L.K. 2007. Endocrinology of stress. *Int. J. Comp. Psych.* 20(2-3):89-95.

329 Wright, J.W., Deak, T. and Parsons, E.C.M. 2009. Concerns Related to Chronic Stress in Marine Mammals. IWC SC/61/E16 7 pp.

and genes[330]. It therefore seems logical to infer that noise-induced chronic stress has the potential to detrimentally alter similar critical life history parameters in marine mammals (e.g., disease susceptibility, reproductive rates, mortality rates), that may have long-term consequences for populations and should be taken into consideration in terms of conservation planning and management. North Atlantic right whales, for instance, showed lower levels of stress-related fecal glucocorticoids after 9-11 due to decreased shipping with an attendant 6 dB decrease in shipping noise[331].

However, no study to date has found a population level change in marine mammals caused by exposure to anthropogenic noise, though noise is listed as a contributing factor to several species' decline or lack of recovery (e.g., Western gray whales[332] [333] [334] and Southern Resident killer whales[335]. A recent detailed review found little response by cetacean populations to human acoustic disturbance in four case study areas[336], which was attributed to a number of reasons, including the lack of accurate population estimates for marine mammal species and the ability of individuals to adapt and compensate for negative effects[337]. The process by which a temporary change in an individual's behaviour could lead to long-term population level consequences is addressed by the Population Consequence of Acoustic Disturbance (PCAD) Model (Figure 6)[338]. The model, developed for marine mammals but theoretically applicable to other fauna, involves different steps from sound source characteristics through behavioural change, life functions impacted, and effects on vital rates to population consequences.

---

330 Kight, C.R. and Swaddle, J.P. 2011. How and why environmental noise impacts animals: an integrative, mechanistic review. Ecology Letters doi: 10.1111/j.1461-0248.2011.01664.x

331 Rolland, R.M., Parks, S.E., Hunt, K.E., Castellote, M., Corkeron, P.J., Nowacek, D.P.,Wasser, S.K., and Kraus, S.D. 2012. Evidence that ship noise increases stress in right whales. Proc. R. Soc. B, doi:10.1098/rspb.2011.2429.

332 International Whaling Commission. 2007. Report of the scientific committee. Annex K. Report of the Standing Working Group on environmental concerns. J. Cetacean Res. Manag. **9** (Suppl.): 227–296

333 Weller, D.W., Rickards, S.H., Bradford, A.L., Burdin, A.M., and Brownell, R.L., Jr. 2006*a* . The influence of 1997 seismic surveys on the behavior of western gray whales off Sakhalin Island, Russia. Paper No. SC/58/E4 presented to the International Whaling Commission Scientific Committee, Cambridge, UK.

334 Weller, D.W., Tsidulko, G.A., Ivashchenko, Y.V., Burdin, A.M., and Brownell, R.L., Jr. 2006*b* . A re-evaluation of the influence of 2001 seismic surveys on western gray whales off Sakhalin Island, Russia. Paper No. SC/58/E5 presented to the International Whaling Commission Scientific Committee, Cambridge, U.K

335 National Marine Fisheries Service. 2002. Status review under the Endangered Species Act: southern resident killer whales (*Orcinus orca*). NOAA Tech. Mem. NMFS NWFSC-54. Available from http://nwfsc.noaa.gov

336 Thomsen, F., McCully, S.R., Weiss, L., Wood, D., Warr, K., Kirby, M., Kell, L. and Law, R. 2011. Cetacean stock assessment in relation to exploration and production industry sound: current knowledge and data needs. Aquatic Mammals 37: 1-93. DOI: 10.1578/AM.37.1.2011.1

337 Tasker, M.L, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

338 NRC (2005) Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. National Research Council of the National Academies of Science, Washington, DC.

At the present time most of the variables of the PCAD model are unknown and there are challenges to fill in the current gaps such as uncertainties in population estimates for species or regions, difficulties in weighting noise against other stressors and the inherent inaccessibility of the marine environment[339]. No one factor is likely to be harmful enough to cause a direct population decline in marine life, but a combination of factors may create the required conditions for reduced productivity and survival in some cases[340].

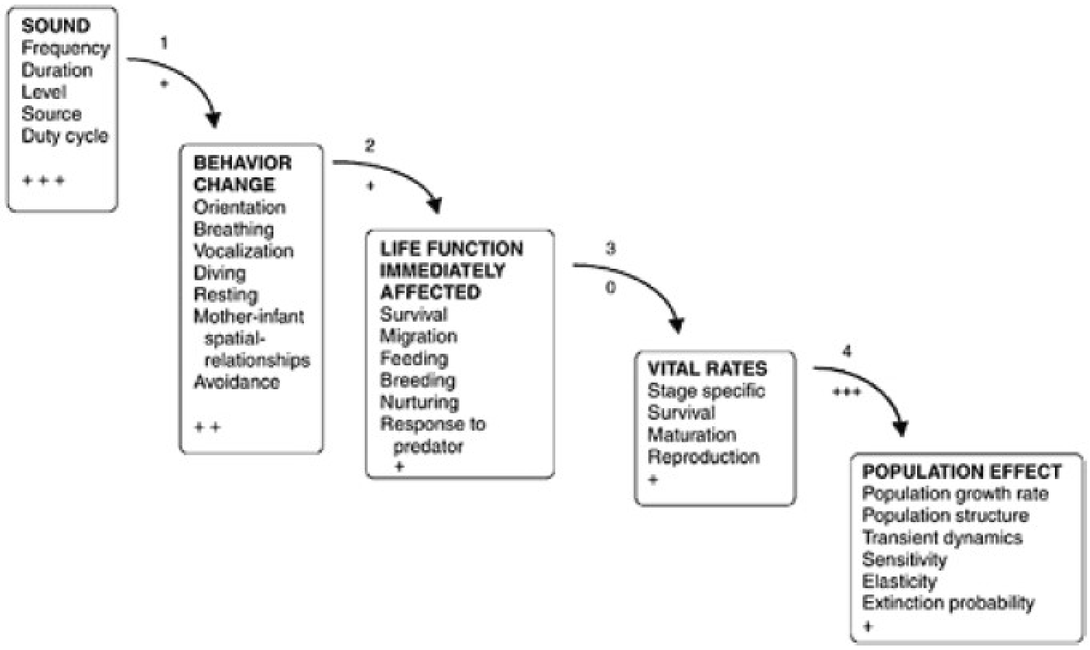


Figure 6. Overview of the PCAD Model by NRC (2005)

Note: The + signs within the boxes indicate how well these features can be measured, while the + signs under the transfer arrows indicate how well these transfer functions are known. As can be seen, some transfer functions such as 1-3 are not well known.

The potential impacts of sound also need to be considered in a wider context, through addressing the consequences of acoustic disturbance on populations in conjunction with other stressors such as bycatch mortality, overfishing leading to reduced prey availability and other forms of pollution such as persistent organic pollutants[341] [342]. These various stressors may also act synergistically or cumulatively. For example underwater noise could interact with bycatch or collision issues in that the individual is less able to detect the presence of fishing nets or nearby

339 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

340 Tasker, M.L, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

341 Perrin, W.F, Würsig, B. and Thewissen, J.G.M. (eds) (2002). Encyclopedia of Marine Mammals. Academic Press, San Diego.

342 Read, A.J., Drinker, P. and Northridge, S.P. (2006). By-catches of marine mammals in U.S. and global fisheries. Conservation Biology, 20: 163-169.

vessels[343]. Multiple sources of anthropogenic sound may also interact cumulatively or synergistically such as when naval sonar emissions from multiple vessels produce confusing sound fields[344].

IMPACTS ON MARINE FISH

In comparison to marine mammals research into the effects of anthropogenic noise on marine fish is still very much in its infancy and there is far less information available[345] [346]. Much of the material available is also technical reports or 'grey literature' and has not always been through the scientific peer review process[347]. A recent evaluation of both the peer-reviewed and grey literature concluded that on the whole very little is known about the effects of anthropogenic sound on fish and stressed the need for a systematic programme of study on a range of species[348].

Marine fish are susceptible to the same range of effects as has been discussed previously for marine mammals although the principles of hearing differ somewhat between the two groups and these differences influence how noise impact assessments should be conducted[349]. The impacts of intense sound over short periods have been studied in some detail with respect to physical trauma and behaviour[350] [351] [352] [353] but there are currently hardly any data available for the effects of ambient noise on fish behaviour[354]. Where data are lacking, inferences can be drawn from

343 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

344 Ibid

345 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

346 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

347 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

348 Ibid

349 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

350 Hastings, M.C. and Popper, A.N. 2005. Effects of sound on fish. Contract 43A0139 Task Order 1, California Department of Transportation. 82pp.

351 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

352 Mueller-Blenkle, C., McGregor, P.K., Gill, A.B., Andersson, M.H., Metcalfe, J., Bendall, V., Sigray, P., Wood, D.T. & Thomsen, F. (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish. COWRIE Ref: Fish 06-08, Technical Report

353 McCauley, R. D., Fewtrell, J. & Popper, A. N. (2003). High intensity anthropogenic sound damages fish ears. Journal of the Acoustical Society of America 113, 638–642

354 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

assessing noise-related impacts on the behaviour of other vertebrates[355]. For fish it is also important to consider the effects of noise on eggs and larvae.

A. INJURY AND PHYSICAL EFFECTS

Hearing loss and auditory damage

Temporary deafness could result in a fish being unable to respond to other environmental sounds that indicate the presence of predators and facilitate the location of prey and mates[356]. Most of the studies investigating hearing loss in fish have been laboratory-based using different types of sound (e.g., pure tones or white noise) and exposure durations with mixed results. There are only a few field-based studies of auditory effects involving actual anthropogenic sound sources (seismic surveys and military sonar) experienced at sea or using playbacks of sounds. Laboratory work on two freshwater species showed that temporary loss of hearing (i.e., temporary threshold shifts [TTS]), can occur at sound pressure levels (SPL) of 140–170 dB re 1 µPa and hearing loss did not recover for at least two weeks after exposure[357]. A significant hearing threshold shift was reported for rainbow trout exposed to a playback of low-frequency active sonar at an SPL of 193 dB re 1 µPa[358]. However, a field-based study of hearing loss in four coral reef fish species during a seismic survey did not find any loss of hearing up to 193 dB re 1 µPa[359]. Hearing impairment (TTS) associated with long-term, continuous exposure (2 hours), and masked hearing thresholds have been reported for fish exposed to simulated noise (playback) of small boats and ferries[360] [361]. Overall the amount of hearing loss in fish appears to be related to the noise intensity compared to the threshold of hearing at that frequency. At frequencies where a fish was more sensitive (i.e., had a lower threshold), TTS produced by constant, broadband white noise was greater[362]. Considerable further research of this subject is required, particularly in a field-based setting using a variety of actual anthropogenic noise sources.

355 Ibid

356 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

357 Ibid

358 Popper, A. N., Halvorsen, M. B., Kane, E., Miller, D. D., Smith, M. E., Song, J., Stein, P. & Wysocki, L. E. (2007). The effects of high-intensity, low-frequency active sonar on rainbow trout. Journal of the Acoustical Society of America 122, 623–635

359 Hastings, M. C., Reid, C. A., Grebe, C. C., Hearn, R. L. & Colman, J. G. (2008). The effects of seismic airgun noise on the hearing sensitivity of tropical reef fishes at Scott Reef, Western Australia. Underwater Noise Measurement, Impact and Mitigation, Proceedings of the Institute of Acoustics 30 (5).

360 Scholik, A.R. and H. Y. Yan. 2001. Effects of underwater noise on auditory sensitivity of a cyprinid fish. Hearing Research 152, 17-24.

361 Vasconcelos, R. O., M. C. P. Amorim, and F. Ladich. 2007. Effects of ship noise on the detectability of communication signals in the Lusitanian toadfish. Journal of Experimental Biology 210, 2104-2112.

362 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

Damage to sensory hair cells of the inner ear of fish exposed to sound has been reported in a few studies[363] [364] [365] but not in others[366] [367]. In a field-based study using caged fish exposed to a seismic air gun some of these hair cells were severely damaged and showed no signs of recovery after 58 days[368]. Furthermore, the hair cell damage recorded in these studies was only a visual manifestation of what may have been a much greater effect[369]. Damage to the lateral line organ in fish has also been proposed when individuals are in close proximity to an intense sound source[370] and the suggested mechanism for this is the decoupling of the cupulae from the neuromasts[371].

Non-auditory damage

The swim bladder of a fish is a gas-filled structure that is susceptible to damage by sound. In addition, sound will cause gas organs such as the swim bladder and lung to oscillate and push on the surrounding tissues. Gas oscillations induced by high SPLs can potentially cause the swim bladder to tear or rupture[372]. Ruptured swim bladders have been reported in fish exposed to

---

363 Enger, P. S. (1981). Frequency discrimination in teleosts – central or peripheral? In *Hearing and Sound Communication in Fishes* (Tavolga, W. N., Popper, A. N. & Fay, R. R., eds), pp. 243–255. New York, NY: Springer-Verlag.

364 Hastings, M. C., Popper, A. N., Finneran, J. J. & Lanford, P. J. (1996). Effect of low frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish Astronotus ocellatus. Journal of the Acoustical Society of America 99, 1759–1766.

365 McCauley, R. D., Fewtrell, J. & Popper, A. N. (2003). High intensity anthropogenic sound damages fish ears. Journal of the Acoustical Society of America 113, 638–642

366 Popper, A. N., Halvorsen, M. B., Kane, E., Miller, D. D., Smith, M. E., Song, J., Stein, P. & Wysocki, L. E. (2007). The effects of high-intensity, low-frequency active sonar on rainbow trout. Journal of the Acoustical Society of America 122, 623–635

367 Song, J., Mann, D. A., Cott, P. A. Hanna, B. W. & Popper, A. N. (2008). The inner ears of northern Canadian freshwater fishes following exposure to seismic air gun sounds. Journal of the Acoustical Society of America 124, 1360–1366.

368 McCauley, R. D., Fewtrell, J. & Popper, A. N. (2003). High intensity anthropogenic sound damages fish ears. Journal of the Acoustical Society of America 113, 638–642

369 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

370 Ibid

371 Denton, E. J. & Gray, J. A. B. (1993). Stimulation of the acoustico-lateralis system of clupeid fish by external sources and their own movements. Philosophical Transactions of the Royal Society B: Biological Sciences 341, 113–127.

372 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

explosions[373] [374] [375], and to pile driving sound in some studies[376] [377] but not others[378]. Low-frequency sonar has the potential to damage swim bladders or adjacent tissue if the frequency emitted matches the resonance frequency of a particular fish species. Most fish are likely to show resonance frequencies between 100 and 500 Hz[379]. Fish that do not possess swim bladders such as flatfish are less susceptible to damage from explosions[380]. 'Blast fishing' explosions on tropical coral reefs not only kill and injure fish and invertebrates but cause extensive damage to reef habitat[381]. Blasts occurring during the decommissioning of oil and gas platforms can also cause in fish mortality[382]. It has been suggested that fish may be susceptible to two types of tissue damage when exposed to intense sound[383]. Firstly sufficiently high sound levels are known to cause the formation of micro-bubbles in the blood and fat tissue[384]. Bubble growth by rectified diffusion[385] at low frequencies could create an embolism and either burst small capillaries to cause superficial or internal bleeding, or cause damage to fish eyes where tissue may have high gas saturation[386]. Secondly, exposure to transient high level sound may cause traumatic brain

373 Aplin, J. A. (1947). The effect of explosives on marine life. California Fish and Game 33, 23–30.

374 Coker, C. M. and Hollis, E. H. (1950). Fish mortality caused by a series of heavy explosions in Chesapeake Bay. Journal of Wildlife Management 14, 435–445.

375 Wiley, M. L., Gaspin, J. B. & Goertner, J. F. (1981). Effects of underwater explosions on fish with a dynamical model to predict fishkill. Ocean Science and Engineering 6, 223–284.

376 Caltrans. (2001). Pile installation demonstration project, fisheries impact assessment. PIDP EA 012081. San Francisco–Oakland Bay Bridge East Span Seismic Safety Project. Caltrans Contract 04A0148 San Francisco, CA: Caltran.

377 Caltrans. (2004). Fisheries and hydroacoustic monitoring program compliance report for the San Francisco–Oakland bay bridge east span seismic safety project. Caltrans Contract EA12033. San Francisco, CA: Caltrans.

378 Nedwell, J, Turnpenny, A., Langworthy, J. & Edwards, B. (2003). Measurements of underwater noise during piling at the Red Funnel Terminal, Southampton, and observations of its effect on caged fish. Subacoustics LTD. Report 558 R 0207. Bishops Waltham: Subacoustic Ltd.

379 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

380 Goertner, J. F., Wiley, M. L., Young, G. A. & McDonald, W. W. (1994). Effects of underwater explosions on fish without swimbladders. Naval Surface Warfare Center Report NSWC TR88-114. Fort Belvoir, VA: Defence Technical Information Center.

381 Saila, S.B., Kocic, V. Lj., and McManus, J.W. (1993). Modelling the effects of destructive practices on tropical coral reefs. Mar. Ecol. Progr. Ser. 94: 51-60.

382 Gitschlag, G.R. and Herczeg, B.A. (1994). Sea turtle observations at explosive removals of energy structures. Mar. Fish. Rev., 56: 1-8.

383 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

384 ter Haar, G., Daniels, S., Eastaugh, K. C. & Hill, C. R. (1982). Ultrasonically induced cavitation in vivo. British Journal of Cancer 45 (Suppl.V), 151–155.

385 Crum, L. A. & Mao, Y. (1996). Acoustically enhanced bubble growth at low frequencies and its implications for human diver and marine mammal safety. Journal of the Acoustical Society of America 99, 2898–2907.

386 Turnpenny, A. W. H., Thatcher, K. P. & Nedwell, J. R. (1994). The effects on fish and other marine animals of high-level underwater sound: Contract Report FRR 127/94. Southampton: Fawley Aquatic Research Laboratories, Ltd.

injury. Fish with swim-bladder projections or other air bubbles near the ear (to enhance hearing) could potentially be susceptible to neurotrauma when exposed to high SPLs[387].

Studies of the effect of impulsive sound (seismic air guns) on the eggs and larvae of marine fish observed decreased egg viability, increased embryonic mortality, or decreased larval growth when exposed to sound levels of 120 dB re 1 µPa[388 389]. Turbot larvae also suffered damage to brain cells and to neuromasts of the lateral line[390]. The neuromasts are thought to play an important role in escape reactions for many fish larvae, and thus their ability to avoid predators[391]. Injuries and increased mortality from air guns occurred at distances less than 5 m from the sound source. The most frequent and serious injuries occur within 1.5 m and fish in the early stages of life were most vulnerable[392]. Juveniles and fry have less inertial resistance to the motion of a passing sound wave, and so are potentially more at risk for non-auditory tissue damage than adult fish[393].

The very limited data available for the effects of sonar on fish show no evidence of tissue damage or mortality to adult fish[394]. Studies focussed on larval and juvenile fish exposed to mid-frequency sonar recorded significant mortality (20-30%) of juvenile herring in 2 of 42 experiments[395], which was estimated in a 'worst-case' scenario to be equivalent to a lower mortality rate than would occur due to natural causes in the wild[396]. However, there is a need to repeat these experiments as the sound level was only tested once and so it is unknown if the increased mortality was due to the level of the test signal or to other unknown factors[397].

387 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

388 Kostyuchenko, L.P. 1973. Effects of elastic waves generated in marine seismic prospecting of fish eggs in the Black Sea. Hydrobiol. Jour. 9 (5): 45-48.

389 Booman, C., Dalen, J., Leivestad, H, Levsen, A., van der Meeren, T. and Toklum, K. 1996. Effects from airgun shooting on eggs, larvae, and fry. Experiments at the Institute of Marine Research and Zoological Laboratorium, University of Bergen. (In Norwegian. English summary and figure legends). Institute of Marine Research. Fisken og havet No. 3 - 1996. 83 pp

390 Ibid

391 Blaxter, J.H.S. and Hoss, D.E. 1981. Startle response in herring: The effect of sound stimulus frequency, size of fish and selective interference with the acoustico-lateralis system. J. Mar. Biol. Assoc. UK 61: 871-879

392 Booman, C., Dalen, J., Leivestad, H, Levsen, A., van der Meeren, T. and Toklum, K. 1996. Effects from airgun shooting on eggs, larvae, and fry. Experiments at the Institute of Marine Research and Zoological Laboratorium, University of Bergen. (In Norwegian. English summary and figure legends). Institute of Marine Research. Fisken og havet No. 3 - 1996. 83 pp

393 Popper, A.N., and Hastings, M.C. 2009b. The effects of human-generated sound on fish. Integrative Zoology, 4: 43 – 52.

394 Ibid

395 Jørgensen, R., Olsen, K. K., Falk-Petersen, I. B. & Kanapthippilai, P. (2005). Investigations of Potential Effects of Low Frequency Sonar Signals on Survival, Development and Behaviour of Fish Larvae and Juveniles. Norway: Norwegian College of Fishery Science, University of Tromsø.

396 Kvadsheim, P. H. & Sevaldsen, E. M. (2005). The Potential Impact of 1–8 kHz Active Sonar on Stocks of Juvenile Fish During Sonar Exercises. FFI/Report- 2005/01027.Kjeller: Norwegian Defence Research Establishment.

397 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

B. BEHAVIOURAL DISTURBANCE

There have been very few studies to determine the effects of anthropogenic noise on marine fish behaviour to date and nothing at all is known about the long-term effects of exposure to sound or about the effects of cumulative exposure to loud sounds[398]. Fish behaviour is also often observed in a cage or tank, which can provide some useful information regarding the initial response to a sound[399] but is not representative of behaviour when exposed to the same sound in the wild, for example in a spawning or feeding ground[400]. The response to sounds by fish can range from no change in behaviour to mild “awareness” of the sound or a startle response (but otherwise no change in behaviour), to small temporary movements for the duration of the sound, to larger movements that might displace fish from their normal locations for short or long periods of time[401]. Depending on the level of behavioural change, there may be no real impact on individuals or populations or substantial changes (e.g., displacement from a feeding or breeding site or disruption of critical functions) that affect the survival of individuals or populations[402] [403]. Moreover, there could be long-term effects on reproduction and survival in species that are subject to national or international conservation efforts and/or commercial interest[404].

An alarm or escape reaction, can be triggered when fish receive a strong sound stimulus[405] [406]; such as an air-gun array[407]and the reaction is often characterised by a typical “C-start” response, where the body of the fish forms a ‘C’ and points away from the sound source[408].

---

398 Ibid

399 Sara, G. et al. (2007) Effect of boat noise on the behaviour of Bluefin tuna Thunnus thynnus in the Mediterranean Sea. Mar. Ecol.-Prog. Ser. 331, 243–253.

400 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

401 Ibid

402 Ibid

403 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

404 Mueller-Blenkle, C., McGregor, P.K., Gill, A.B., Andersson, M.H., Metcalfe, J., Bendall, V., Sigray, P., Wood, D.T. & Thomsen, F. (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish. COWRIE Ref: Fish 06-08, Technical Report.

405 Blaxter, J.H.S. & hoss, d.e. 1981: Startle Response in herring: The effect of sound stimulus frequency,size of fish and selective interference with the acoustic-Lateralis system. J. Mar. Biol. Ass., U.K. 61: 871-879.

406 Popper, A. N. & Carlson, T. J. 1998: Application of sound and other stimuli to control fish behaviour. Transactions of the American Fisheries Society 127(5): 673-707.

407 Hassel, A., Knutsen, T., Dalen, J., Skaar, K. Løkkeborg, S., Misund, O. A., Østensen, Ø., Fonn, M. & Haugland, E. K. (2004). Influence of seismic shooting on the lesser sandeel (*Ammodytes marinus*). ICES Journal of Marine Science 61, 1165–1173.

408 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

Avoidance behaviour of vessels, vertically or horizontally in the water column, has been reported for cod and herring, and was attributed to vessel noise[409] [410]. Vessel activity can also alter schooling behaviour and swimming speed of fish[411]. Relatively low levels of pile driving noise played to cod and sole caused changes in swimming speed, a freezing response and directional movement away from the sound[412]. Large-scale avoidance behaviour was inferred from studies of the effect of seismic surveys on catch rates in long-line and trawl fisheries. Significant declines in catches of cod and haddock were recorded up to 25 miles from the air-gun source, which was the maximum distance examined, and catch rates did not recover until five days after the seismic survey ceased, which was the maximum time observed[413] [414]. Similarly, a 52% decrease in rockfish catch was reported when the catch area was exposed to a single air-gun array[415] which may have been caused by a change in swimming depth or shoaling behaviour[416]. Pelagic species such as blue whiting reacted to air guns by diving to greater depths but also by an increased abundance of fish 30–50 km away from the affected area, suggesting that migrating fish would not enter the zone of seismic activity[417]. Conversely, a study using direct video observation showed that temperate reef fish remained close to their territories after exposure to air-gun arrays with only minor behavioural responses observed[418]. Mid-frequency active sonar did not elicit a significant behavioural response in herring in terms of vertical or horizontal escape reactions[419]. ADD's (or pingers) which produce frequencies lower than 10 kHz and have a source level above

409 Vabø, R. et al. (2002) The effect of vessel avoidance of wintering Norwegian spring-spawning herring. Fish. Res. 58, 59–77

410 Handegard, N.O. et al. (2003) Avoidance behavior in cod, *Gadus morhua*, to a bottom trawling vessel. Aqua. Liv. Res. 16, 265–270

411 Sara, G. et al. (2007) Effect of boat noise on the behaviour of Bluefin tuna *Thunnus thynnus* in the Mediterranean Sea. Mar. Ecol.-Prog. Ser. 331, 243–253.

412 Mueller-Blenkle, C., McGregor, P.K., Gill, A.B., Andersson, M.H., Metcalfe, J., Bendall, V., Sigray, P., Wood, D.T. & Thomsen, F. (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish. COWRIE Ref: Fish 06-08, Technical Report.

413 Engås, A., Løkkeborg, S., Ona, E. & Soldal, A. V. (1996). Effects of seismic shooting on local abundance and catch rates of cod (Gadus morhua) and haddock (Melanogrammus aeglefinus). Canadian Journal of Fisheries and Aquatic Science 53, 2238–2249.

414 Engås, A. & Løkkeborg, S. (2002). Effects of seismic shooting and vessel-generated noise on fish behaviour and catch rates. Bioacoustics 12, 313–315.

415 Skalski, J. R., Pearson, W. H. & Malme, C. I. (1992). Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (Sebastes spp.). Canadian Journal of Fisheries and Aquatic Sciences 49, 1357–1365.

416 Wardle, C. S., Carter, T. J., Urquhart, G. G., Johnstone, A. D. F., Ziolkowski, A. M., Hampson, G. & Mackie, D. (2001). Effects of seismic air guns on marine fish. Continental Shelf Research 21, 1005–1027.

417 Slotte, A., Kansen, K., Dalen, J. & Ona, E. (2004). Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. Fisheries Research 67, 143–150.

418 Wardle, C. S., Carter, T. J., Urquhart, G. G., Johnstone, A. D. F., Ziolkowski, A. M., Hampson, G. & Mackie, D. (2001). Effects of seismic air guns on marine fish. Continental Shelf Research 21, 1005–1027.

419 Doksæter, L., Godø, O. R., Handegard, N. O., Kvadsheim, P.H., Lam, F.-P. A., Donovan, C. and Miller, P. J. O. 2009. Behavioral responses of herring (*Clupea harengus*) to 1–2 and 6–7 kHz sonar signals and killer whale feeding sounds. Journal of the Acoustical Society of America 125: 554-564.

130 dB re 1 μPa are likely to have a significant influence on the behaviour of fish[420]. Although the responses of fish to commercially available acoustic harassment devices (AHDs) have not been thoroughly tested it is thought that AHDs which produce substantial energy in the ultrasonic range may cause some behavioural avoidance responses in fish with good ultrasonic hearing but only close to the device (within 20 metres)[421].

A recent study of foraging performance in three-spined sticklebacks exposed to acoustic noise found that the addition of noise resulted in decreased foraging efficiency, with more attacks needed to consume the same number of prey items[422]. Acoustic noise increased food-handling errors and reduced discrimination between food and non-food items, results that are consistent with a shift in attention. In this case noise may have attracted the attention of the fish, thus preventing them from focusing fully on foraging.

Increased levels of anthropogenic noise in the marine environment may also invoke a stress response in fish. Studies of captive freshwater fish exposed to simulated boat noise for 30 minutes found increased level of the stress hormone cortisol in the blood[423]. Noise-related increases in heart rate and muscle metabolism have also been reported for captive fish[424] [425]. Although data are lacking for wild fish in terms of noise-related stress effects, these studies at least suggest that anthropogenic noise could be a stressor in natural water bodies[426]. Stress is known to affect health and well-being in terrestrial vertebrates by influencing processes such as growth and reproduction. Highly stressed fish may also be more susceptible to predation or other environmental effects than non-stressed fish[427]. The issue of noise-related stress in marine fish is clearly in need of investigation in the natural environment which may involve developing new analytical techniques to accurately measure stress levels '*in situ*'.

C. MASKING

Masking by anthropogenic noise can affect fish in two main ways, by interfering with acoustic communication or through the masking of important environmental auditory cues.

420 Kastelein, R. A., S. van der Heul, J. van der Veen, W. C. Verboom, N. Jennings, D. de Haan, and P. J. H. Reijnders. 2007. Effects of acoustic alarms, designed to reduce small cetacean bycatch in gillnet fisheries, on the behaviour of North Sea fish species in a large tank. Marine Environmental Research 64:160-180.

421 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

422 Purser J, Radford AN (2011) Acoustic Noise Induces Attention Shifts and Reduces Foraging Performance in Three-Spined Sticklebacks (Gasterosteus aculeatus). PLoS ONE 6(2): e17478. doi:10.1371/journal.pone.0017478

423 Wysocki, L.E. et al. (2006) Ship noise and cortisol secretion in European freshwater fishes. Biol. Conserv. 128, 501–508

424 Graham, A.L. and Cooke, S.J. (2008) The effects of noise disturbance from various recreational boating activities common to inland waters on the cardiac physiology of a freshwater fish, the largemouth bass (Micropterus salmoides). Aquatic Conserv: Mar. Freshw. Ecosyst. 18, 1315–1324

425 Buscaino, G. et al. 2009. Impact of an acoustic stimulus on the motility and blood parameters of European sea bass (Dicentrarchus labrax L.) and gilthead sea bream (Sparus aurata L.). Mar. Environ. Res. 69, 136–142

426 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

427 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

The potential for masking of acoustic communication in marine fish is considerable. Over 800 species from 109 families of bony fish are known to produce sounds and many more species are suspected to do so[428 429]. The majority of fish species detect sounds from below 50 Hz up to 500–1500 Hz with most communication signals in fish falling within a frequency band between 100 Hz and 1 kHz[430431], which overlaps with low frequency shipping noise. There are also a small number of species that can detect sounds to over 3 kHz, while a very few species can detect sounds to well over 100 kHz[432]. Fish are known to produce sounds during territorial fighting, when competing for food or when being attacked by a predator[433]. Acoustic communication can also be extremely important for courtship interactions[434] and in spawning aggregations[435]. Masking of the sounds produced by fish for mate detection and recognition, or for aggregating reproductive groups may therefore have significant fitness consequences for populations. Noise produced by boat traffic has been shown to reduce the effective range of communication signals and therefore the signalling efficiency between individual fish in freshwater environments[436 437]. A study in the Mediterranean Sea revealed that recreational boat noise can significantly increase detection threshold levels for conspecific sounds in brown meagre drums and damselfish, and it was inferred that passing vessels were reducing detection distances in this environment by up to 100 times[438]. Signals may also be detected but not fully understood as some of the required information in the signal is lost. Although not reported in marine fish to date, a reduction in

428 Ladich, F. (2004) Sound production and acoustic communication. In The Senses of Fish: Adaptations for the Reception of Natural Stimuli (von der Emde et al., eds),pp. 210–230, Kluwer Academic Publishers & Narosa Publishing House

429 Kasumyan, A.O. (2008) Sound and sound production in fishes. J. Ichthyol. 11, 981–1030

430 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

431 Zelick, R., D. A. Mann, and A. N. Popper. 1999. Acoustic communication in fishes and frogs, p. 363-411. *In* A. P. Popper and R. R. Fay (ed.), Comparative Hearing: Fish and Amphibians, Springer Verlag, New York

432 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489

433 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

434 Myrberg, A.A. et al. (1986) Sound production by males of a coral reef fish (Pomacentrus partitus): its significance to females. Anim. Behav. 34, 913–923

435 Aalbers, S.A. (2008) Seasonal, diel, and lunar spawning periodicities and associated sound production of white seabass (Atractoscion nobilis). Fishery Bull. 106, 143–151

436 Amoser, S., Wysocki, L.E., Ladich, F., 2004. Noise emission during the first powerboat race in an Alpine lake and potential impact on fish communities. J. Acoust. Soc. Am. 116, 3789–3797.

437 Vasconcelos, R.O., Amorim, M.C.P., Ladich, F., 2007. Effects of ship noise on the detectability of communication signals in the Lusitanian toadfish. J. Exp. Biol. 210, 2104–2112.

438 Codarin, A., et al. Effects of ambient and boat noise on hearing and communication in three fish species living in a marine protected area (Miramare, Italy). Mar. Pollut. Bull. (2009), doi:10.1016/j.marpolbul.2009.07.011

detection distance that influenced mate attraction was reported in birds[439], while sexual signals for mate selection in frogs[440] have been masked in noisy conditions. Some fish communities that are located in busy shipping lanes or noisy coastal areas are likely to be restricted in their ability to detect and respond to acoustic signals.

Anthropogenic noise may also interfere with prey or predator detection in marine fish[441]. Predator avoidance by fish may depend on species hearing or localizing specific sounds. For example some herring species (Clupeidae) of the genus *Alosa* are capable of detecting ultrasound (up to 180 kHz), which could allow them to detect and avoid echo-locating whales[442]. Studies on European eels and juvenile salmonids revealed that they are able to detect and avoid infrasound (<20 Hz), which may allow them to sense the hydrodynamic noise generated by approaching predators[443] [444]. It has been suggested that predators that use sound for hunting can be restricted by noisy conditions through lower availability of suitable foraging areas (habitat displacement) and a lower catching efficiency[445]. The latter has also recently been shown for predatory fish that rely on vision to catch prey and was attributed to the sound interfering with the attention span of the fish, distracting it from feeding[446].

Anthropogenic masking of natural acoustic cues that are important for the orientation of marine fish may also be occurring in coastal environments. The noise generated by temperate or tropical (coral) reef communities is one of the cues used by the pelagic larval stages of reef fish for orientation prior to settlement[447] [448] [449]. Fish larvae have also been shown to return to their natal

439 Habib, L. et al. (2006) Chronic industrial noise affects pairing success and age structure of ovenbirds Seiurus aurocapilla. J. Appl. Ecol. 44, 176–184

440 Wollerman, L. and Wiley, R.H. (2002) Background noise from a natural chorus alters female discrimination of male calls in a neotropical frog. Anim. Behav. 63, 15–22

441 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243

442 Dokseater, L. et al. (2009) Behavioral responses of herring (Clupea harengus) to 1-2 and 6-7 kHz sonar signals and killer whale feeding sounds. J. Acoust. Soc. Am. 125, 554–564

443 Sand, O. et al. (2000) Avoidance responses to infrasound in downstream migrating European silver eels, Anguilla anguilla. Environ. Biol. Fishes 57, 327–336

444 Knudsen, F.R. et al. (1997) Infrasound produces flight and avoidance response in Pacific juvenile salmonids. J. Fish Biol. 51, 824–829

445 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243.

446 Purser J, Radford AN (2011) Acoustic Noise Induces Attention Shifts and Reduces Foraging Performance in Three-Spined Sticklebacks (Gasterosteus aculeatus). PLoS ONE 6(2): e17478. doi:10.1371/journal.pone.0017478

447 Leis, J.M., Carson-Ewart, B.M., Hay, A.C., Cato, D.H., 2003. Coral-reef sounds enable nocturnal navigation by some reef-fish larvae in some places and at some times. J. Fish. Biol. 63, 724–737.

448 Simpson SD, Meekan M, Montgomery J, McCauley R, Jeffs A. 2005. Homeward sound. Science 308:221.

449 Montgomery, J.C., Jeffs, A., Simpson, S.D., Meekan, M., Tindle, C., 2006. Sound as an orientation cue for the pelagic larvae of reef fishes and decapod crustaceans. Adv. Mar. Biol. 51, 143–196.

reef[450] [451], most probably using acoustic and chemical cues for locating the settlement habitat. Recent studies of reef noise indicate that habitats within coral reefs produce different acoustic profiles[452] that are used by some species of juvenile reef fish for nocturnal orientation[453]. It has also been found that reef fish larvae, after several hours of exposure, can become attracted to artificial sounds that would normally be avoided[454]. It has also been suggested that increased levels of noise may inhibit orientation / settlement of fish larvae on coral reefs by masking the necessary acoustic cues received by larval fish[455]. It does appear that anthropogenic noise has the potential to negatively influence the recruitment of fish larvae onto temperate or tropical reef systems but this needs verification. Shipping noise from engines has also been shown to attract settlement of mussel larvae, causing biofouling of ship hulls[456].

Anthropogenic-induced degradation of marine habitats such as coral reefs may also indirectly influence larval orientation and recruitment to habitats by changing the acoustic profile of these habitats. Quieter habitats combined with increasing anthropogenic noise may have an impact on larval recruitment through reduced settlement[457].
This section has reviewed in some detail the known and potential impacts of anthropogenic noise on marine teleost fish but elasmobranchs (sharks, skates and rays) have not been mentioned until now. In fact there are no reported studies of the effects of anthropogenic noise exposure on elasmobranchs and only a few experiments exploring behavioural responses to sound in sharks (but not skates or rays)[458]. Studies of acoustic attraction in 18 species of coastal and oceanic sharks found that individuals would approach underwater speakers broadcasting low-frequency, erratically pulsed sounds from a distance of several hundred metres[459]. A few studies investigating avoidance behaviour, found that sudden loud sounds (20-30 dB above ambient noise levels) played when a shark approached a location would startle the shark and cause it to

450 Jones GP, Planes S, Thorrold SR (2005) Coral reef fish larvae settle close to home. Curr Biol 15:1314–1318

451 Almany GR, Berumen ML, Thorrold SR, Planes S, Jones GP (2007) Local replenishment of coral reef fish populations in a marine reserve. Science 316:742–744

452 Kennedy EV, Guzman HM, Holderied MW, Mair JM, Simpson SD (2010) Reef generated noise provides reliable information about habitats and communities: evidence from a Panamanian case study. J Exp Mar Biol Ecol 395: 85–92

453 Radford CA, Stanley JA, Simpson SD, Jeffs AG (2011) Juvenile coral reef fishes use sound to locate habitats. Coral Reefs, 30:295-305

454 Simpson SD, Meekan MG, Larsen NJ, McCauley RD, Jeffs A (2010) Behavioural plasticity in larval reef fish: orientation is influenced by recent acoustic experiences. Behav Ecol 21: 1098–1105.

455 Simpson SD, Meekan MG, Jeffs A, Montgomery JC, McCauley RD. 2008. Settlement-stage coral reef fishes prefer the higher frequency invertebrate-generated audible component of reef noise. Anim Behav 75:1861–8.

456 Wilkens, S.L., Stanley, J.A., Jeffs A.G. 2012. Induction of settlement in mussel (*Perna canaliculus*) larvae by vessel noise, Biofouling: The Journal of Bioadhesion and Biofilm Research, 28:1, 65-72.

457 Leis, J.M., Siebeck, U. and Dixon, D. How nemo finds homes:The neuroecology of dispersal and of population connectivity in larvae of marine fishes. Integrative and Comparative Biology, volume 51, number 5, pp. 826–843

458 Casper, B.M., Halvorson, M.B. and Popper, A.N. (in press). Are sharks even bothered by a noisy environment?

459 Myrberg AA Jr (2001) The acoustical biology of elasmobranchs. Environ Biol Fish 60:31-45.

turn away from the area. In most cases involving attraction and repulsion, the sharks would habituate to the stimuli after a few trials[460].

Elasmobranchs do not have a swim bladder or any other air-filled cavity, meaning that they are incapable of detecting sound pressure. Therefore particle motion is assumed to be the only sound stimulus that can be detected. The hearing bandwidth for elasmobranchs has been measured as between 20 Hz and 1 kHz, with similar thresholds in all species above 100 Hz[461]. Elasmobranchs do not appear to be as sensitive to sound as teleost fish when measured in comparable ways[462]. However, the current knowledge of elasmobranch hearing is based on data from only a few of the hundreds of species, and so one must be cautious in making generalizations about an entire subclass of fishes based on these data[463].

Anthropogenic noise sources that have the potential to affect elasmobranchs are thought to be pile driving, wind turbines and boat noise[464]. Elasmobranchs have been reported to aggregate around coastal and offshore man-made structures[465]. High intensity sounds produced by pile driving could damage hearing in elasmobranchs in the form of a TTS and result in a temporary loss of sensitivity[466]. Secondly the impact of the hammer on the pile may cause barotrauma in elasmobranchs and this has recently been reported in some organs in teleost fish including the liver and kidneys[467]. Demersal elasmobranchs such as skates and rays may also be damaged by the intense vibrations in the sediments that are caused by pile driving[468]. The continuous low frequency sound produced by operating turbines in offshore wind farms could potentially mask sounds that are important to elasmobranchs. Similarly, shipping noise may mask biologically important sounds or result in some of the effects observed in teleost fish also occurring in elasmobranchs (e.g., the production of stress hormones)[469]. It is clear that extensive research is required to assess the effects of anthropogenic noise on elasmobranch (and also teleost) fish in the marine and coastal environment.

460 Casper, B.M., Halvorsen, M.B. and Popper, A.N. (in press). Are sharks even bothered by a noisy environment?

461 Casper and Mann 2009

462 Casper, B.M., Halvorsen, M.B. and Popper, A.N. (in press). Are sharks even bothered by a noisy environment?

463 Ibid

464 Ibid

465 Stanley DR, Wilson CA (1991) Factors affecting the abundance of selected fishes near oil and gas platforms in the Northern Gulf of Mexico. Fish Bull 89:149-159.

466 Casper, B.M., Halvorsen, M.B. and Popper, A.N. (in press). Are sharks even bothered by a noisy environment?

467 Halvorsen et al., (in press)

468 Casper, B.M., Halvorsen, M.B. and Popper, A.N. (in press). Are sharks even bothered by a noisy environment?

469 Ibid

IMPACTS ON OTHER MARINE ORGANISMS

Other marine animals that are sensitive to underwater sound include marine turtles[470], and many invertebrates[471] [472]. There is very limited information available for the effects of anthropogenic noise on these marine taxa at the present time although research and conservation interest is growing in these fields.

MARINE TURTLES

Marine turtles are sensitive to low frequency sounds within the range of 100 to 1000 Hz with greatest sensitivity between 200 to 400 Hz[473]. As for invertebrates only studies involving air-gun arrays and their effect on marine turtles have been completed to date. These studies are either experimental where enclosed individuals are exposed to air guns or are part of monitoring assessments conducted during seismic surveys from the survey vessel[474]. Most experimental studies to assess short-term responses have demonstrated a strong initial avoidance response in marine turtles to air-gun arrays[475] [476] [477] at a strength of 175 dB re 1µPa rms or greater. Enclosed turtles also responded less to successive air-gun shots which may have been caused by reduced hearing sensitivity (TTS). For example, one turtle experienced a TTS of 15dB and recovered two weeks later[478]. It was estimated in one study that a typical air-gun array operating in 100–120 m water depth, could cause behavioural changes at a distance of ~2 km and avoidance at around 1 km for marine turtles[479]. A recent monitoring assessment recorded that 51% of turtles dived at or before their closest point of approach to the air-gun array[480].

---

470 Southwood, A., Fritsches, K., Brill, R. and Swimmer, Y. 2008. Sound, chemical and light detection in sea turtles and pelagic fishes: sensory-based approaches to bycatch reduction in longline fisheries. Endang Species Res 5: 225-238

471 Budelmann, B. U. (1992a). Hearing in crustacea. In The Evolutionary Biology of Hearing (ed. D. B. Webster, R. R. Fay and A. N. Popper), pp. 131-140. New York: Springer-Verlag

472 Budelmann, B. U. (1992b). Hearing in non-arthropod invertebrates. In The Evolutionary Biology of Hearing (ed. D. B. Webster, R. R. Fay and A. N. Popper), pp. 141-155. New York: Springer-Verlag.

473 Southwood, A., Fritsches, K., Brill, R. and Swimmer, Y. 2008. Sound, chemical and light detection in sea turtles and pelagic fishes: sensory-based approaches to bycatch reduction in longline fisheries. Endang Species Res 5: 225-238

474 LGL 2011. Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Central-Western Bering Sea, August 2011. LGL Report P1198-3

475 O'Hara, J. and J.R. Wilcox. 1990. Avoidance responses of loggerhead turtles, *Caretta caretta*, to low frequency sound. **Copeia** 1990(2):564-567.

476 McCauley RD, Duncan AJ, Penrose JD, et al. 2000. Marine seismic surveys – a study of environmental implications. APPEA J 40: 692–706

477 Lenhardt, M. 2002. Sea turtle auditory behavior. J. Acoust. Soc. Amer. 112(5, Pt. 2):2314 (Abstract).

478 Ibid

479 McCauley RD, Duncan AJ, Penrose JD, et al. 2000. Marine seismic surveys – a study of environmental implications. APPEA J 40: 692–706

480 DeRuiter, S.L. and Doukara, R.L 2010. Loggerhead turtles dive in response to airgun sound exposure. (ASA abstract)

Long-term exposure to high levels of low frequency anthropogenic noise in coastal areas that are also vital habitat may affect turtle behaviour and ecology[481]. Avoidance behaviour may result in significant changes in turtle distribution with potential consequences for individuals or populations if displaced from their preferred feeding habitat[482]. At lower sound levels turtles that remain in an affected area may show abnormal behaviour that reduces their foraging efficiency. However there are currently no reported studies of the long-term effects of altered behaviour in marine turtles.

MARINE INVERTEBRATES

Most marine invertebrates that are sensitive to sound are receptive to low frequencies by detecting the particle motion component of the sound field. Crustaceans appear to be most sensitive to sounds of less than 1 kHz[483] but able to detect up to 3 kHz in some species[484]. Cephalopods are sensitive to water movement stimuli in a range between <20 and 1500 Hz[485 486]. As well as being receptive to sound many invertebrates are also capable of producing sounds including species of barnacles, amphipods, shrimp, crabs, lobsters, mantis shrimps, sea urchins and squid[487 488 489 490]. In some species of invertebrates the sounds emitted are thought to be ecologically important in terms of acoustic communication between conspecifics[491]. It has been

481 Samuel Y. et al., 2005. Underwater, low-frequency noise in a coastal sea turtle habitat. J. Acoust. Soc. Am. Volume 117, Issue 3, pp. 1465-1472

482 Pendoley, K. 1997. Sea turtles and management of marine seismic programs in Western Australia. Petrol. Expl. Soc. Austral. J. 25:8-16.

483 Budelmann, B. U. (1992a). Hearing in crustacea. In The Evolutionary Biology of Hearing (ed. D. B. Webster, R. R. Fay and A. N. Popper), pp. 131-140. New York: Springer-Verlag

484 Lovell, J. M., M. M. Findlay, R. M. Moate, and H. Y. Yan. 2005. The hearing abilities of the prawn Palaemon serratus. Comp. Biochem. Physiol. A-Molecular & Integrative Physiology 140:89-100.

485 Packard, A., Karlsen, H.E., and Sand, O. (1990). Low frequency hearing in cephalopods. J. Comp. Physiol. A., 166: 501-505.

486 Hu, M.Y., H.Y. Yan, W-S Chung, J-C Shiao, and P-P Hwang. 2009. Acoustically evoked potentials in two cephalopods inferred using the auditory brainstem response (ABR) approach. Comp. Biochem. Physiol. A 153:278-283.

487 Au, W.W.L. and K. Banks. 1998. The acoustics of snapping shrimp Synalpheus parneomeris in Kaneohe Bay. J. Acoust. Soc. Am. 103:41-47.

488 Iversen, R.T.B., Perkins, P.J., Dionne, R.D., 1963. An indication of underwater sound production by squid. Nature 199, 250–251.

489 Radford, C., Jeffs, A., Tindle, C., Montgomery, J.C., 2008. Resonating sea urchin skeletons create coastal choruses. Mar. Ecol. Prog. Ser. 362, 37–43.

490 Staaterman, E.R., Clark, C.W., Gallagher, A.J., deVries, M.S., Claverie, T. and Patek, S.N. 2011. Rumbling in the benthos:acoustic ecology of the California mantis shrimp *Hemisquilla californiensis.* Aquat Biol 13: 97-105

491 Ibid

suggested that acoustic communication and perception in invertebrates might be related to as many functions as in marine vertebrates[492].

At the time of writing there are no reported research studies to determine the effects of a number of anthropogenic noise sources (pile driving, industrial activities and sonar) on marine invertebrates. In addition there are currently no reliable data available on hearing damage in invertebrates as a result of exposure to anthropogenic noise[493]. Sensitivity to low frequencies indicates that marine invertebrates are likely to be susceptible to sources such as shipping noise, offshore industrial activities (e.g., wind or tidal turbines) and seismic surveys.

The few studies that have been completed have primarily focussed on the impact of seismic surveys (air-gun arrays) on marine invertebrates, mainly crustaceans and cephalopods. A critical review of 20 studies completed up to 2004 found that only nine were quantitative[494] and within these the effects on marine invertebrate species were mixed (Table 2). The authors concluded that the lack of robust scientific evidence for the effects of seismic surveys on marine invertebrates meant that no clear conclusions could be made.

There are however a number of studies that should be mentioned. Firstly a significant increase in the strandings of giant squid in Spain during 2001 and 2003 coincided with the proximity of seismic survey vessels conducting air-gun arrays[495]. Pathological analysis of stranded squid showed the presence of lesions in tissues and organs leading to the suggestion that they were caused by excessive sound exposure from air guns[496]. Secondly a recent experimental study showed that moderately intense low frequency sound was responsible for the severe acoustic trauma and mortality in four species of cephalopod[497]. Lesions in the sensory epithelium and damaged sensory hair cells and nerve fibres were reported in each species. As relatively low levels of low-frequency sound and short exposure had induced severe acoustic trauma in cephalopods, it was suggested that there may be considerable effects of similar noise sources on these species in natural conditions over longer time periods[498].

Table 2. A summary of impacts of seismic surveys on marine invertebrates (after Moriyasu et al., 2004)

492 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

493 OSPAR Commission. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission

494 Moriyasu et al., 2004. Effects of seismic and marine noise on invertebrates: A literature review. Canadian Science Advisory Secretariat. Research document 2004/126

495 Guerra A, González AF, and Rocha F. 2004a. A review of records of giant squid in the north-eastern Atlantic and severe injuries in *Architeuthis dux* stranded after acoustic exploration. *ICES CM* 2004/CC: 29.

496 Guerra A, González AF, Rocha F, et al. 2004b. Calamares gigantes varados. Víctimas de exploraciones acústicas. Investigación y Ciéncia 334: 35–37 (cited from Andre et al., 2011)

497 Andre et al., 2011. Low-frequency sounds induce acoustic trauma in cephalopods. Front Ecol Environ 9: 489–493,

498 Ibid

	Lethal / Physical	Physiological / Pathological	Behavioural	Catch rate
Negative	*Loligo vulgaris* *Chionoectes opilo (eggs)* *Chlamys islandicus* Sea urchins *Architeuthis dux*	*Bolinus brandaris*	*Alloteuthis sublata* *Sepioteuthis australs* *Architeuthis dux*	*Bolinus brandaris*
No impact	*Chionoectes opilo* *Mytilus edulis* *Gammarus locusta* *Crangon crangon*	*Chionoectes opilo*	*Chionoectes opilo*	*Crangon crangon* *Penaeus blebejus* *Nephrops norvegicus* *Illes coindetti* *Squilla mantis* *Paphia aurea* *Anadara inaequivalvis*

Table 2 indicates that marine invertebrates can also be affected by seismic surveys in terms of behaviour. Direct observation of squid exposed to air-gun sound showed a strong startle response involving ink ejection and rapid swimming at 174 dB re 1µPa rms and also avoidance behaviour[499].

Increased levels of background noise are likely to alter the acoustic environment of marine invertebrates. Low frequency anthropogenic noise may be masking acoustic communication in marine invertebrates such as crustaceans[500]. Masking of important acoustic cues used by invertebrates during larval orientation and settlement may also be a factor in the coastal zone and could lead to maladaptive behaviour that reduces successful recruitment[501]. More subtle physiological changes could also occur in a noisy (stressful) environment. For example, brown shrimp exposed to increased background noise for up to three months demonstrated significant decreases in both growth and reproductive rates[502]. Shrimps were also more aggressive in the noisy tank, with increased mortality and decreased food intake. These are often regarded as symptoms of stress in vertebrates.

499 McCauley RD, Duncan AJ, Penrose JD, et al. 2000. Marine seismic surveys – a study of environmental implications. APPEA J 40: 692–706.

500 Staaterman, E.R., Clark, C.W., Gallagher, A.J., deVries, M.S., Claverie, T. and Patek, S.N. 2011. Rumbling in the benthos:acoustic ecology of the California mantis shrimp *Hemisquilla californiensis*. Aquat Biol 13: 97-105

501 Simpson SD, Radford AN, Tickle EJ, Meekan MG, Jeffs AG (2011) Adaptive Avoidance of Reef Noise. PLoS ONE 6(2): e16625. doi:10.1371/ journal.pone.0016625

502 Lagardère, J.P. 1982. Effects of noise on growth and reproduction of *Crangon crangon* in rearing tanks. Mar. Biol. 71:177-186.

IV. MITIGATION AND MANAGEMENT OF UNDERWATER NOISE

This chapter reviews the existing measures and procedures in place to mitigate for the effects of underwater noise on marine organisms. Current guidelines for noise mitigation management have primarily been designed for marine mammals and particularly cetaceans. The limitations of mitigation guidance for naval exercises using active sonar and seismic surveying plus the development of standards for the measurement and control of underwater noise attributable to military and commercial operations will also be discussed. A number of management frameworks have been proposed. To date mitigation measures for underwater noise fall into two main categories: noise control at source and spatio-temporal restrictions of noise producing activities.

It should be noted here that the overall high level of uncertainty that currently exists regarding many of the effects of anthropogenic noise on marine fauna means that it is very important to use a precautionary approach when undertaking noise emitting activities in the marine environment. The application of the precautionary principle to the issue of marine noise has been discussed in some detail[503]. The precautionary approach may be inconvenient to those with narrow commercial interests, but precaution in the face of uncertainty is rational and is an approach that is now deeply embedded in the way that society operates[504]. Reducing uncertainty by increasing our knowledge and understanding of the issue will be the best guard against excessive precaution and over-regulation[505].

NOISE CONTROL AT SOURCE

One way to regulate noisy activities is to set criteria for noise exposure that should not be exceeded. For example, recently proposed sound exposure criteria for cetaceans and pinnipeds consist of both un-weighted peak pressures and weighted sound exposure levels which are an expression for the total energy of a sound wave[506]. These values are currently based on limited data sets with respect to noise induced injury and behavioural response in marine mammals. There have been similar attempts to define exposure criteria for fish[507], but none of the studies have been published in the peer reviewed literature[508]. A level of 180 dB re 1 µPa rms for cetaceans (both baleen and toothed whales) and 190 dB re 1 µPa rms for pinnipeds has been used

503 Gillespie, A. 2007. The Precautionary Principle in the Twenty-First Century: A Case Study of Noise Pollution in the Ocean. The International Journal of Marine and Coastal Law 22(1): pp. 61-87

504 Boyd, I.L., G. Frisk, E. Urban, P. Tyack, J. Ausubel, S. Seeyave, D. Cato, B. Southall, M. Weise, R. Andrew, T. Akamatsu, R. Dekeling, C. Erbe, D. Farmer, R. Gentry, T. Gross, A. Hawkins, F. Li, K. Metcalf, J.H. Miller, D. Moretti, C. Rodrigo, and T. Shinke. 2011. An International Quiet Ocean Experiment. *Oceanography* 24(2):174–181, doi:10.5670/oceanog.2011.37.

505 Ibid

506 Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, C.R. Jr., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A., and Tyack, P. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33: 411-521.

507 Popper, A.N., Carlson, T.J., Hawkins, A.D. and Southall, B.L. (2006). Interim criteria for injury of fish exposed to pile driving operations: a white paper (available at: http://www.wsdot.wa.gov/NR/rdonlyres/84A6313A-9297-42C9-BFA6750A691E1DB3/0/BA_PileDrivingInterimCriteria.pdf).

508 Tasker at al., 2010 Tasker, M.L. Amundin M., Andre M., Hawkins A., Lang W., Merck T., Scholik-Schlomer A., Teilmann J., Thomsen F., Werner S. & Zakharia M. 2010. Marine Strategy Framework Directive. Task Group 11 Report. Underwater noise and other forms of energy. JRC and ICES.

as a generic exposure criterion in the U.S.[509] [510], although these have been criticised as being set too high[511]. There are no widely accepted exposure criteria for marine fish or other taxa.

Mitigation of the source can take the form of reducing the total amount of sound produced, by reducing power, duration and/or by reducing the number of times a system transmits sound. Where the species of concern has a well-defined hearing sensitivity, it may be possible to operate at frequencies where the animal's hearing is relatively insensitive.

SPATIO-TEMPORAL RESTRICTIONS

Noise levels experienced by marine animals during sound intensive activities can also be controlled by setting exclusion or safety zones. For example, the Joint Nature Conservation Committee (UK) recommends a marine mammal exclusion zone of 500m during the start of seismic surveys[512] while the Umweltbundesamt (Germany) recommends an exclusion zone of 750m around a pile driving site where a certain sound pressure level should not be exceeded. However, it remains unclear whether or not safety zones are effective in protecting marine animals from excessive sound exposure. For example, it is not always guaranteed that sound pressure drops monotonically with increasing distance. Exclusion zone validity is also questionable if exposure levels in the field are not measured during the sound producing operation. More subtle effects such as masking and behavioral responses are also possible beyond the recommended exclusion zone for some marine animals[513].

Exclusion of the noisy activity through the use of spatial restrictions such as statutory marine protected areas (MPAs) has been described as the most effective means of protecting cetaceans and their habitats from the cumulative and synergistic effects of noise as well as from other anthropogenic stressors[514] [515]. Enforcement of permanent or temporary exclusion zones such as MPAs requires effective and constant monitoring, control and surveillance[516]. The use of spatio-temporal restrictions (STRs) to protect marine mammals and other taxa from noise pollution and

509 NMFS (National Marine Fisheries Service) 2003. Taking marine mammals incidental to conducting oil and gas exploration activities in the Gulf of Mexico. Federal Register, 68: 9991 – 9996.

510 NOAA (National Oceanic and Atmospheric Administration). 2005. Endangered fish and wildlife; Notice of intent to prepare and environmental impact statement. Federal Register, 70: 1871-1875.

511 Weilgart, L.S. 2007. The impacts of ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

512 Joint Nature Conservation Committee- JNCC-(2004). Guidelines for minimising acoustic disturbance to marine mammals from seismic surveys. JNCC, Aberdeen (www.jncc.gov.uk).

513 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

514 Sascha K. Hooker & Leah R. Gerber. 2004. Marine Reserves as a Tool for Ecosystem-Based Management: The Potential Importance of Megafauna. 54 BioScience 27 .

515 Weilgart, L.S. 2006. Managing Noise through Marine Protected Areas around Global Hot Spots. IWC Scientific Committee (SC/58/E25).

516 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution.Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029. www.lab.upc.es .

other stressors has been strongly endorsed with the proposal of a conceptual framework for STR implementation[517]. Geographical and seasonal restrictions to avoid the ensonification of sensitive species and habitats are also known to be a highly effective mitigation measure[518] and can be part of an STR approach within marine spatial planning. Sound-producing activities can be scheduled to avoid areas or times that sensitive marine mammals and other species use for susceptible activities such as mating, breeding, feeding, or migration. There is however a difference between human activities producing noise as an unwanted side effect (e.g., shipping and pile driving) and activities deliberately emitting sounds (e.g., seismic surveys) for specific goals. Noise from the former can be reduced by using mitigation tools without impairing their main mission objectives. The latter are potentially more difficult to reduce their sound emission and may also be less flexible on a temporal scale.

Proposed mitigation measures or techniques

The development of 'warning signals' for marine mammals has been proposed[519] but there has been little development and testing for this to date. Some studies have shown that right whales (*Eubalaena* sp.) show strong responses to signals designed to alert them even though in this case one response was to surface and therefore be potentially more susceptible to ship collisions[520]. Very little is known of responses to warning signals by other marine species[521]. Acoustic harassment devices have been used for both seals and harbour porpoises and have proven to be effective in scaring the animals away from the source at close ranges[522] [523] [524], although habituation is possible[525]. However, since these devices deliberately disturb the receiver, their application needs to be considered from a conservational viewpoint. 'Whale-finding' sonar has

517 Agardy, T., Aguilar, N., Cañadas, A., Engel, M., Frantzis, A., Hatch, L., Hoyt, E., Kaschner, K., LaBrecque, E., Martin, V., Notarbartolo di Sciara, G., Pavan, G., Servidio, A., Smith, B., Wang, J., Weilgart, L., Wintle, B. and Wright, A. 2007. A Global Scientific Workshop on Spatio-Temporal Management of Noise. Report of the Scientific Workshop. 44 pages

518 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

519 National Research Council 1994. Low-frequency sound and marine mammals: current knowledge and research needs. National Academy Press, Washington, D. C. 92pp.

520 Nowacek, D. P., Johnson, M. P. and Tyack, P. L. 2004. Right whales ignore ships but respond to alarm stimuli. Proceedings of the Royal Society B: Biological Sciences 271: 227–231.

521 Aguilar de Soto, N., Johnson, M., Madsen, P., Bocconcelli, A., Tyack, P, Borsani, F. Does shipping noise affect the foraging behaviour of Cuvier's beaked whale (Ziphius cavisrostris)? Marine Mammal Science 22(3):690-699

522 Yurk, H. and Trites, A.W. (2000). Experimental attempts to reduce predation by harbor seals on out-migrating juvenile salmonids. Transactions of the American Fisheries Society 129, 1360-1366.

523 Culik, B.M., Koschinski, S., Tregenza, N. and Ellis, G.M. (2001). Reactions of harbour porpoises *Phocoena phocoena* and herring *Clupea harengus* to acoustic alarms. Marine Ecology Progress Series 211, 255-260.

524 Cox, T.M., Read, A.J., Solow, A. and Tregenza, N. (2001). Will harbour porpoises habituate to pingers?. Journal of Cetacean Research and Management. 3, 81-86.

525 National Research Council 1994. Low-frequency sound and marine mammals: current knowledge and research needs. National Academy Press, Washington, D. C. 92pp

been identified as the mitigation measure of the future[526]. These are high-frequency low-power sonars and therefore have a limited detection range (~ 2 km). Another suggestion is the use of sonar systems currently deployed in commercial fisheries (e.g., 'tuna finding' sonar) for the initial detection of marine mammals within an area. Adding more noise to the marine environment as a mitigation measure for noise remains controversial.

MITIGATION MEASURES FOR SPECIFIC NOISE GENERATING ACTIVITIES

Marine construction and industrial activities

One of the greatest sources of noise pollution from marine industrial activities is pile driving. There are currently several options available to reduce the sound impacts of pile driving at source[527] [528]:

- Enclosing the ramming pile with acoustically-isolated material (mantling) can decrease the source level by 5–25 dB, with higher frequencies more affected than lower ones. Further research is required to establish whether this will have a reduction in the far field. Mantling appears to be very promising but has so far only been tested in a relatively short pile.
- Installing an air-bubble curtain around the pile will result in a decrease of up to 20 dB, depending on frequency[529]. However, air bubble curtains are very expensive and might only be effective in relatively shallow water.
- Applying a soft-start/ramp-up procedure by slowly increasing the energy of the emitted sound). Soft-start procedures are theoretically promising but their effect has not been tested to a large degree. Ramping-up might also make it more difficult for cetaceans and seals to localise the sound source[530].
- The use of acoustic harassment devices for marine mammals or fish may be effective in scaring the animals away from the source of a potential impact[531]. Their effective deterrent

526 Gentry, R. L. 2004. Mitigation measures for use with military sonar. *In*: Proceedings of the workshop on active sonar and cetaceans, pp. 66–69. Ed. by P. G. H. Evans and L. A. Miller. European Cetacean Society Newsletter No 42.

527 Nehls, G., Betke, K., Eckelmann, S., and Ros, M. (2007). Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms. COWRIE Ltd, Newbury, U.K.

528 ASCOBANS 2009: Sixth Meeting of the Parties, Res. 2, "Adverse Effects of Underwater Noise on Marine Mammals during Offshore Construction Activities for Renewable Energy Production"

529 Würsig, B., Green, C.R. Jr., and Jefferson, T.A. (2000). Development of an air bubble curtain to reduce underwater noise of percussive piling. Mar. Environ. Res. 49, 79-93.

530 Richardson, W. J., Greene, C. R., Malme, C. I., & Thomson, D. H. (Eds.). 1995. Marine mammals and noise (Academic Press, New York), 576 pp.

531 Yurk, H. & Trites, A.W. 2000. Experimental attempts to reduce predation by harbour seals (Phoca vitulina) on out-migrating juvenile salmonids. Transactions of the American Fisheries Society 129: 1360-1366

zone can be less than the noise impact zone so several devices may need to be deployed at different distances from the construction site.

- Precautionary mitigation measures can include not carrying out pile driving in confined areas in close proximity to migrating fish and turtles, or during peak feeding or breeding season for marine mammals

- Alternative methods such as hydraulic pile driving may prove favourable as this method results in lower noise emissions which are close to the background noise level at sea (<100 dB re 1µPa).

- Delaying the start of or ceasing piling if turtles or marine mammals are detected (visually or acoustically) close to the source may also be effective in mitigating close-range effects[532].

Shipping

The scientific understanding of exactly how shipping noise impacts marine life, particularly regarding behavioural impacts, is currently limited[533]. However, the acoustic communication functions of many species may be negatively impacted by noise exposure, depending upon conditions and ambient noise levels in some biologically important areas[534] [535]. Reducing the overall noise output from marine vessels is likely to have demonstrable positive outcomes for acoustic communication, navigation, foraging efficiency, predator avoidance capabilities and noise induced stress. Unlike persistent forms of pollution, noise does not linger in the marine environment after it is introduced. Vessel-quieting technologies and/or operational strategies therefore have the potential to provide immediate benefits for marine animals that rely on sound.

Quieting technology for both surface and sub-surface military vessels to reduce their acoustic signature has been in use for some time[536]. Some of the understanding and many of the concepts of noise reduction engineering in military vessels can be tailored to the merchant fleet[537]. Commercial applications of ship quieting technology are advancing, with many of the associated technologies focusing on aspects of the propeller or other components of the propulsion systems.

532 Evans, P.G.H. and Hammond, P.S. (2004) Monitoring Cetaceans in European Waters. Mammal Review, 34: 131-156.

533 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

534 Hatch, L. T., C. W. Clark, R. Merrick, S. Van Parijs, D. Ponirakis, K. Schwehr, M. Thompson, and D. Wiley. (2008). Characterizing the relative contributions of large vessels to total ocean noise fields: a case study using the Gerry E. Studds Stellwagen Bank National Marine Sanctuary. Environmental Management (online – see: http://www.springerlink.com/content/u1p51226016240lp/fulltext.pdf)

535 Wright, A. J., N. Aguilar Soto, A. L. Baldwin, M. Bateson, C. Beale, C. Clark, T. Deak, E. F. Edwards, A. Fernández, A. Godinho, L. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L. Weilgart, B. Wintle, G. Notarbartolo-di-Sciara, and V. Martin. 2008. Do marine mammals experience stress related to anthropogenic noise? International Journal of Comparative Psychology, 20: 274-316.

536 McDonald, M. A., J. A. Hildebrand, and S. M. Wiggins. 2006. Increases in deep ocean ambient noise in the northeast Pacific west of San Nicholas Island, California. Journal of the Acoustic Society of America 120, 711-718.

537 Wright, A.J. (ed) 2008. International Workshop on Shipping Noise and Marine Mammals, Hamburg, Germany, 21st-24th April 2008. Okeanos - Foundation for the Sea, Auf der Marienhohe 15, D-64297 Darmstadt. 33+v p. http://www.okeanos-foundation.org/assets/Uploads/Hamburg-shipping-report-2.pdf

There may also be benefits in efficiency and reduced fuel consumption associated with reduced propeller cavitation, which will also reduce the overall radiated noise signature[538]. Minimizing propeller cavitation across the range of operating conditions should be the priority for larger vessels, given that other on-board noise sources will likely be overwhelmed by cavitation noise[539]. A range of actions have recently been identified to reduce ship noise including the development and implementation of noise limits and guidelines for individual ships that are considered before and during construction as well as actions that will help to identify and develop engineering measures for reduction of propeller and machinery noise[540].

Efforts to reduce structure-borne noise may be facilitated by advances in propulsion systems. The use of devices termed 'skysails' can result in the saving of up to 35% in fuel costs and cut noise levels accordingly as there is less engine demand. Skysails are attached to the bow of the ship and harness the wind in assisting the ship's propulsion[541]. Operational measures such as routing and speed restrictions could also have positive outcomes for ambient noise reduction in some areas. The relative costs and environmental benefits of either technological or operational mitigation measures related to vessel noise output are not well-known. One estimate for the quieting of an oil tanker was $2.7 million[542].

Working with the shipping industry is an essential part of the mitigation process along with reaching international agreements on noise emission levels. At a workshop in 2008 several industry leaders agreed that vessel noise is a global issue and set a goal of freezing noise levels within 10 years and then reducing them by several-fold within 30 years[543]. Recently, the United States submitted a proposal to the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) to explicitly consider this international matter and consider a global strategy[544]. The issue has been taken up by the IMO and progress is being made on exploring technical options to minimize the introduction of incidental noise into the marine environment from commercial shipping and, in particular, develop voluntary technical guidelines for ship-quieting technologies as well as potential navigation and operational practices.

538 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

539 Southall, B. L., A. E. Bowles, William T. Ellison, J. J., J. J. Finneran, R. L. Gentry, C. R. G. Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2008. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals 33:1-521.

540 Wright, A.J. (ed) 2008. International Workshop on Shipping Noise and Marine Mammals, Hamburg, Germany, 21st-24th April 2008. Okeanos - Foundation for the Sea, Auf der Marienhohe 15, D-64297 Darmstadt. 33+v p. http://www.okeanos-foundation.org/assets/Uploads/Hamburg-shipping-report-2.pdf

541 André M, Morell M, Mas A, et al. 2010. Best practices in management, assessment and control of underwater noise pollution. Laboratory of Applied Bioacoustics, Technical University of Catalonia, CONAT150113NS2008029.

542 Malakoffv, D. 2010. A push for quieter ships. Science 328. 1502 – 1503.

543 Ibid

544 United States Government (U.S.G.). 2008. Minimizing the introduction of incidental noise from commercial shipping operations in the the marine environment to reduce potential adverse impacts on marine life. Submitted to the Marine Environment Protection Committee of the International Maritime Organization, 58th session, agenda item 19.

In 2010, following a thorough assessment of the existing design and operational modifications and possibilities potentially relevant in the reduction of incidental noise produced by large vessels, MEPC agreed that:

1. the propeller is the main source for ship-generated underwater noise;
2. non-binding, technical guidelines and consideration of solutions to reduce the incidental introduction of underwater noise from commercial shipping would, in turn, reduce potential adverse impacts to marine life. Accordingly, the most plausible design and/or retrofit options (propulsion, hull design, onboard machinery and operational modifications) should be assessed by naval architects and engineers;
3. depending on the practicality/cost of noise mitigation measures, possible operational modifications should be considered for both new and existing vessels; and,
4. future research programmes should focus on the propeller and the relationship between cavitation and the cause of underwater sonic energy.

Currently the matter is before IMO's Design and Equipment Sub-Committee, which aims to develop the technical guidelines to address the issue on noise from commercial shipping and its adverse impacts on marine life, with a view to providing advice to MEPC in 2012-2013.

Military active sonar

Almost all of the mitigation measures conducted by the military are focused on marine mammals. Mitigation strategies range from the control of noise at source, to the complete cessation of the sonar activity. Simulations are used for training personnel in sonar operations but cannot completely remove the need for training at-sea.

The likelihood of a marine mammal being in the area prior to the commencement of a sonar transmission is moderate unless there is a large degree of overlap between the location of important habitats or migration routes and areas of sonar usage. There are several mitigation measures that might be effective in preventing injury through the direct effects of sonar. Firstly, vessels can avoid areas of known marine mammal abundance. If marine mammals are detected close to the source then regulation of the sonar transmission can be implemented. Detection of marine animals in the vicinity is therefore an important part of the mitigation process and is conducted by the use of marine mammal observers (MMOs) and either passive or active acoustic monitoring systems (PAM or AAM). MMOs are trained observers who aim to visually detect and identify marine mammals, at distances of up to 500m during daylight hours. Use of MMOs is mandatory on UK, German and Norwegian naval ships operating active sonar. The effectiveness of MMOs especially in conditions of poor visibility such as poor sea state, fog, and darkness, and for deep-diving species that are seldom seen at the surface, is likely limited.

Both passive and active acoustic monitoring can be used to detect marine mammals. Passive monitoring relies on marine animals to produce sound (and for those sounds to be recognised) and thus is not reliable for all species at all times. AAM systems can detect non-vocalizing animals such as marine mammals or fish, although often only at closer ranges than passive monitoring. Active acoustic monitoring can also estimate the range of targets more easily than passive monitoring. AAM is relatively undeveloped compared to PAM for detecting marine mammals and it adds another type of anthropogenic noise to the marine environment. Both systems can be installed on remotely operated or autonomous vehicles or from buoys or bottom-mounted hydrophones to provide a sweep of a wider area or for a longer time period than would be possible from a single vessel.

Passive or active acoustic monitoring offers the means to assess a large area of ocean when studying beaked whales in order to improve mitigation measures. If the lethal effects previously observed in beaked whales are due to a behavioural response to a lower level of active sonar sound and not to the direct physical effects of the higher level of sound itself then the exclusion zone during sonar transmissions needs to be large enough to ensure such a potentially lethal behavioural response does not occur.

Mitigation guidance during naval exercises

Guidance for mitigation is developed individually by a country for use by their own Navy, and, on the whole, navies self-regulate and set their own mitigation strategies[545]. Naval mitigation measures for active sonar exercises were recently reviewed in detail[546] but may have been updated since. Access to military mitigation guidelines can be challenging and it is likely that some guidance is not publicly available[547]. The mitigation guidance used during naval exercises usually has three main components[548]:

1. time/area planning (of exercises/active sonar use) to avoid marine mammals;
2. implementation of operational procedures (e.g., ‘soft start’); and
3. monitoring of animals for the purpose of maintaining an ‘exclusion zone’.

A summary of the guidance implemented by a number of Navies up to 2008 (Table 3) indicates that there is considerable variation in the guidelines followed by different countries and only one measure (use of an exclusion zone) is implemented by all those listed. A few of the key mitigation measures and their limitations will be mentioned here. Details of other measures are available in the review[549].

Avoidance of sensitive areas

Most naval guidance loosely defines sensitive areas as breeding, feeding or migration habitat for marine mammals, and/or focuses on specific measures for beaked whales. While many guidelines request more stringent mitigation procedures within such areas and suggest planning

545 Glassborow, J., 2006. Sensors and sensibilities: navies factor mammals into sonar use. Janes Navy international, September 2006. p. 28–32

546 Dolman, S. J., Weir, C.R., and Jasny, M. 2009. Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin 58 pp. 465-477.

547 Ibid

548 Ibid

549 Ibid

surveys to avoid sensitive times or areas, there is little rigorous definition of these areas and how they should influence naval exercises. The Norwegian navy (RNoN) guidelines include avoiding areas and periods of high marine mammal density and known beaked whale habitats, as well as avoiding whale watching areas, areas of intense fishing and whaling activities, and some fish spawning grounds and maintenance of a 200 m buffer around aquaculture facilities[550]. Only a few of the guidelines imposed a buffer zone around sensitive areas.

Soft start

A soft start (or "ramp-up") is a technical term for the gradual introduction of the sound source, and aims to provide any animals in the vicinity of the source with an opportunity to move away. However the effectiveness of the technique has not been proven. Soft starts are compulsory in most naval exercises with the exception of a few. During active sonar operation, soft start involves a gradual build-up of sound level and/or pulse duration over time, with the aim of warning marine mammals and allowing them to depart from the area before the sonar pulses reach peak amplitude and/or duration. The soft start process can vary in length from 15 to 30 minutes and breaks in transmission can also vary in length before a soft start is required again. For example a break of 30 minutes will trigger the need for a soft start for NATO exercises whilst the same trigger for the Canadian navy is a two hour gap.

Visual detection

Apart from external factors such as darkness or adverse weather conditions, the efficacy of visual detection depends on a number of variables including the number of marine mammal observers (MMOs) present, their experience, the regularity of observation breaks (i.e. concentration span), their dedication, objectivity (crew member or independent third-party), and enthusiasm and lastly their level of training[551]. There does not appear to be a standard training programme for MMOs[552] or a requirement that they are independent and civilian trained[553]. Aerial surveillance is required in some parts of the U.S. in addition to MMOs. For major exercises off California, a federal court required the U.S. Navy to conduct dedicated aerial monitoring for one hour before the start of sonar use and to continue monitoring during each exercise[554].

Exclusion zones

---

550 Ibid

551 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

552 Parsons, E.C.M., Dolman, S.J., Jasny, M., Rose, N.A., Simmonds, M.P., Wright, A.J. 2009. A critique of the UK's JNCC Seismic Survey Guidelines for minimising acoustic disturbance to marine mammals: best practise? Marine Pollution Bulletin 58 pp. 643 651.

553 Dolman, S. J., Weir, C.R., and Jasny, M. 2009. Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin 58 pp. 465-477.

554 Ibid

The exclusion zone (or 'safety zone') is usually defined as the radius around the sonar source within which real-time mitigation measures are implemented if animals are detected. Exclusion zones vary considerably in size and may be larger for naval sonar than for seismic surveying, where a 500 m exclusion zone is standard. The zone radius varies according to the type of marine mammal (e.g., toothed, baleen or beaked whale), source type (impulsive or coherent) and also between navies, ranging between 1500 and 4000 m[555].

Mitigation measures for marine fish

Only the Royal Norwegian Navy has implemented mitigation measures for fish; which are subject to revision depending upon ongoing studies on sonar effects on fish. During the planning of exercises involving transmissions below 5 kHz, planners should avoid spawning grounds, and areas with large numbers or intense fishing of herring and brisling (small herring). As a general precaution, a safety zone of 200m from all fish farms and all fishing vessels actively involved in fishing is also implemented. In addition some restrictions on transmission of certain waveforms and frequencies are required, as signals at these frequencies can match the swim bladder resonance of juvenile herring leading to damage[556].

Seismic surveys

A range of mitigation measures, similar to those used for active sonar, are applied either singly or in combination to reduce the potential impacts of marine seismic surveys on marine life. The methods employed include: geographical and/or seasonal restrictions, source reduction or optimisation, the use of buffer zones, surveillance of buffer zones by visual, acoustic or other means, and "ramp-up" or "soft-start" techniques.

Source reduction

Two international conservation agreements (ASCOBANS[557] and ACCOBAMS[558]) and a number of advisory bodies such as the California Coastal Commission[559] have suggested limits on source levels used during seismic surveys and have proposed measures including the use of lowest practicable power levels, reduction of unnecessary high intensity sound[560], array optimisation or avoidance of sources of 'unnecessarily' high energy. For example, the Joint Nature Conservation Committee (JNCC) of the UK calls for operators to reduce unnecessary high-intensity sound

555 Ibid

556 Jørgensen, R., Olsen, K. K., Falk-Petersen, I.-B. and Kanapthippilai, P. 2005. Investigations of potential effects of low frequency sonar signals on survival, development and behaviour of fish larvae and juveniles. Norwegian College of Fishery Science University of Tromsø. 49pp.

557 ASCOBANS 2006: Fifth Meeting of the Parties, Res. 4, "Adverse Effects of Sound, Vessels and Other Forms of Disturbance on Small Cetaceans

558 ACCOBAMS 2004: Second Meeting of Parties, Res. 2.16, "Assessment and Impact Assessment of Man Made Noise."

559 California Coastal Commission 2002: Consistency Determination. No. CD-14-02, USGS, 2002 Southern California seismic survey.

560 JNCC-Joint Nature Conservation Committee. 2003: JNCC Report No. 323, C.J. Stone, The Effects of Seismic Activity on Marine Mammals in UK Waters: 1998-2000.

produced by air guns or other acoustic energy sources. These guidelines have been incorporated into relevant permits for oil and gas seismic surveys within the UK.

Geographical and seasonal restrictions

The most effective and straightforward mitigation measures are geographical and seasonal restrictions to avoid ensonification of sensitive species and habitats. This approach is taken in Australia[561], Brazil[562], the UK[563] and Norway[564] [565]. The IWC Scientific Committee has called for seismic surveys to be arranged spatial-temporally so that eventual acoustic impacts are reduced[566]. The IUCN recommends that member governments work through domestic and international legislation to consider restrictions for sound in their management guidelines for Marine Protected Areas (MPAs)[567]. In Norway, seasonal restrictions on seismic surveys may be imposed in specific areas[568], or included in the license conditions[569]. Prior to each seismic survey the Norwegian Institute of Marine Research undertakes a biological evaluation and provides recommendation. More regions need to clearly define and identify sensitive areas of their marine environment both spatially and temporally to then prevent or severely restrict intense sound producing activities to protect marine biodiversity.

Exclusion zones

Animals outside this zone are presumed not to be exposed to harmful levels of sound. The radius of exclusion zones for seismic surveys is usually defined by the regulatory agency or promoted

561 Environment Australia 2001: Guidelines on the application of the Environment Protection and Biodiversity Conservation Act to interactions between offshore seismic operations and larger cetaceans, ISBN 064254784X (Oct. 2001).

562 Brazil CONAMA. 2004: National Environment Council Res. 305 (July 2004).

563 ASCOBANS 2003: Fourth Meeting of Parties, Res. 5, “Effects of Noise and of Vessels”.

564 Bjørke, H., Dalen, J., Bakkeplass, K., Hansen, K., Rey, L. 1991. Seismic activities’ accessibility in relation to vulnerable fish resources. (In Norwegian). Institute of Marine Research, HELP Report no 38, 1991, Bergen, Norway: 119 pp.

565 Dalen, J., Ona, E., Vold Soldal, A. & Sætre, R. 1996: Offshore seismic investigations: An evaluation of consequences for fish and fisheries. Institute of Marine Research, Bergen, Norway. Fisken og havet No 9 - 1996. 26 pp.

566 IWC - International Whaling Commission. 2004: Report of the Scientific Committee, at 12.2.5, pp. 37-39 and Annex K – Report of the Standing Working Group on Environmental Concerns. 267-275 and 282-289. Journal of Cetacean Research and Management. Vol. 7 Suppl. April 2005, ISSN 1561-0713.

567 IUCN-World Conservation Union. 2004: Resolution 3.068 Undersea noise pollution (Nov. 2004).

568 Bjørke, H., Dalen, J., Bakkeplass, K., Hansen, K., Rey, L. 1991. Seismic activities’ accessibility in relation to vulnerable fish resources. (In Norwegian). Institute of Marine Research, HELP Report no 38, 1991, Bergen, Norway: 119 pp.

569 Anon. 1985: Permission for investigation for petroleum. The Norwegian Petroleum Directorate: p 12-16 in Fishery-proficient person aboard seismic vessel. The Directorate of Fisheries, Bergen, 1992.

by other groups[570], and can range from 500m[571] to in excess of 1km[572]. The presence of animals within the exclusion zone may require stopping an operation or delaying its start-up.

Visual surveillance

Monitoring exclusion zones is carried out by specialist marine mammal observers (MMOs). These observers scan the zone before and during start-up and also through the period of the survey, recording and subsequently reporting sightings of animals both within and beyond the safety zone[573]. The ability to monitor zones is determined by sea state and practical visibility. However, the ability to monitor certain species is limited even within small radii[574]. The probability of visually detecting beaked whales is 1-2% at most due to their long dives[575]. Visual surveillance data can provide information that may aid understanding of behavioural reactions of different species. IWC[576] has made the following recommendations:

- Continuous acoustic monitoring of critical habitats on sufficient temporal and spatial scales in relation to pre- and post-seismic activity.
- Independent monitoring of critical habitats (from survey vessel and independent platforms) to evaluate displacement from critical habitat and/or disruption of important cetacean behaviours in the critical habitat.
- Increased effort to monitor strandings that may coincide with the activity.

Visual surveillance is frequently supplemented by acoustic and other electronic techniques. These include both passive and active acoustic monitoring, as well as radar and infrared scanning[577]. The PAM system usually employed during seismic surveys is the towed array, since air guns are mobile and require a moveable mitigation system.

---

570 IUCN-World Conservation Union. 2006: Report of the interim independent scientists group (IISG) on mitigation measures to protect Western gray whales during Sakhalin II construction operations in 2006. Workshop convened by the IUCN, Vancouver, British Columbia, 3–5 April 2006.

571 JNCC-Joint Nature Conservation Committee. 2003: JNCC Report No. 323, C.J. Stone, The Effects of Seismic Activity on Marine Mammals in UK Waters: 1998-2000.

572Environment Australia 2001: Guidelines on the application of the Environment Protection and Biodiversity Conservation Act to interactions between offshore seismic operations and larger cetaceans, ISBN 064254784X (Oct. 2001).

573 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

574 Barlow, J. and Gisiner, R. 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. Journal of Cetacean Research and Management, 7: 239–249.

575 US-MMC 2004: Beaked Whale Technical Workshop Summary. April 13-16, 2004, Baltimore, USA.

576 IWC. 2004. Report of the Scientific Committee, at 12.2.5, pp. 37-39 and Annex K – Report of the Standing Working Group on Environmental Concerns. 267-275 and 282-289. Journal of Cetacean Research and Management. Vol. 7 Suppl. April 2005, ISSN 1561-0713.

577 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

Soft Start/Ramp-up techniques

Soft starts are commonly used in seismic surveys around the world. In most regions a soft-start is required to be at least 20 minutes before full power is reached and a survey line commenced[578]. The upper limit is generally 30 minutes with some regions going up to 40-45 minutes.

Limitations to mitigation techniques for active sonar exercises and seismic surveys

Current limitations of the mitigation techniques used for naval sonar exercises and seismic surveys have been thoroughly reviewed in the literature recently[579] [580]. A summary of the limitations identified for both sources of anthropogenic noise in the marine environment are provided in Table 4. It is clear that the guidance and execution of mitigation measures for both sound sources are not completely effective in preventing marine mammals (and most likely other taxa) from being exposed to damaging or disturbing levels on some occasions.

Many of the current guidelines in place are out dated or are based on inadequate data as highlighted by a number of authorities including United States Commission on Ocean Policy in its Ocean Blueprint for the 21st Century[581]. In addition, particular research gaps identified by the Scientific Committee of the IWC[582], ICES[583], and the Parties to ACCOBAMS[584], highlight the current limited effectiveness of existing mitigation measures. As a result, before adequate mitigation can be enforced it will be necessary to address some of the pressing research questions, then critically review current mitigation guidelines and update them accordingly.

578 Ibid

579 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

580 Dolman, S. J., Weir, C.R., and Jasny, M. 2009. Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin 58 pp. 465-477.

581 United States Commission on Ocean Policy. (2005). Ocean Blueprint for the 21st Century (National Technical Information Service, Washington). 315–316.

582 IWC Scientific Committee, (2004) IWC/56/Rep I. Section 12.2.5.

583 The International Council for the Exploration of the Sea (ICES) (2005) Report of the Ad Hoc Group on the Impact of Sonar on Cetaceans. ICES CM 2005/ACE:06. At page 47. See ICES Advisory Committee on Ecosystems, n. 1 above, at 47– 49.

584 Resolution 2.16. Assessment And Impact Assessment Of Man-Made Noise. Report of the Second Meeting of the Parties to ACCOBAMS (UNEP/CMS).

Table 3. Marine mammal guidance implemented during naval exercises (after Dolman et al., 2009)

Mitigation	Australia	Canada	France	Italy	Norway	NURC	Canary Islands	UK	Hawaii	SoCAL	RIMPAC 2006	NDE I, 2006	NDE II, 2007
Selection of area	Y	N	Y	Y	Y	Y	N	Y	N	N	N	N	Y
Buffer zone	Y	N	N	Y	N	N	N	N	N	N	N	N	N
Coastal exclusion	Y	N	N	N	N	N	Y	N	Y	Y	Y	Y	N
Det sys/database	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	N
Pre/post ded. Survey	Y	N	Y	Y	Y	Y	N/R	Y	Y	Y	Y	Y	Y
Increased lookout	Y	Y	Y	Y	Y	Y	N/R	Y	Y	Y	Y	Y	Y
Trained observers	N	N	N	N	N	N	N/R	Y	Y	Y	Y	Y	Y
Weather/sightability	Y	Y	N	N	N	Y	N/R	Y	Y	N	Y	Y	Y
PAM	Y	Y	Y	Y	Y	Y	N/R	Y	Y	Y	N	Y	Y
Other monitoring	Y	N	N	N	N	Y	N/R	N	Y	Y	Y	Y	Y
Min source required	N	Y	N	N	Y	Y	N/R	N	Y	Y	Y	Y	Y
Prop. conditions	N	Y	N	N	N	Y	N/R	N	Y	Y	Y	Y	Y
Soft start/ramp-up	N	Y	Y	Y	Y	Y	N/R	N	Y	N	N	N	N
Delay if cet obs'd	N	N	N	N	Y	Y	N/R	N	N	N	N	N	N
Repeat ramp-up	N	N	N	Y	Y	Y	N/R	N	N	N	N	N	N
Pwr dn if cet det	N	N	Y	N	Y	Y	N/R	Y	Y	Y	Y	Y	Y
Sonar off if cet det	Y	Y	Y	N	Y	Y	N/R	Y	Y	Y	Y	Y	Y
Exclusion zone	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
All marine mammals	N	Y	Y	Y	Y	N	N/R	Y	Y	Y	Y	Y	Y
Cow/calf pairs	Y	N	N	N	N	N	N/R	N	Y	Y	N	N	N
Other species	Y	N	N	N	Y	N	N/R	Y	N	N	N	Y	N
Stranding response	N	Y	N	N	N	Y	N/R	N	Y	N	Y	Y	Y
Reporting	Y	Y	N	N	N	Y	N/R	Y	Y	Y	Y	Y	Y
EIA	Y	N	N	N	N	Y	N/R	Y	Y	Y	Y	N	N
Excl. of spec. area	Y	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y
Research	N	N	N	N	Y	N	N	N	Y	Y	N	N	N

Y, yes; N, no; N/R, not required; NDE, US National Defence Exemption.

Some national guidelines[585] for marine mammal noise mitigation during seismic surveys have come under significant criticism[586 587]. The JNCC guidelines were the first national guidelines to be developed and have become the unofficial standard of international mitigation measures for noise management during seismic surveys. However, only a few features of these measures have a firm scientific basis. On the whole, existing guidelines do not offer adequate protection to marine mammals, given the complex propagation of air-gun pulses; the difficulty of monitoring in particular the smaller, cryptic, and/or deep-diving species, such as beaked whales and porpoises; limitations in monitoring requirements; lack of baseline data; and other biological and acoustical complications or unknowns[588]. Current guidelines offer a 'common sense' approach to noise mitigation, but should be updated regularly according to the most recent research findings. Broader measures are needed to ensure adequate species protection and to address data gaps. There have been calls for a consistent global set of guidelines for industrial-induced marine noise[589].

Enforcement of existing mitigation measures can also be an issue. There is a lack of onboard monitoring (or feedback system) of the effectiveness of guidelines, no evaluation of the mitigation procedures and no repercussions for operators that fail to comply with the guidelines[590].

There are also areas both within and beyond national jurisdiction that are not subject to mitigation measures for seismic surveys. In fact the majority of the world's oceans are open to seismic surveying and other similar noise producing works without any marine mammal mitigation procedures in place[591]. However, the legislation that a State may have adopted to regulate underwater noise will apply to the vessels flying its flag, independent of where they carry out their activities (unless this is specified in the legislation itself). Some of the regional guidelines are also rather selective regarding inclusion of their own waters, for example in most

585 JNCC, 2004. Guidelines for minimizing acoustic disturbance to marine mammals from seismic surveys. Joint Nature Conservation Committee, Peterborough. http://www.jncc.gov.uk/pdf/Seismic_survey_guidelines_200404.pdf

586 Parsons, E. C. M., Dolman, S. J., Wright, A. J., Rose, N. A. and Simmonds, M. P. 2009. A critique of the UK's JNCC Seismic Survey Guidelines for minimising acoustic disturbance to marine mammals: best practise? Mar. Poll. Bull.. 58: 643-651

587 http://whitelab.biology.dal.ca/lw/Canadian_Seismic_Comments.doc.

588 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

589 Compton, R., Goodwin, L., Handy, R., Abbott, V (2008) A critical examination of worldwide guidelines for minimising the disturbance to marine mammals during seismic surveys. Marine Policy 32, 255–262.

590 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

591 Ibid

of the Gulf of Mexico the MMO guidelines apply only to water depths greater than 200m[592] providing no protection for marine mammals in shelf waters. In regions where no statutory legislation exists for the protection of marine mammals or other species, many surveys occur within sensitive habitats without any consideration of marine faunal species which they may affect[593].

The mitigation guidelines governing the use of active sonar have come under similar criticism[594]. Furthermore, despite the range of mitigation measures in place, a large amount of associated naval operations are conducted with no or minimal mitigation. Another limitation is that ships carrying mid-frequency military sonar operate at relatively high speed and any marine mammal detections may occur too late to take useful action. Mitigation measures are also often based on insufficient data for species such as beaked whales which are thought to be very susceptible to the effects of sonar. More detailed research into the accumulative and synergistic effects of noise on marine mammal species is now being called for[595], which can contribute to the implementation of more consistent and stringent, science based mitigation policies.

There is clearly a lack of consistency in mitigation measures applied between the world's navies when planning for mitigating the damaging effects of sonar upon the marine environment. As a result there have been calls to move towards a science-based global standard of best practice for all nations' navies, offering adequate protection to all marine mammal species[596].

592 Smith, J.G. & M.R. Jenkerson. Acquiring and Processing Marine Vibrator Data in the Transition Zone. Mobil Exploration and Producing Technical Centre (1998).

593 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

594 ACCOBAMS, 2007. Guidelines to address the impact of anthropogenic noise on marine mammals in the ACCOBAMS area. Resolution 3.10 Adopted at the Third Meeting of Parties.

595 Weilgart, L.S. 2007: The Impacts of anthropogenic ocean noise on cetaceans and implications for management. [http://www.nrcresearchpress.com/doi/abs/10.1139/Z07-101]

596 Dolman, S.J., Weir, C.R. and Jasny, M. (2009). Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin, 58: 465–477.

Table 4. Limitations of mitigation measures used for Active Sonar exercises and Seismic Surveys (adapted from Weir and Dolman 2007 and Dolman et al., 2009)

Mitigation Measure	Limitations for Active Sonar	Limitations for Seismic Surveys	Comments
Soft starts	Some sonar systems are not designed for soft start Existing guidance for operation is largely ambiguous for power levels (sound level and pulse duration)	Often the sole measure used at night and may not be effective for some species[597] Insufficient detail provided for the level of acoustic outputs for each stage of the soft start. No allowance for the variation in air-gun volume Often operated manually leading to variation in precision Independent monitoring of the procedure is challenging	Naval soft start guidance should provide specific information on the required increase in both sound level and pulse duration over time
Monitoring in adverse conditions	All current guidance depends on visual monitoring meaning there is effectively no mitigation in place for active sonar use occurring at night or in adverse weather	No mitigation is effectively in place for operations at night Apart from reduced visibility, guidelines do not address adverse weather conditions	Visual monitoring at night is limited to 100 m with infra-red binoculars Visual detection of marine mammal species decreases significantly with increasing sea state[598]

597 McCauley RD et al. 1998. The Response of Humpback Whales (*Megaptera novaeangliae*) to Offshore Seismic Survey: Preliminary Results of Observations about a Working Seismic Vessel and Experimental Exposures.

598 Clarke, R. 1982. An Index of Sighting Conditions for Surveys of Whales and Dolphins. Report of the International Whaling Commission 32

	conditions		
Visual detection	Lack of appropriate training programmes and feedback processes for MMOs Lack of independence of MMOs	Lack of appropriate training programmes and feedback processes for MMOs Lack of independence of MMOs MMO reports not sent directly to the regulator Monitoring can be intermittent or absent if MMOs are not on board	Need for standardised training and assessment Clear potential for conflict of interests Independence of reporting process can be compromised
Species included	Some regions currently offer no protection to dolphins and porpoises	No protection for dolphins and porpoises.	Small odontocetes are also affected by seismic surveys[599] or mid-frequency active sonar[600]
Exclusion zone	Scientific basis for defining exclusion zones is not clear	Scientific basis for defining exclusion zones is not clear	Exposure levels used to define zones[601] can be higher than scientifically recommended standards[602]
Pre-shoot watch	30 minute period used in most guidelines is not sufficient for deep	30 minute period used in most guidelines is not sufficient for deep water (>200m depth)	Known dive times of some species (e.g., sperm whale and beaked whales) regularly equal

599 Goold. JC. 1996. Acoustic Assessment of Populations of Common Dolphin *Delphinus Delphis* in Conjunction with Seismic Surveying. J Mar Biol Assoc UK 76

600 Rendell, L.E., Gordon, J.C.D., 1999. Vocal response of long-finned pilot whales (*Globicephala melas*) to military sonar in the Ligurian Sea. Marine Mammal Science 15, 198–204

601 DOC. 2005. Draft Guidelines for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations. Department of Conservation, Wellington, New Zealand.

602 Department of Fisheries and Oceans. 2005. Statement of Canadian Practice: Mitigation of Seismic Noise in the Marine Environment

	water (>200m depth) May be ineffective for fast moving military vessels		or exceed 30 minutes. Naval vessels with active sonar can be travelling at high speeds e.g., 18 knots
Soft start delays	Most naval guidance does not require a soft start delay	Some guidelines do not define the length of the delay or when the soft start can re-commence	Only present in NATO naval guidance
Shut downs	Shut downs are not implemented for all marine mammals by some navies Procedure to follow a shut-down is unclear e.g., 30 minute clearance Most guidance does not stipulate a soft start after the shut-down.	Shut downs are not usually implemented for all marine mammals (e.g., small odontocetes) Can only be operated in daylight as require visual detection Procedure to follow a shut-down is unclear e.g., 30 minute clearance and/or soft start.	Consider specific shut down procedures for calves, which are more sensitive to anthropogenic sounds Animals may be in the locality of the source when full power resumes
PAM	Recognised but not being used to its full potential Lack of training and guidance on implementation	Not being used to its full potential Lack of training and guidance on implementation Often deployed more than 1 km ahead of the survey vessel	Prioritise the development of PAM training programmes PAM monitoring occurs too far from the air guns to be effective

Sensitive areas	Lack of rigorous definition of areas and how they apply to naval operations	Lack of rigorous definition of areas and how they apply to seismic operations	Only two countries[603] have defined prohibited areas for seismic surveys according to marine fauna Naval and seismic guidance should use clear criteria to define and implement mitigation measures in sensitive habitats, including time/area planning
Use of small volume air guns (as a mitigation method)	Not applicable	Variation in the duration of use e.g. for 24 hours or only at night Use is not restricted to the licensed prospecting area Concerns over time-sharing of firing between vessels in adjacent areas	No evidence that continual firing of a small gun acts as a deterrent to marine mammals. Some species may actively approach small volume air guns[604] Potential cumulative effects of continuous sound
Equipment operation		No overall restriction for air-gun use at night	Visual monitoring is limited to 100 m with infra-red binoculars
Other sources of disturbance	Guidance for minimising impacts to marine animals needs to address all activities during a naval exercise		Naval exercises often involve multiple vessels and activities which have the potential to disturb marine animals

603 Barlow J and Gisiner R. 2006. Mitigating, Monitoring and Assessing the Effects of Anthropogenic Sound on Beaked Whales. Journal of Cetacean Research and Management 7

604 McCauley RD et al. 1998. The Response of Humpback Whales (*Megaptera novaeangliae*) to Offshore Seismic Survey: Preliminary Results of Observations about a Working Seismic Vessel and Experimental Exposures

Noise profiles of other activities

Reducing the potential impacts of devices, such as Acoustic Harassment Devices (AHDs), on non-target species may be achieved through changing frequencies to those where non-target species are less sensitive, or by using responsive-mode devices that only emit sound when an animal approaches an area of interest. Similarly, it may be possible to use pingers that are triggered by echolocation activity of an approaching dolphin or porpoise. Changes in frequency of data transmission devices may help eliminate the potential risk to more sensitive species[605]. Noise levels of AHDs could be reduced by decreasing the duty cycle of the device. This will decrease the risk of hearing damage in target or non-target species and may reduce the likelihood of target species becoming habituated to the signal.

Decreasing the potential impacts of noise produced by marine renewable devices may be feasible at the design stage. It may not be possible to reduce noise levels through changes to individual turbines, but measures can be used to reduce the risk of "acoustic barrier effects" or specify the avoidance of important areas when designing the configuration of arrays of turbines, for example, to ensure that narrow channels used as transit routes for marine animals are not fully occluded by turbines, or critical habitats are not used to site arrays of turbines[606].

Reducing the effects of ocean tomography or thermometry studies, and data transmission devices, may be possible by ensuring that the immediate vicinity around the sound source is clear of animals through the use of exclusion zones using existing best practise guidelines or developing new specific guidance[607].

Playing temporarily aversive sounds that causes animals to show a small-scale avoidance response up to a certain distance from the sound source may provide a means of reducing physical injury such as hearing damage. This may be feasible for temporary noise activities like ocean tomography studies or acoustic data transmission. With all species, planning activities so that their timing will reduce the likelihood of encounters with breeding areas or juvenile animals, using the lowest practicable power levels throughout the survey, and seeking methods to reduce and/or baffle unnecessary frequencies from the devices will lead to reduced risk of injury, masking, and behavioural responses.

The use of marine protected areas to restrict or reduce the effects of anthropogenic noise can also be applied to all the aforementioned sound sources. This particularly needs to be considered for the increasing use of the coastal and inshore zone by small and medium-sized vessels.

No information is available for the mitigation of the environmental effects of any non-military sonars operated by small to medium-sized vessels. In fact there seem to be no published studies on how commercial sonars, depth finders and fisheries acoustics gear may influence the distribution and behaviour of cetaceans[608] or other marine animals.

Management frameworks and expert processes

Working groups have been set up by a number of bodies recently, to address the issues surrounding marine noise and its negative effects on marine fauna. Many of these groups

605 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission. 133 p.

606 Ibid

607 Ibid

608 Nowacek, D.P., Thorne, L.H., Johnston, D.W. and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review, 37: 81 – 115

have established expert committees, in an effort to improve mitigation and legislation, or developed detailed management framework concepts.

In 2004, the National Oceanic and Atmospheric Administration (NOAA) hosted an initial meeting, entitled “Shipping Noise and Marine Mammals: A Forum for Science, Management and Technology“, which essentially served as an introduction of this issue to industry representatives, conservation managers and scientists from various fields[609]. At that meeting, a number of recommendations for future action and consideration were made, including the need for a greater scientific basis for assessing the relative magnitude of the potential problem and various mitigation measures directed to reduce impacts. The following publication was produced[610], whereby the following future recommendations were decided upon:

- Compile a “menu” of existing quieting technologies (retrofitting & new construction), their likely feasibility in terms of meeting specified goals for noise reduction of large vessels, and anticipated costs/ benefits in specified categories. Identify potential technologies unlikely to succeed for large vessels.

- Discuss conclusions and caveats for the most promising technical approaches, with consideration of which ships have the greatest sound output, which classes are most numerous generally and in areas that are most significant biologically.

- Discuss costs/benefits for marine mammals and their management from vessel-quieting, specifically the potential interactions between vessel-quieting and marine mammal ship-strike issues

- Identify and plan the next steps regarding large vessel sounds and marine life.

Recently, the European Commission Joint Research Centre under the Marine Strategy Framework developed a task group charged with investigating the effects of underwater noise and other forms of energy[611]. The report outlines the limited extent of knowledge of the effects of underwater energy, particularly noise, and particularly at any scale greater than the individual/group level. The report contains much background scientific information and has suggestions for possible further indicators in the future for noise, as well as on the assessment of the effects of electromagnetic fields and heat on the marine environment.

Excluding anthropogenic marine noise from certain zones is considered to be one of the most effective mitigation strategies[612]. A Workshop on the Spatio-Temporal Management of Noise

609 Southall, B. L. 2005. Final report of the NOAA International Symposium: “Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology,” 18-19 May, 2004, Arlington, VA, U.S.A.

610 Final Report of the National Oceanic and Atmospheric Administration (NOAA) International Symposium: Potential Application of Vessel-Quieting Technology on Large Commercial Vessels 1-2 May, 2007 Silver Spring, Maryland, U.S.A.

611 M.L. Tasker, M. Amundin, M. Andre, A. Hawkins, W. Lang, T. Merck, A. Scholik-Schlomer, J. Teilmann, F. Thomsen, S. Werner & M. Zakharia. Marine Strategy Framework Directive. Task Group 11. Report Underwater noise and other forms of energy.

612 OSPAR Commission. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London, UK: OSPAR Commission.

was undertaken in 2007 in Spain[613]. Workshop participants agreed that there is a need to develop a systematic protocol for identifying and prioritising noise mitigation actions. A six-step Framework was the main outcome from the meeting, which draws upon some of the general principles of conservation planning and adaptive management, whilst also being tailored to the context of noise mitigation for cetaceans. The six steps are:

- Define the goal(s), constraints and geographic scope of the planning process;
- Identify relevant data and data gaps;
- Synthesise habitat and threat data to generate exposure ranking maps;
- Generate map of mitigation priority areas;
- Identify and prioritise actions for priority conservation zones, and;
- Implement and monitor.

A draft research strategy was developed based on the activities and proceedings of an Expert Group on anthropogenic sound and marine mammals convened at the joint Marine Board-ESF and National Science Foundation (US) Workshop on October 4-8 2005[614]. The outcomes of this work put forward recommendations for a four-step analytical risk framework process adapted to the issue of marine mammals and anthropogenic sound to assess and identify priority research topics for reducing uncertainty. The risk framework process includes hazard identification, characterizing exposure to the hazard, characterizing dose-response relationships and risk characterization, typically feeding into a risk management step (Box 1). A rationale was developed to help prioritise research questions and to develop a set of approaches that could be used to help answer these questions[615]. The risk framework process could also be applied to other marine fauna such as marine turtles, fish and invertebrates.

---

613 Agardy, T., Aguilar, N., Cañadas, A., Engel, M., Frantzis, A., Hatch, L., Hoyt, E., Kaschner, K., LaBrecque, E., Martin, V., Notarbartolo di Sciara, G., Pavan, G., Servidio, A., Smith, B., Wang, J., Weilgart, L., Wintle, B. and Wright, A. 2007. A Global Scientific Workshop on Spatio-Temporal Management of Noise. Report of the Scientific Workshop. 44 pages. http://www.okeanos-foundation.org/assets/Uploads/str2007en2.pdf

614 Boyd, I., 2008. The effects of anthropogenic sound on marine mammals. A draft research strategy. Report Produced from the Joint Marine Board-ESF and National Science Foundation (US) Workshop at Tubney House on October 4–8, 2005.

615 Ibid – Tables 3 and 4 for beaked whale research questions

A four-step analytic process is applied. A sound leaves a source (e.g., sonar transducer, seismic airgun array), moves through the water, and results in an exposure (marine mammals receiving sound). The exposure creates a dose in the exposed animals (the type and amount of the sound received by the animals, which may be expressed in any of several ways), and the magnitude, duration, timing, and other characteristics of the dose determine the extent to which there is an effect. This model is captured in the following analytic steps:

Step 1:

Hazard Identification: entails identification of the sound sources and the circumstances in which they are used that are suspected to pose hazards, quantification of the concentrations at which they are present in the environment, a description of the specific effects of the sound source, and an evaluation of the conditions under which these effects might be expressed in exposed marine mammals. Information for this step may be derived from environmental monitoring data and the direct correlation of effect with the presence of a hazard as well as other types of experimental work. This step is common to qualitative and quantitative risk assessment.

Step 2:

Dose-Response Assessment: entails a further evaluation of the conditions under which the effects of sound might be manifest in exposed marine mammals, with particular emphasis on the quantitative relation between the dose and the response. This step may include an assessment of variations in response, for example, differences in susceptibility in relation to age, sex, reproductive status and time of year.

Step 3:

Exposure Assessment: involves specifying the population that might be exposed to the hazard, identifying the routes through which exposure can occur, and estimating the characteristics (magnitude, duration, and timing) of the doses that marine mammals might receive as a result of their exposure.

Step 4:

Risk Characterization: involves integration of information from the first three steps to develop a qualitative or quantitative estimate of the likelihood that any of the hazards associated with the sound source will be realized in exposed marine mammals. This is the step in which risk-assessment results are expressed. Risk characterization should also include a full discussion of the uncertainties associated with the estimates of risk.

Box 1. The Risk Assessment Framework (after Boyd et al., 2008)

Both the Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)[616] and the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) [617] have established working groups that address underwater noise and have produced guidelines for its mitigation. These two groups are now working on producing joint summaries of these guidelines for specific stakeholders, e.g. relating to renewable energy, military, seismic surveys and shipping.

The 2009 European Cetacean Society (ECS) Conference included a workshop addressing the issue of 'Beaked whales and active sonar: Transiting from research to mitigation'. A small working group of relevant experts was set up to produce a technical report[618]. This report discusses practical effective techniques to apply mitigation in order to reduce impact of active sonar on cetaceans. The working group concluded that standards should be developed that

616 ACCOBAMS 2010: Fourth Meeting of the Parties, Res. 4.17 "Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area"

617 ASCOBANS AC17/Doc.4-08 (WG) Final Report of the ASCOBANS Intersessional Working Group on the Assessment of Acoustic Disturbance

618 ASCOBANS AC16/Doc.50 (O) Technical Report on Effective Mitigation for Active Sonar and Beaked Whales, Dist. 26 March 2009

define an appropriate level of cetacean monitoring, depending on the species. To improve the effectiveness of real-time mitigation, such measures must reflect the challenges involved in detecting some of the most sonar sensitive species. The working group recommended that navies adopt the following measures for real-time mitigation:

Effective detection of cetaceans present in the exercise area

- Monitoring with an appropriately designed array of visual and passive acoustic sensors in the exercise area during operation. Where available, on-range hydrophone networks should be utilised for real-time mitigation: otherwise, temporary hydrophone arrays of adequate size and sensitivity to reliably detect beaked whales should be used;

- Acoustic monitoring using transparent protocols for detection and classification of cetacean vocalisations. For beaked whales, on-range hydrophone networks and networks of temporary hydrophone arrays are potentially useful methods upon which efforts should continue to be focused;[619]

- Pre-sonar watch of a predetermined period (at least 2 hours for beaked whale detection) in which to provide the best chance to detect all available cetaceans visually (on board and where possible from aerial surveys) and acoustically;

- Use of dedicated, experienced and, where possible, independent marine mammal observers, trained to a minimum standard on visual and acoustic detection of beaked whales; and

- Assuming visual monitoring is maintained for the protection of other species, restriction of operation, to the greatest extent possible, to observable visual conditions, such as during good light (during the daytime) and appropriate environmental conditions (including a sea state <3).

Mitigation requirements once cetaceans are detected:

- Sonar power reduction and shut-down within conservatively defined radii to the greatest extent practicable around the sonar array, based on models of sound transmission (verified in local conditions) and of effects of sonar on sensitive species. For beaked whales (and likely for other species and situations), a conservatively defined radius would extend to the isopleth where the risk of significant behavioural effects becomes more than negligible (acknowledging that this might be beyond the radius of visibility);

- Suspension or relocation of activities where detections of potentially affected species are higher than predicted in pre-exercise planning. Suspension, relocation, or other

619 André, M., van der Schaar, M., Zaugg, S., Mas, A., Morell, M., Solé, M., Castell, J.V. and Sánchez, A. 2009. Real-time detection of beaked whale sonar signals over background noise and other acoustic events. Challenges of sonar mitigation for beaked whales. Presentation at the Workshop on Beaked whales and active sonar: transiting from research to mitigation. 23 rd Conference of the European Cetacean Society held in Istanbul, Turkey.

restrictions are also warranted where detections of potentially affected species are higher than predicted in pre-exercise planning, or where unexpected oceanographic conditions such as surface-ducting would result in higher numbers of impacts than predicted.

V. FUTURE RESEARCH NEEDS

This assessment of anthropogenic noise and its impact on marine organisms has highlighted the extent of knowledge gaps and uncertainties for this issue. The current status of scientific knowledge (in terms of the level and types of sound that will result in a specific effect) often results in estimates of potential adverse impacts that contain a high degree of uncertainty[620]. These uncertainties need to be addressed in a systematic manner to fully understand the effects of increased noise from human activities in the marine environment. There are a suite of future research needs that have to be addressed to both better characterise and quantify anthropogenic noise in the marine environment and the impact it has on marine organisms. However, the extensive knowledge gaps also mean that prioritisation will be required. Detailed research programmes of noise effects on species, populations, habitats and ecosystems as well as cumulative effects with other stressors need to be put in place or consolidated where they already exist. Current knowledge for some faunal groups such as elasmobranch fish, marine turtles, seabirds and invertebrates is particularly lacking. Other priorities for acoustic research are endangered or threatened marine species and critical habitats they depend upon for important activities such as foraging or spawning. Marine species that support commercial fisheries should also be assessed for susceptibility to noise pollution and the issue of anthropogenic noise considered for fisheries management plans. Existing or proposed management frameworks also need to be tested and refined accordingly in a range of scenarios. A number of current or proposed large-scale research programmes are addressing a range of issues with a focus on marine mammals. However, there is a need to scale up the level of research and management efforts to significantly improve our understanding of the issue and minimise our noise impacts on marine biodiversity.

There have been a number of reviews of research needs in recent years that have mainly focussed on marine mammals[621] [622] [623] and also specific research needs for other taxa[624] [625] in the literature. The main research priorities recommended by these reviews are summarised in Table 5. Details of these recommendations will be incorporated into the following sections as appropriate.

---

620 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

621 MMC (Marine Mammal Commission) 2007. Marine mammals and noise: a sound approach to research and management. Marine Mammal Commission, Bethesda, Maryland. 370pp.

622 Boyd, I., 2008. The effects of anthropogenic sound on marine mammals. A draft research strategy. Report Produced from the Joint Marine Board-ESF and National Science Foundation (US) Workshop at Tubney House on October 4–8, 2005.

623 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

624 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

625 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243

Research needs can be split into four main areas:

- Further characterisation of underwater noise and properties of emitted sound in a changing marine environment
- Baseline data on the biology, distribution, abundance and behaviour of marine species
- Detailed information on the impacts of sound on marine animals at the individual, population and ecosystem level
- Assessment and improvement of mitigation procedures and measures

ANTHROPOGENIC SOURCES AND AMBIENT NOISE

Although there has been considerable previous investment in the collection of underwater sound data for commercial, military or research purposes our knowledge of anthropogenic sound fields in the marine environment is incomplete[626]. The seas and oceans are also becoming noisier as marine-based human activities increase in diversity and intensity, particularly in coastal and shelf waters (Figure 7). Ambient noise levels for mid and high frequencies are increasing with the greater use of sonar and increased small boat traffic[627]. Anthropogenic noise sources are also often distributed heterogeneously in time and space which contributes to the complexity of underwater 'soundscapes' that marine organisms inhabit[628]. In addition, the different components of anthropogenic sound attenuate at different rates depending on their frequency and environmental conditions further increasing complexity and making it difficult to predict the actual sound levels received by marine organisms[629]. The type of sound is also important in terms of whether it is a continuous emission over a long time period or a series of short intermittent pulses causing different chronic or acute effects even though the power of the sound emitted is the same.

626 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

627 Ibid

628 Boyd, I., 2008. The effects of anthropogenic sound on marine mammals. A draft research strategy. Report Produced from the Joint Marine Board-ESF and National Science Foundation (US) Workshop at Tubney House on October 4–8, 2005

629 Ibid

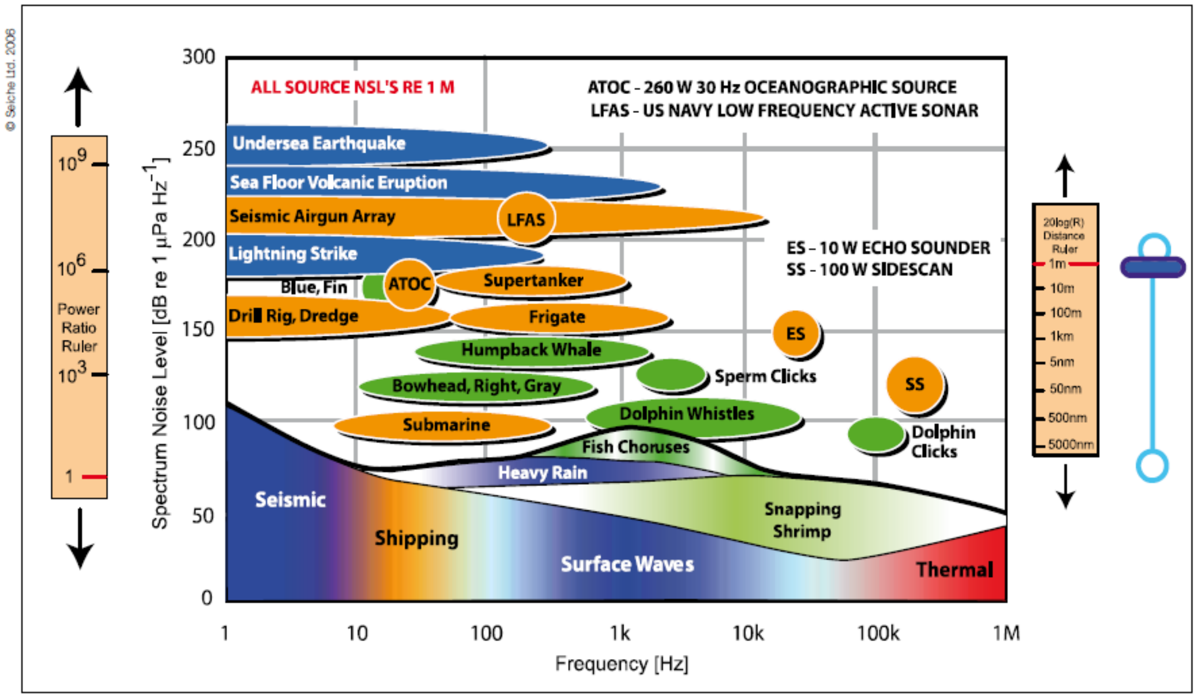


Figure 7. Noise levels and frequencies of anthropogenic and naturally occurring sound sources in the marine environment (Seiche graphic)

Further quantification of the underwater acoustic environment is therefore required. Increased levels of passive (or active) acoustic monitoring are needed to detect and characterise both biological and anthropogenic sound sources and collect ambient noise information for key areas. Anthropogenic sources considered to be of the highest concern (in the United States) are certain military sonars, ice-breaking, seismic air guns and new classes of large vessels closely followed by wide-azimuth seismic surveys, pile driving, as well as oil drilling and production[630]. Priorities for action are likely to change somewhat at the national level depending on the key activities and sound sources present or planned within areas under national jurisdiction. Regional or ocean-wide priorities for acoustic research will need to be considered and agreed through regional or global bodies.

Passive acoustic monitoring can also provide real-time information to characterise ambient sound fields and feed into models to predict future trends. To model ambient noise levels a better understanding of the signal characteristics of anthropogenic sources is needed[631]. For example further information for the key parameters that make up the noise spectra of ships and also smaller vessels is required. With improved source profiles and an understanding of how the level of activity exactly contributes to the resulting ambient noise profile, researchers can extend noise modelling so that better predictions can be made for regions with known anthropogenic activities but are currently lacking in acoustic information[632].

630 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

631 Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Mar. Ecol. Prog. Ser 395:4-20

632 Ibid.

More detailed information on the location and distribution of anthropogenic noise sources in the oceans can contribute to real-time estimations of regional or global noise levels as part of large-scale ocean monitoring systems. For example the geographic position of commercial vessels or the tracklines for seismic profiling could be used in models along with data on environmental variables (bathymetry, sound speed profiles, wind and wave noise spectra) to provide a more accurate assessment of the relative contribution of natural and anthropogenic noise sources[633].

There is also a need for further research to predict the effects on declining ocean pH on the properties of underwater sound. As ocean acidity increases there is a corresponding reduction in the absorption of low frequency sound (100 Hz - 10 kHz)[634] [635] and the mechanism for this chemical relaxation-based acoustic energy loss is well known[636]. More than 50% reduction in the absorption of sound at 200 Hz has been predicted in high latitudes (e.g., North Atlantic) by 2100[637] although these predictions have recently been disputed by subsequent modelling studies[638]. If the former predictions are the more likely scenario then there is the potential that marine organisms sensitive to low frequency sound (e.g., baleen whales) will be more susceptible, particularly in acoustic hotspots where high levels of anthropogenic noise (e.g., shipping) coincide with the greatest drop in absorption.

BASELINE BIOLOGICAL INFORMATION

To understand how anthropogenic noise is having an impact on marine biodiversity it is important that we also know as much as possible about a particular species both in terms of its biology and ecology. Information for species and populations is incomplete for many marine animals, particularly for invertebrates but also for many marine fish and mammals (e.g., beaked whales). The scale of this task suggests that a system of prioritisation is needed. Marine species that are known or highly likely to be susceptible to the effects of anthropogenic noise but are also threatened by other stressors such as overexploitation, habitat loss or other forms of pollution are one of the highest priorities. In addition many threatened species will be lacking in basic biological information that is relevant to underwater acoustics. For example elasmobranch fish are recognised as highly threatened

633 Ibid

634 Hester, K.C., Peltzer, E.D., Kirkwood, W.J. and Brewer, P.G. 2008. Unanticipated consequences of ocean acidification: a noisier ocean at lower pH. Geophysical Research Letters. 35. doi:10.1029/2008GL034913

635 Ilyina, T., Zeebe, R.E. and Brewer, P.G. 2009. Future ocean increasingly transparent to low-frequency sound owing to carbon dioxide emissions. Nature Geoscience Vol 3: 18-22

636 Francois, R. E., and Garrison, G. R. (1982). "Sound absorption based on ocean measurements. Part II: Boric acid contribution and equation for total absorption," J. Acoust. Soc. Am. 72, 1879–1890.

637 Ilyina, T., Zeebe, R.E. and Brewer, P.G. 2009. Future ocean increasingly transparent to low-frequency sound owing to carbon dioxide emissions. Nature Geoscience Vol 3: 18-22

638 Udovydchenkov, I.A., Duda, T.F., Doney, S.C. and Lima, I.D. 2010. Modeling deep ocean shipping noise in varying acidity conditions. J. Acoust. Soc. Am. 128. DOI: 10.1121/1.3402284

taxa[639] but very little is known about their sense of hearing with data available for only a few species[640]. Research is therefore required for species that are data deficient in terms of auditory biology, hearing sensitivity and how they use sound for communication or for key life processes such as feeding or predator avoidance. Again, due to the number of species involved, research could focus on representative[641] species as surrogates for less-common or more-difficult-to-test species[642] or on a wide range of morphologically and taxonomically diverse species of interest[643]. Representative species could be selected according to trophic group, lifestyle (e.g., pelagic or demersal/benthic) or life history stage. In addition to an improved understanding of the importance of sound to marine organisms it is equally important to collect detailed information on the distribution, behaviour and population size of selected species. Knowing what constitutes normal behaviour and which habitats are preferred by marine species at particular times will enable more effective management and mitigation measures to be made.

Another priority is the use of all reliable biological information currently available for species from a range of sources (e.g., fisheries data for stocks and distribution, marine mammal monitoring data, tagging studies for marine turtles, teleost fish or elasmobranchs) to help build up a more coherent picture of the life history traits for that organism. The development and maintenance of standardised online databases has been highly prioritised for marine mammals[644] and could be applied to other groups of marine vertebrates such as teleost and elasmobranch fish and marine turtles.

NOISE IMPACTS ON MARINE BIODIVERSITY

The high level of uncertainty for many species also applies to our current knowledge of the impacts of anthropogenic noise. It will therefore be necessary to prioritise which marine species are selected for research and the same criteria mentioned previously for selection should apply. High priority research areas are listed in Table 6 and include anthropogenic noise effects on individuals in terms of physical damage, physiology and behaviour but also the long-term effects on populations and the cumulative effects of noise in combination with other stressors. There is considerably more known about the effects of anthropogenic noise on marine mammals than other taxa. One further prioritisation criterion could be to markedly

639 Godin AC, Worm B (2010) Keeping the lead: How to strengthen shark conservation and management policies in Canada. Mar Policy 34:995-1001

640 Casper, B.M., Halvorsen, M.B. and Popper, A.N. (in press). Are sharks even bothered by a noisy environment?

641 those thought to adequately represent related species on which such data are not available

642 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

643 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

644 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

increase the knowledge base for data-deficient groups (e.g., marine fish, turtles and invertebrates).

An overarching priority is to increase the collection of field-based data for behavioural (and other) long-term responses of individuals to anthropogenic sound rather than relying on data collected in laboratory or enclosed conditions. This is particularly required for teleost fish where it is not possible to extrapolate from studies of caged fish to wild animals[645] and only a few studies have observed noise impacts on free-living fish in their natural environment[646]. For non-behavioural research new technology may need to be developed to monitor particular noise effects *'in situ'* via 'smart' tags e.g., for measurements of hearing loss, metabolism and the production of stress hormones.

The more long-term chronic and also cumulative effects of anthropogenic noise on marine organisms and populations have received some attention in recent years, particularly for marine mammals[647] [648], but are in need of thorough assessment for other taxa as well (e.g., teleost and elasmobranch fish, marine turtles and invertebrates). It is known that chronic disturbance in the coastal environment can lead to reduced reproductive success in some cases[649] and further research studies are required to investigate whether this is also the case for other marine fauna. Reproductive success may also be compromised by changes in behaviour (e.g., avoidance of spawning sites) or masking of communication between potential mates[650].

Increasing levels of ambient noise in marine and coastal environments have led to concerns of masking of important biological signals either received or emitted by marine organisms. Although this has theoretically been demonstrated for marine mammals[651], there is little evidence to confirm masking in other marine taxa. Teleost fish are one group where acoustic

645 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

646 Wardle, C. S., Carter, T. J., Urquhart, G. G., Johnstone, A. D. F., Ziolkowski, A. M., Hampson, G. & Mackie, D. (2001). Effects of seismic air guns on marine fish. Continental Shelf Research 21, 1005–1027.

647 Wright, A.J., Soto, N.A., Baldwin, A.L., Bateson, M., Beale, C.M., Clark, C., Deak, T., Edwards, E.F., Fernández. A., Godinho, A., Hatch, L.T., Kakuschke, A., Lusseau, D., Martineau, D., Weilgart, L.S., Wintle, B.A., Notarbartolo-di-Sciara, G. and Martin, V. 2007. Do marine mammals experience stress related to anthropogenic noise? International Journal of Comparative Psychology, 20: 274 – 316.

648 Wright, A.J. (ed) 2009. Report of the Workshop on Assessing the Cumulative Impacts of Underwater Noise with Other Anthropogenic Stressors on Marine Mammals: From Ideas to Action. Monterey, California, USA, 26th-29th August, 2009. Okeanos - Foundation for the Sea, Auf der Marienhöhe 15, D-64297 Darmstadt. 67+iv p. http://www.okeanos-foundation.org/assets/Uploads/CIReportFinal3.pdf

649 Bejder L (2005) Linking short and long-term effects of nature-based tourism on cetaceans. PhD dissertation, Dalhousie University, Halifax, NS

650 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243

651 Clark, C.W., Ellison, W.T., Southall, B.L., Hatch L., van Parijs, S.M., Frankel, A. and Ponirakis, D. 2009. Acoustic masking in marine ecosystems: intuitions, analyses, and implication. Marine Ecology Progress Series, 395: 201 – 222

reception and communication can be highly important for survival or reproduction[652]. Masking of important orientation cues may also occur for both fish and invertebrate larvae prior to settlement[653 654]. The potential for masking in a range of marine taxa is apparent and the risk of an impact is likely to increase as anthropogenic noise levels rise in shallow seas. This should be regarded as a high priority research need as it has the potential to affect multiple species simultaneously with long-term consequences for populations and communities.

The socio-economic consequences of noise-induced impacts on marine populations have not been considered by the research community. Avoidance of noisy areas or reduced population success may have a significant effect on catches of commercial fish or invertebrate species. Seismic surveys have previously been linked to short-term reductions in catch levels[655].

Reviews have also highlighted methodological issues in experimental design and the need for proper controls and pathology (where applicable) as well as careful measurement of sound sources and signals and the use of proper sound metrics[656 657 658]. Standardisation in research studies will help to both define the sound field received but also allow for comparisons of source signals of different types[659].

MITIGATION AND MANAGEMENT

The mitigation and management of anthropogenic noise in the marine environment has been extensively covered in the previous chapter. This highlighted a number of issues that currently exist with commercial and government approved mitigation procedures for marine activities emitting underwater noise. There is a need to critically assess the effectiveness of such mitigation procedures[660] through an independent peer-reviewed process. Measuring the

652 Slabbekorn, H., Bouton, N., van Opzeeland, I., Coers, A, ten Cate, C and Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fishes. Trends in Ecology and Evolution 1243

653 Simpson SD, Meekan MG, Jeffs A, Montgomery JC, McCauley RD. 2008. Settlement-stage coral reef fishes prefer the higher frequency invertebrate-generated audible component of reef noise. Anim Behav 75:1861–8.

654 Simpson SD, Radford AN, Tickle EJ, Meekan MG, Jeffs AG (2011) Adaptive Avoidance of Reef Noise. PLoS ONE 6(2): e16625. doi:10.1371/ journal.pone.0016625

655 Engås, A. & Løkkeborg, S. (2002). Effects of seismic shooting and vessel-generated noise on fish behaviour and catch rates. Bioacoustics 12, 313–315.

656 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

657 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

658 Moriyasu et al., 2004. Effects of seismic and marine noise on invertebrates: A literature review. Canadian Science Advisory Secretariat. Research document 2004/126

659 Popper, A.N. and Hastings, M.C. 2009a. The effects of anthropogenic sources of sound on fish. Journal of Fish Biology, 75: 455 – 489.

660 Dolman, S. J., Weir, C.R., and Jasny, M. 2009. Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin 58 pp. 465-477

efficacy of mitigation measures such as ‘soft start’ in naval sonar exercises is also required. Once existing mitigation procedures and measures have been assessed, recommendations and guidelines can then be provided to the relevant practitioners. The long-term aim is the production of global standards that nations (and their military, for sonar operations) can sign up to and considerable progress has been made to achieve this for marine mammals[661 662].

As well as improving mitigation procedures and measures it is important that industry is encouraged to improve existing mitigation tools such as the mechanisms of sound emission by developing quieter noise sources through engineering modifications (e.g., shorter duration, narrower directionality or eliminating unnecessary frequencies)[663 664 665]. The development of passive acoustic monitoring (PAM) systems or other remote sensing techniques to detect a range of marine taxa is an important step for improving mitigation[666]. For example, PAM will become more successful as a mitigation tool if it is able to accurately detect a significant number of vocalising marine mammal species within exclusion zones, identify each marine mammal species and provide a reliable range measurement to the animal[667].

Current research programmes such as the International Quiet Ocean Experiment (IQOE)[668] and the Listening to the Deep Ocean (LIDO) project[669] are important elements in improving

---

661 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

662 Dolman, S. J., Weir, C.R., and Jasny, M. 2009. Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin 58 pp. 465-477

663 Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116

664 Weilgart, L.S. (ed) 2010. Report of the Workshop on Alternative Technologies to Seismic Airgun Surveys for Oil and Gas Exploration and their Potential for Reducing Impacts on Marine Mammals. Monterey, California, USA, 31st August – 1st September, 2009. Okeanos - Foundation for the Sea, Auf der Marienhöhe 15, D-64297 Darmstadt. 29+iii pp. http://www.okeanos-foundation.org/assets/Uploads/Airgun.pdf

665 Weilgart, L. 2012. Are there technological alternatives to air guns for oil and gas exploration to reduce potential noise impacts on cetaceans? In: Popper, A.N., and A. Hawkins (Eds.). The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology 730: 605-607, New York: Springer Press.

666 Southall, B., Berkson, J., Bowen, D., Brake, R., Eckman, J., Field, J., Gisiner, R., Gregerson, S., Lang, W., Lewandoski, J., Wilson, J., and Winokur, R. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, DC

667 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27.

668 Boyd, I.L., G. Frisk, E. Urban, P. Tyack, J. Ausubel, S. Seeyave, D. Cato, B. Southall, M. Weise, R. Andrew, T. Akamatsu, R. Dekeling, C. Erbe, D. Farmer, R. Gentry, T. Gross, A. Hawkins, F. Li, K. Metcalf, J.H. Miller, D. Moretti, C. Rodrigo, and T. Shinke. 2011. An International Quiet Ocean Experiment. *Oceanography* 24(2):174–181

669 Andre, M., van der Schaar, M., Zaugg, S., Houegnigan, L., Sanchez, A.M. and Castell, J.V. 2011. Listening to the Deep: live monitoring of ocean noise and cetacean acoustic signals. Mar Poll Bull 63:18-26.

our understanding of underwater sound and anthropogenic noise in our oceans and need to be supported over the long-term.

Table 5. Priority research needs for Anthropogenic Noise and its impact on Marine Biodiversity (adapted from Boyd et al., 2008; Southall et al., 2009; Tasker et al., 2010)

Subject Area (s)	Research Priorities	Biodiversity Conservation Priorities
Marine acoustics and monitoring	Long term biological and ambient noise measurements in high-priority areas (*e.g.*, protected areas, critical habitats, commerce hubs,) and more widely at the ocean basin level to record trends	Migratory corridors; foraging, mating / spawning and nursery habitats Identification of remaining quiet areas and ambient noise hotspots
	Determine the characteristics, distribution and abundance of anthropogenic sound sources in the marine environment	Identify 'noisy hotspots' where multiple sources occur
	Develop new technologies (*e.g.*, acoustic monitoring) to detect, identify, locate, and track marine vertebrates, in order to increase the effectiveness of detection and mitigation.	Monitoring of susceptible groups (e.g., beaked whales) and non-vocal vertebrates (e.g., teleost fish, elasmobranchs, turtles)
Baseline Biological Information	Biological research on: • Acoustic sensory organs structure and function • Use of sound by marine organisms; • Species-specific communication maximum ranges; • Basic information on hearing, especially for low frequency and high frequency species; • Modelling of the auditory system (to reduce dose response experimental exposure to sound).	Data deficient taxa: Teleost fish, Elasmobranchs, Marine Turtles, Invertebrates Marine species that are endangered and/or highly susceptible to multiple stressors

	Expand/improve distribution, abundance, behavioural and habitat data for marine species particularly susceptible to anthropogenic sound	Beaked whales, Threatened cetaceans
	Expand/improve distribution, abundance, behavioural and habitat data for marine species with high potential susceptibility to anthropogenic sound	Teleost fish, invertebrates (Cephalopods)
Baseline Biological Information and Monitoring	Support the development, standardization, and integration of online data archives of marine vertebrate distribution, abundance, and movement for use in assessing potential risk to marine vertebrates from sound-producing activities.	
	Standardize data-collection, reporting, and archive requirements of marine vertebrate monitoring programmes	Marine mammals, Marine turtles, Selected fish (apex predators, threatened keystone species), selected invertebrates
Sound effects on marine organisms	Data collection, involving controlled exposure experiments, for key species of concern and/or for data deficient taxa for sound effects (where applicable) on: • Hearing loss (TTS/PTS) and auditory damage (e.g., sensory hair cells) • Physiological (e.g., stress effects); • Behavioural – e.g., avoidance / displacement or disruption of normal activity; • Non-auditory injury – barotrauma, embolism, DCS • Masking – communication and orientation • Particle motion impacts	Key concerns: baleen whales, beaked whales, Arctic & endangered species of marine mammal) Data deficient taxa: Teleost fish, Elasmobranchs, Marine Turtles, Invertebrates

	Investigate cumulative effects of noise and stressors on marine organisms for both: • multiple exposures to sound • sound in combination with other stressors	Identify noise exposure criteria for cumulative effects
	Improve ability to identify and understand biologically-significant effects of sound exposure in order to improve effectiveness and efficiency of efforts to mitigate risk	
Sound effects on marine populations and communities	Measure changes in vital rates, e.g., fecundity, survival for populations. Measure changes in community composition.	Endangered species with small populations and limited distribution or mobility
Mitigation	Develop and improve noise exposure criteria and policy guidelines based on periodic reviews of best available science to better predict and regulate potential impacts	
	Develop and validate mitigation measures to minimize demonstrated adverse effects from anthropogenic noise	
	Test/validate mitigating technologies to minimize sound output and/or explore alternatives to sound sources with adverse effects (*e.g.,* alternative sonar waveforms).	

VI. CONCLUSIONS

The levels of anthropogenic noise in the marine environment have increased substantially in the last century[670] as human activities in coastal and oceanic waters have expanded and diversified. The underwater world is subject to a wide array of man-made noise from activities such as commercial shipping, oil and gas exploration and the use of various types of sonar[671]. The level of activity is also predicted to rise over the coming decades as maritime transportation and the exploration and extraction of marine resources continues to grow[672].

Sound is extremely important to many marine animals and plays a key role in communication, navigation, orientation, feeding and the detection of predators[673]. From invertebrate larvae[674] to the largest animals on the planet[675], the detection and recognition of underwater sound is crucial. The use of sound underwater is particularly important to many marine mammals such as cetaceans and especially the toothed whales which have highly specialised echolocation abilities. Many other marine taxa also rely on sound on a regular basis including teleost fish and invertebrates such as decapod crustaceans. The importance of sound for many marine taxa is still rather poorly understood and in need of considerable further investigation.

Concerns about the impacts of anthropogenic sound on marine animals have grown steadily over the last four decades. The levels of introduced noise in the marine environment are now considered to be a global issue and a significant stressor for marine life. Noise is listed as one of the impacts that can result in a substantial loss of biodiversity over time in sensitive marine habitats[676].

A wide range of effects of increased levels of sound on marine fauna have been documented both in laboratory and field conditions. Low levels of sound can be inconsequential for many animals. However, as sound levels increase the elevated background noise can disrupt normal behaviour

670 NRC (National Research Council). 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press. 192pp

671 Hildebrand, J. A. 2005. Impacts of anthropogenic sound. – in: Reynolds, J.E. et al. (eds.), Marine mammal research: conservation beyond crisis. The Johns Hopkins University Press, Baltimore, Maryland, pp 101-124

672 Boyd, I.L., G. Frisk, E. Urban, P. Tyack, J. Ausubel, S. Seeyave, D. Cato, B. Southall, M. Weise, R. Andrew, T. Akamatsu, R. Dekeling, C. Erbe, D. Farmer, R. Gentry, T. Gross, A. Hawkins, F. Li, K. Metcalf, J.H. Miller, D. Moretti, C. Rodrigo, and T. Shinke. 2011. An International Quiet Ocean Experiment. *Oceanography* 24(2):174–181

673 Richardson, W.J., Malme, C.I., Green, C.R.jr. and D.H. Thomson (1995). Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp

674 Vermeij MJA, Marhaver KL, Huijbers CM, Nagelkerken I, Simpson SD (2010) Coral Larvae Move toward Reef Sounds. PLoS ONE 5(5): e10660. doi:10.1371/ journal.pone.0010660

675 Stafford, K. M., C. G. Fox, and D. S. Clark. 1998. Long-range acoustic detection and localization of blue whale calls in the northeast Pacific. Journal of the Acoustical Society of America 104:3616–3625

676 Warner, R. 2008.Protecting the diversity of the depths: environmental regulation of bioprospecting and marine scientific research beyond national jurisdiction. Ocean Yearbook. 22: 411-443.

patterns leading to less efficient feeding for example. Masking of important acoustic signals or cues can reduce communication between conspecifics[677] and may interfere with larval orientation which could have implications for recruitment. Some marine mammals have tried to compensate for the elevated background noise levels by making changes in their vocalisations[678].

Intense levels of sound exposure have caused physical damage to tissues and organs of marine animals[679] [680], and even moderate levels of noise can lead to mortality, with lethal injuries of cetaceans documented in stranded individuals caught up in atypical stranding events[681]. Noise has been shown to cause permanent or temporary loss of hearing in marine mammals and fish. Behavioural responses such as strong avoidance of the sound source can lead to habitat displacement[682]. Some marine animals, such as beaked whales are particularly susceptible to anthropogenic sound, and some populations have experienced declines for years after a sonar-induced stranding event[683]. Short-term effects have been observed in a number of marine mammals and fish but the long-term consequences of chronic noise pollution for individuals and populations are still mainly unknown. Potential long-term impacts of reduced fitness and increased stress leading to health issues have been suggested[684]. There is also growing concern of the cumulative effects of anthropogenic sound and other stressors and how this can affect populations and communities[685].

677 Clark, C.W., Ellison, W.T., Southall, B.L., Hatch L., van Parijs, S.M., Frankel, A. and Ponirakis, D. 2009. Acoustic masking in marine ecosystems: intuitions, analyses, and implication. Marine Ecology Progress Series, 395: 201 – 222

678 Holt, M.M., Noren, D.P., Veirs, V., Emmons, C.K. and Veirs, S. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. J. Acoust. Soc. Am. 125. DOI: 10.1121/1.3040028

679 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy

680 Andre et al., 2011. Low-frequency sounds induce acoustic trauma in cephalopods. Front Ecol Environ 9: 489–493,

681 Fernández, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herráez, P., Castro, P., Jaber, J.R., Martín, V., and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57

682 Lusseau, D. 2005. Residency pattern of bottlenose dolphins Tursiops spp. In Milford Sound, New Zealand, is related to boat traffic. Mar. Ecol. Prog. Ser. 295: 265–272

683 Claridge, D.E. 2006. Fine-scale distribution and habitat selection of beaked whales. M.Sc. thesis, Department of Zoology, University of Aberdeen, Scotland, U.K.

684 Wright, J.W., Deak, T. and Parsons, E.C.M. 2009. Concerns Related to Chronic Stress in Marine Mammals. IWC SC/61/E16 7 pp.

685 Wright, A.J. (ed) 2009. Report of the Workshop on Assessing the Cumulative Impacts of Underwater Noise with Other Anthropogenic Stressors on Marine Mammals: From Ideas to Action. Monterey, California, USA, 26th-29th August, 2009. Okeanos - Foundation for the Sea, Auf der Marienhöhe 15, D-64297 Darmstadt. 67+iv p. Available from http://www.okeanos-foundation.org/assets/Uploads/CIReportFinal3.pdf

Research has particularly focussed on cetaceans and other marine mammals such as pinnipeds to a lesser extent but there are still many knowledge gaps that need addressing. Acoustic research for marine fish and invertebrates is still very much in its infancy and requires considerable investment to set up systematic studies of the effects of marine noise on these animals. Consequently many sound-induced impacts for less well-studied taxa are currently potential effects some of which have been inferred from studies of other faunal groups. Substantial further research is required in order to better understand the impacts of anthropogenic sound on marine biodiversity. However, a system of prioritisation will also be needed to focus on species that are already highly threatened or endangered through a combination of multiple stressors and intrinsic characteristics, but also representative groups of understudied taxa such as marine fish and invertebrates.

Mitigation of anthropogenic sound levels in the marine environment require regular updating to keep in touch with changes in acoustic technology and the latest scientific knowledge of marine species such as acoustic sensitivity and population ecology. Activities such as military exercises emitting sonar or seismic surveys using air guns do have mitigation guidelines in place but these can vary considerably between navies or regions and a number of limitations have been identified[686] [687]. There have been calls for the setting of global standards for the main activities responsible for producing anthropogenic sound in the oceans. Progress is being made with regard to commercial shipping and quieting but standards for naval sonar or seismic surveys are also required to reduce impacts on marine species.

Mitigation and management of anthropogenic noise through the use of spatio-temporal restrictions of activities has been recommended as the most practical and straightforward approach to reduce effects on marine animals. A framework for the implementation of STR's is available for use by national and regional bodies to ensure that acoustic issues are considered in future marine spatial planning[688].

There are also additional global factors to consider when assessing the potential of anthropogenic noise to affect marine species. It is known that low frequency sound absorption decreases with increasing acidity in seawater. Modelling of projected changes in acidity caused by ocean acidification has suggested that particularly noisy regions that are also prone to reduced sound absorption should be recognised as hotspots where mitigation and management is probably most needed. Further work is required to verify or refute these predictions.

---

686 Weir, C., Dolman, S.J., 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. Journal of International Wildlife Law and Policy 10, 1–27

687 Dolman, S. J., Weir, C.R., and Jasny, M. 2009. Comparative review of marine mammal guidance implemented during naval exercises. Marine Pollution Bulletin 58 pp. 465-477.

688 Agardy, T., Aguilar, N., Cañadas, A., Engel, M., Frantzis, A., Hatch, L., Hoyt, E., Kaschner, K., LaBrecque, E., Martin, V., Notarbartolo di Sciara, G., Pavan, G., Servidio, A., Smith, B., Wang, J., Weilgart, L., Wintle, B. and Wright, A. 2007. A Global Scientific Workshop on Spatio-Temporal Management of Noise. Report of the Scientific Workshop. 44 pages. http://www.okeanos-foundation.org/assets/Uploads/str2007en2.pdf

Previously relatively quiet areas of the oceans such as the Arctic are also highly likely to be exposed to increased levels of anthropogenic sound as the sea ice coverage decreases. The ‘new waters’ will be open to dramatically increased levels of shipping, exploration and exploitation especially by the oil and gas industry (seismic surveys and offshore industry) but also to commercial fishing vessels and possibly naval exercises (active sonar). The effects on marine biodiversity are likely to be significant. Management frameworks for the Arctic need to consider anthropogenic noise as an important stressor alongside others when deciding the extent of activities permitted in these waters.

Anthropogenic sound in the marine environment is an issue that is likely to increase in significance over the next few decades, which could have both short- and long-term negative consequences for marine animals. The uncontrolled introduction of increasing noise is likely to add significant further stress to already-stressed oceanic biota[689]. Protecting marine life from this growing threat will require more effective control of the activities producing sound which depends on a combination of greater understanding of the impacts and also increased awareness of the issue by decision makers both nationally and regionally to implement adequate regulatory and management measures.

Annex 1. Overview of observed effects of underwater noise on marine life (adapted from Boyd et al., 2008; OSPAR, 2009)

Note: *Papers cited refer to observed effects to actual anthropogenic noise sources ‘in situ’ unless otherwise stated in parentheses e.g., modelled. Most laboratory experiments are not included but recordings of anthropogenic noise sources played to marine species at sea are listed as ‘simulated’ in parentheses*

689 Boyd, I.L., G. Frisk, E. Urban, P. Tyack, J. Ausubel, S. Seeyave, D. Cato, B. Southall, M. Weise, R. Andrew, T. Akamatsu, R. Dekeling, C. Erbe, D. Farmer, R. Gentry, T. Gross, A. Hawkins, F. Li, K. Metcalf, J.H. Miller, D. Moretti, C. Rodrigo, and T. Shinke. 2011. An International Quiet Ocean Experiment. *Oceanography* 24(2):174–181

Impact	Type of effect	Type of Anthropogenic Noise	Marine organisms affected
Physiological Non auditory	Damage to body tissue: e.g., massive internal haemorrhages with secondary lesions, ossicular fractures or dislocation, leakage of cerebro-spinal liquid into the middle ear, rupture of lung tissue	1. Intense low or mid-frequency (Naval) sonar, 2. Seismic air gun arrays, 3. Explosions	1. Beaked whales[690] [691], 2. Giant squid (inferred) [692], 3. Humpback whale[693]
	Induction of gas embolism (Gas Embolic Syndrome, Decompression Sickness/DCS, 'the bends', Caisson syndrome)	Intense mid-frequency (Naval) sonar	Beaked whales[694][695], odontocete cetaceans[696]
	Induction of fat embolism	Intense mid-frequency (Naval)	Beaked whales[697]

690 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy.

691 Fernández, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herráez, P., Castro, P., Jaber, J.R., Martín, V., and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57

692 Guerra, A and Gonzalez, A.F. 2006. Severe injuries in the *Arhiteuthis dux* stranded after acoustic explorations. In: International Workshop on Impacts of Seismic Survey. Activities on Whales and other Marine Biota. Federal Environment Agency, Dessau, Germany.

693 Ketten, D.R. (1995). Estimates of blast injury and acoustic zones for marine mammals from underwater explosions. In: Kastelein, R.A., Thomas, J.A., and Nachtigall, P.E. (ed), Sensory Systems of Aquatic Mammals. De Spil Publishers, Woerden, NL, pp: 391-407.

694 Fernandez et al., 2005. Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57

695 Hooker et al., 2009. Could beaked whales get the bends?: Effect of diving behaviour and physiology on modelled gas exchange for three species: *Ziphius cavirostris*, *Mesoplodon densirostris* and *Hyperoodon ampullatus*. Resp. Physiol Neurobiol. 137: 235-246

696 Jepson et al., 2003. Gas-bubble lesions in stranded cetaceans. Nature 425: 575–576.

697 Fernández et al. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57

Impact	**Type of effect**	**Type of Anthropogenic Noise**	**Marine organisms affected**
		sonar	
	Disruption of gas filled organs such as the swim bladder (fishes) [with	Pile driving	Various fish species[698], Chinook Salmon (juvenile)[699]

698 Caltrans. (2004). Fisheries and hydroacoustic monitoring program compliance report for the San Francisco–Oakland bay bridge east span seismic safety project. Caltrans Contract EA12033. San Francisco, CA: Caltrans.

699 National Cooperative Highways Research Program. 2011. Hydroacoustic impacts on fish from pile installation. NCHRP Project 25-28. Research Results Digest 363 http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_363.pdf

Impact	**Type of effect**	**Type of Anthropogenic Noise**	**Marine organisms affected**
	surrounding tissue]		
	Endochrinological stress responses	Seismic air guns	Sea bass[700], Atlantic Salmon[701], Bottlenose dolphin and Beluga (simulated)[702]
Auditory (Sound	Gross damage to the auditory system e.g., resulting in: rupture of the	1. Intense mid-frequency sonar, 2. Explosions	1. Beaked whales[703], 2. Humpback whale[704]

700 Santulli, A., Modica, A., Messina, C., Ceffa, L., Curatolo, A., Rivas, G., Fabi, G., D'Amelio, V. 1999. Biochemical responses of European sea bass (*Dicentrarchus labrax L.*) to the stress induced by offshore experimental seismic prospecting in the mediterranean sea. Marine Pollution Bulletin 38, 105-1114

701 Svedrup, A., Kjellsby, E., Kr uger, P. G., Flùysand, R., Knudsen, F. R., Enger, P. S., Serck-Hanssen, G., Helle, K. B. (1994) E€ects of experimental seismic shock on vasoactivity of arteries, integrity of vascular endothelium and on primary stress hormones of the Atlantic salmon. Journal of Fish Biology 45, 973-995.

702 Romano, T.A. et al. 2004. Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure. Can. J. Fish. Aquat. Sci. 61: 1124–1134

703 Evans DL, England GR (2001) Joint interim report Bahamas marine mammal stranding event of 14–16 March 2000. US Department of Commerce and US Navy.

704 Ketten, D.R., Lien, J. & Todd, S. 1993. Blast injury in humpback whale ears: Evidence and implications. J. of the Acoustic Society of America 94: 1849–1850

Impact	**Type of effect**	**Type of Anthropogenic Noise**	**Marine organisms affected**
	oval or round window or rupture of the ear drum		
	Vestibular trauma e.g., resulting in: vertigo, dysfunction of coordination and	1. Explosions, 2. Air guns (naval sonar, pile driving, other sonars,	1. Humpback whale[705], 2. Spotted dolphin[706]

705 Todd, S., Stevick, P., Lien, J., Marques, F., and Ketten, D. (1996). Behavioural effects of exposure to underwater explosions in humpback whales (*Megaptera novaengliae*). Can J. Zool., 74: 1661-1672.

706 Gray & Van Waerebeek 2011. Postural instability and akinesia in a pantropical spotted dolphin, S.a., in proximity to operating airguns of a geophysical seismic vessel. J. Nat. Cons.

Impact	Type of effect	Type of Anthropogenic Noise	Marine organisms affected
	equilibrium	drilling)	
	Damage to the sensory hair cells	Air guns (actual and simulated)	Various fin-fish[707], Pink snapper[708], Cephalopods (four species)[709]
	Permanent hearing threshold shift (PTS) i.e. a permanent elevation of the level at which a sound can be detected	1. Air guns (modelled), 2. Sonar (simulated)	1. Baleen whales[710], 2. Harbour seal[711]
	Temporary hearing threshold shift (TTS) i.e. a temporary elevation of the level at which a sound can be detected	1. Air guns (modelled), 2. Mid-frequency sonar (simulated), 3. Ice breaker (modelled)	1. Baleen whales[712], Harbour porpoise[713], 2. Bottlenose dolphin[714],, 3. Beluga[715]
Perceptual	Masking of communication with conspecifics	1. Shipping, 2. high-frequency sonar, 3. Recreational vessels,	1, Cuvier's beaked whale[716], 3. Delphinid cetaceans[717], Fish:

707 McCauley RD, Duncan AJ, Penrose JD, et al. 2000. Marine seismic surveys – a study of environmental implications. APPEA J 40: 692–706.

708 McCauley, R. D., Fewtrell, J. & Popper, A. N. (2003). High intensity anthropogenic sound damages fish ears. Journal of the Acoustical Society of America 113, 638–642

709 André et al., 2011. Low-frequency sounds induce acoustic trauma in cephalopods. Front Ecol Environ 9: 489–493

710 Gedamke et al. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: the effect of uncertainty and individual variation. JASA 129 (1): 496-506

711 Reichmuth 2009 Effects of Noise and Tonal Stimuli on Hearing in Pinnipeds. ONR report, or Kastak et al. 2008. Noise-induced PTS in a harbor seal. JASA 123 (5) p. 2986.

712 Gedamke et al. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: the effect of uncertainty and individual variation. JASA 129 (1): 496-506

713 Lucke, K., Siebert, U., Lepper, P.A., Blanchet, M-A. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. J. Acoust. Soc. Am. 125: 4060-4070.

714 Finneran, J.J., Carder, D.A., Schlundt, C.A. and Ridgway, S.H., 2005. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. J. Acoust. Soc. Am. 118: 2696-2705

715 Erbe, C. and D. M. Farmer. 2000. Zones of impact around icebreakers affecting beluga whales in the Beaufort Sea. Journal Acoustical Society of America 108, 1332-1340.

716 Aguilar Soto, N., N. Johnson, P. T. Madsen, P. L. Tyack, A. Bocconcelli, and J. F. 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? Marine Mammal Science 22, 690–699

Impact	**Type of effect**	**Type of Anthropogenic Noise**	**Marine organisms affected**
		frequency sonar	(modelled)[719], Pacific humpback dolphin[720]4. Beluga (modelled)[721], 5. Humpback whale[722]
	Masking of other biologically important sounds including orientation and settlement cues, echolocation signals	Shipping	Cuvier's beaked whale[723]
Behavioural	Stranding or beaching	Intense low or mid-frequency (Naval)	Beaked whales[724 725 726 727 728 729], Short finned pilot

717 Jensen, F.H., Bedjer. L., Wahlberg, M., Aguilar Soto, N., Johnson, M., Madsen, P.T. 2009. Vessel noise effects on delphinid communication. Mar. Ecol. Prog. Ser. 395: 161-175.

718 Codarin et al., 2009. Effects of ambient and boat noise on hearing and communication in three fish species living in a marine protected area (Miramare, Italy). Mar. Pollut. Bull., doi:10.1016/j.marpolbul.2009.07.011

719 Erbe, C. 2002. Underwater noise of whale-watching boats and potential effects on killer whales (*Orcinus orca*), based on an acoustic impact model. Marine Mammal Science 18, 394- 418

720 Van Parijs, S.M. and Corkeron, P.J. 2001. Boat trafficaffects the acoustic behaviour of Pacific humpack dolphins, *Sousa chinensis*. J. Mar. Biol. Assoc. U.K. 81: 533-538.

721 Erbe, C. and D. M. Farmer. 2000. Zones of impact around icebreakers affecting beluga whales in the Beaufort Sea. Journal Acoustical Society of America 108, 1332-1340.

722 Miller, P.J.O., Biassoni, N., Samuels, A. and Tyack, P.L. 2000. Whale songs lengthen in response to sonar. Nature, 405: 903

723 Aguilar Soto, N., N. Johnson, P. T. Madsen, P. L. Tyack, A. Bocconcelli, and J. F. 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? Marine Mammal Science 22, 690–699

724 Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392: 29.

725 Balcomb, K. C. III and Claridge, D. E. 2001. A mass stranding of cetaceans caused by naval sonar in the Bahamas. Bahamas Journal of Science 5: 1–12.

726 Fernández, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herráez, P., Castro, P., Jaber, J.R., Martín, V., and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family *Ziphiidae*) exposed to anthropogenic sonar signals. Vet. Pathol. 42: 446-57.

727 Brownell, R. L., Yamada, T., Mead, J. G. and van Helden, A. L. 2004. Mass strandings of Cuvier's beaked whales in Japan: U.S. Naval acoustic link? Paper IWC/SC/56/E37 to 56th meeting of IWC Scientific Committee. 10 pp

728 Wang, J.W. and Yang, S-C. 2006. Unusual stranding events of Taiwan in 2004 and 2005. J. Cetacean Res. Manage. 8(3): 283–292

Impact	**Type of effect**	**Type of Anthropogenic Noise**	**Marine organisms affected**
		sonar	whale[730] [731], Pygmy sperm whale[732], Pygmy killer whale[733], Minke whale[734] [735], Hawaiian melon-headed whale[736],
	Behaviour modified (less effective / efficient)	Shipping (simulated)	Sea bass and sea bream[737]
	Behaviourally-mediated effects including	1. Acoustic deterrents, 2.	1. Harbour porpoise[738] [739] 2. Bottlenose dolphin[740] [741],

729 Yang, W.-C., Chou, L.-S., Jepson, P. D., Brownell, R. L., Cowan, D., Chang, P. H., Chiou, H.- I., Yao, C.-J., Yamada, T. K., Chiu, J.-T., Wang, P.-J. and Fernández, A. 2008. Unusual cetacean mortality event in Taiwan, possibly linked to naval activities. Veterinary Record 162, 184–186

730 Ibid

731 Hohn, A.A., Rotstein, D.S., Harms, C.A., and Southall, B.L. 2006. Report on Marine Mammal Unusual Mortality Event UMESE 0501Sp: Multispecies mass stranding of pilot whales (*Globicephala macrorhynchus*), minke whale (*Balaenoptera acutorostrata*), and dwarf sperm whales (*Kogia sima*) in North Carolina on 15-16 January 2005. Silver Spring: National Marine Fisheries Service. 230 pp.

732 Ibid

733 Wang, J.W. and Yang, S-C. 2006. Unusual stranding events of Taiwan in 2004 and 2005. J. Cetacean Res. Manage. 8(3): 283–292

734 Balcomb, K. C. III and Claridge, D. E. 2001. A mass stranding of cetaceans caused by naval sonar in the Bahamas. Bahamas Journal of Science 5: 1–12

735 Hohn, A.A., Rotstein, D.S., Harms, C.A., and Southall, B.L. 2006. Report on Marine Mammal Unusual Mortality Event UMESE 0501Sp: Multispecies mass stranding of pilot whales (*Globicephala macrorhynchus*), minke whale (*Balaenoptera acutorostrata*), and dwarf sperm whales (*Kogia sima*) in North Carolina on 15-16 January 2005. Silver Spring: National Marine Fisheries Service. 230 pp

736 Southall, B.L., Braun, R., Gulland, F.M.D., Heard, A.D., Baird, R.W., Wilkin, S.M., and Rowles, T.K. 2006. Hawaiian melon-headed whale (*Peponacephala electra*) mass stranding event of July 3-4, 2004. Silver Spring: National Marine Fisheries Service. 78 pp.

737 Buscaino, G. et al. 2009. Impact of an acoustic stimulus on the motility and blood parameters of European sea bass (*Dicentrarchus labrax* L.) and gilthead sea bream (*Sparus aurata* L.). Mar. Environ. Res. 69, 136–142

738 Kastelein, R.A., Jennings, N., Verboom, W.C., de Haan, D., Schooneman, N.M. 2006. Differences in the responses of a striped dolphin (*Stenella coeruleoalba*) and a harbour porpoise (*Phocoena phocoena*) to an acoustic alarm. Mar. Enviro. Res. 61: 363-378.

739 Olesiuk, P.F., Nichol, L.M., Sowden, M.J., and Ford, J.K.B. 2002. Effect of the sound generated by an acoustic harassment device on the relative abundance and distribution of harbor porpoises (Phocoena phocoena) in Retreat Passage, British Columbia. Mar. Mamm. Sci. 18: 843-862.

Impact	Type of effect	Type of Anthropogenic Noise	Marine organisms affected
		fishing gear, 6. Drilling, 7. Dredging, 8. High-frequency sonar, 9. Intense low or mid-frequency sonar, 10. Air guns, 11. Pile	whales[748], humpback whales, turtles, fish and squid[749], Pelagic fish – herring, blue whiting and others[750], Various Cetaceans[751], 11. Cod and sole[752], Harbour

740 Goodwin, L., and Cotton, P.A. 2004. Effects of boat traffic on the behavior of bottlenose dolphins (*Tursiops truncatus*). Aq. Mammals 30: 279-283

741 Lemon, M., Lynch, T.P., Cato, D.H., and Harcourt, R.G. 2006. Response of travellingbottlenose dolphins (*Tursiops aduncus*) to experimental approaches by a powerboat in Jervis Bay, New South Wales, Australia. Bio. Conserv. 127: 363-372.

742 Sarà et al., 2007. Effect of boat noise on the behaviour of Bluefin tuna *Thunnus thynnus* in the Mediterranean Sea. Mar. Ecol.-Prog. Ser. 331, 243–253

743 Noren, D.P., Johnson, A.H., Rehder, D., Larson, A. 2009. Close approaches by vessels elicit surface active behaviors by southern resident killer whales. Endangered Species Res. 8: 179-192.

744 Au, W. W. L. and M. Green, M. 2000. Acoustic interaction of humpback whales and whale-watching boats. Marine Environmental Research 49, 469-481

745 Kvadsheim, P., Benders, F., Miller, P., Doksaeter, L., Knudsen, F., Tyack, P., Nordlund, N., Lam, F.-P., Samarra, F., Kleivane, L., and Godø, O.R. 2007. Herring (sild), killer whales (spekkhogger) and sonar – the 3S-2006 cruise report with preliminary results. Norway: Norwegian Defence Research Establishment. 79 pp.

746 Kvadsheim, P.H. et al. 2010. Effects of naval sonar on seals. Norwegian Defence Research Establishment (FFI). FFI-rapport 2010/02222. 26 pp.

747 Tyack, P and Clark, C., 1998. Quicklook Phase II, Playback of Low-Frequency Sound to Gray Whales Migrating Past the Central California Coast. Quicklook Report pp. 1-34.

748 Ljungblad, D.K., Würsig, B., Swartz, S.L., and Keene, J.M. 1988. Observations on the behavioral responses of bowhead whales (*Balaena mysticetus*) to active geophysical vessels in the Alaskan Beaufort Sea. Arctic 41(3): 183-194

749 McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J., McCabe K. 2000. Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid. Western Australia: Curtin University of Technology. 203 pp.

750 Slotte, A., Hansen, K., Dalen, J., and One, E. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. Fish. Res. 67: 143-150.

751 Stone, C.J., and Tasker, M.L. 2006. The effects of seismic airguns on cetaceans in UK waters. J. Cetacean Res. Manage. 8: 255-263.

752 Mueller-Blenkle, C., McGregor, P.K., Gill, A.B., Andersson, M.H., Metcalfe, J., Bendall, V., Sigray, P., Wood, D.T. & Thomsen, F. (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish. COWRIE Ref: Fish 06-08, Technical Report

Impact	**Type of effect**	**Type of Anthropogenic Noise**	**Marine organisms affected**
		driving, 12 Icebreakers	porpoises[753]12. Beluga[754]
	Adaptive shifting of vocalisation intensity and/or frequency including cessation of calls	1. Shipping, 2. Recreational vessels, 3. Air guns, 4. Intense low or mid-frequency sonar, 5. Acoustic devices. 6. Acoustic experiments	1. Right whale[755], 2. Killer whale[756], Beluga[757], Fin whale[758], 3. Sperm whale[759], Fin whale[760] 4. Long finned pilot whale[761], Blue and fin whale[762], Humpback whale[763] [764], Sperm whale[765], Blainville's beaked

753 Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. 2006. Effects of offshore wind farm noise on marine mammals and fish, biola, Hamburg, Germany on behalf of COWRIE Ltd

754 Finley KJ, Miller GW, Davis RA, Greene CR (1990) Reactions of belugas, *Delphinapterus leucas*, and narwhals, *Monodon monoceros*, to ice-breaking ships in the Canadian high arctic. Canadian Bulletin of Fisheries and Aquatic Science 224:97-117

755 Parks, S.E., Clark, C.W., and Tyack, P.L. 2007. Short- and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. J. Acoust. Soc. Am. 122: 3725-3731.

756 Holt, M.M., Noren, D.P., Veirs, V., Emmons, C.K., and Viers, S. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. J. Acoust. Soc. Am. 125: EL27-32.

757 Lesage, V., Barrette, C., Kingsley, M.C.S., and Sjare, B. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence River estuary, Canada. Mar. Mamm. Sci. 15: 65-84

758 Watkins, W. W. 1986. Whale reactions to human activities in Cape Cod waters. Marine Mammal Science 2: 251-262.

759 Bowles, A.E., Smultea, M., Würsig, B., DeMaster, D.P., and Palka, D. 1994. Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test. J. Acoust. Soc. Am. 96: 2469-2484.

760 International Whaling Commission Scientific Committee (IWC/SC). 2007. Report and Annex K of the 2007 Scientific Committee Report: Report of the Standing Working Group on Environmental Concerns. J. Cetacean Res. Manag. 9 (Suppl.): 227-296

761 Rendell, L.E., and Gordon, J.C.D. 1999. Vocal responses of long-finned pilot whales (*Globicephala melas*) to military sonar in the Ligurian Sea. Mar. Mammal Sci. 15: 198-204

762 Clark, C.W., Tyack, P. and Ellison, W.T. 1998. Quicklook. Low-Frequency Sound Scientific Research Program, Phase I: responses of blue and fin whales to SURTASS LFA

763 Clark, C.W. and Tyack, P. 1998. Quicklook, Low-Frequency Sound Scientific Research Program, Phase III: responses of humpback whales to SURTASS LFA off the Kona Coast, Big Island, Hawaii.

764 Miller, P.J.O., Biassoni, N., Samuels, A. and Tyack, P.L. 2000. Whale songs lengthen in response to sonar. Nature, 405: 903

Impact	Type of effect	Type of Anthropogenic Noise	Marine organisms affected
			whales[766], 5. Sperm whale[767], 6. Humpback whale[768]
	Interruption of normal behaviour such as feeding, breeding or nursing	1. Recreational or other vessels, 2. Air guns, 3. intense low or mid-frequency sonar, (drilling, explosions, dredging, high-frequency sonar, pile	1. Killer whale[769], Manatee[770], Damselfish[771], Cuvier's beaked whale[772], 2. Sperm whale[773] [774], 3. Blainville's beaked whales[775]

765 Watkins, W.A., Moore, K.E., and Tyack, P. 1985. Sperm whale acoustic behaviors in the southeast Caribbean. Cetology 49: 1-15

766 McCarthy E, Moretti D, Thomas L, DiMarzio N, Morrissey R, Jarvis S, Ward J, Izzi A, Dilley A (2011) Changes in spatial and temporal distribution and vocal behavior of Blainville's beaked whales (*Mesoplodon densirostris*) during multiship exercises with mid-frequency sonar. Marine Mammal Science

767 Watkins, W.W. and Schevill, W.E. 1975. Sperm whales (*Physeter catodon*) react to pingers. Deep Sea Research 22 : 123-129.

768 Risch D, Corkeron PJ, Ellison WT, and Van Parijs SM. 2012. Changes in humpback whale song occurrence in response to an acoustic source 200 km away. PLoS ONE 7(1): e29741. doi:10.1371/journal.pone.0029741

769 Lusseau, D., Bain, D.E., Williams, R., and Smith, J.C. 2009. Vessel traffic disrupts the foraging behavior of southern resident killer whales *Orcinus orca*. Endang. Species Res. 6: 211-221.

770 Miksis-Olds, J.L., Donaghay, P.L., Miller, J.H., Tyack, P.L., and Nystuen, J.A. 2007. Noise level correlates with manatee use of foraging habitats. J. Acoust. Soc. Am. 121: 3011-3020.

771 Picciulin et al., 2010. *In situ* behavioural responses to boat noise exposure of *Gobius cruentatus* (Gmelin, 1789; fam. Gobiidae) and *Chromis chromis* (Linnaeus, 1758; fam. Pomacentridae) living in a Marine Protected Area. Journal of Experimental Marine Biology and Ecology 386: 125–132

772 Aguilar Soto, N., N. Johnson, P. T. Madsen, P. L. Tyack, A. Bocconcelli, and J. F. 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? Marine Mammal Science 22, 690–699

773 International Whaling Commission Scientific Committee (IWC/SC). 2007. Report and Annex K of the 2007 Scientific Committee Report: Report of the Standing Working Group on Environmental Concerns. J. Cetacean Res. Manag. 9 (Suppl.): 227-296

774 Miller, P.J.O., Johnson, M., Madsen, P.T., Quero, M.E., Biassoni, N. & Tyack, P. 2006: At-sea experiments indicate that airguns affect the foraging behaviour of sperm whales in the Gulf of Mexico. IWC-SC/58/ForInfo2. 34 pp

775 Tyack PL, Zimmer WMX, Moretti D, Southall BL, Claridge DE, et al. 2011. Beaked Whales Respond to Simulated and Actual Navy Sonar. PLoS ONE 6(3): e17009. doi:10.1371/journal.pone.0017009

		driving, shipping)	
	Short-term or long-term displacement from area (habitat displacement)	1. tourism vessels, 2. Acoustic deterrents, 3. Shipping and/or drilling (Bottom-towed fishing gear, dredging, air guns)	1. Bottlenose dolphin[776], 2. Killer whale[777], 3. Gray whale [778], Bowhead whale[779]

-----

776 Lusseau, D. 2004. The hidden cost of tourism: Detecting long-term effects of tourism using behavioral information. Ecol. & Soc. 9: 2

777 Morton, A.B., and Symonds, H.K. 2001. Displacement of Orcinus orca (L.) by high amplitude sound in British Columbia. ICES J. Mar. Sci. 59: 71-80.

778 Bryant, P.J., Lafferty, C.M., and Lafferty, S.K. 1984. Reoccupation of Laguna Guerrero Negro Baja California, Mexico, by gray whales. Pp. 375-386 in M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.). The Gray Whale *Eschrictius robustus*. Orlando: Academic Press.

779 Schick, R.S., and Urban, D.L. 2000. Spatial components of bowhead whale (*Balaena mysticetus*) distribution in the Alaskan Beaufort Sea. Can. J. Fish. Aquat. Sci. 57: 2193-2200.

Appendix B

WBM Report

Port Bonython Bulk Commodities Export Facility Ship Propeller Wash Assessment

Reference:
R.B19279.002.03.PortBonythonPropWashAssessment.docx
Date: January 2014

Port Bonython Bulk Commodities Export Facility
Ship Propeller Wash Assessment

Prepared for:	ARUP
Prepared by:	BMT WBM Pty Ltd (Member of the BMT group of companies)

Offices

Brisbane
Denver
London
Mackay
Melbourne
Newcastle
Perth
Sydney
Vancouver

Document Control Sheet

BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane Qld 4000
Australia
PO Box 203, Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

Document:	R.B19279.002.03.PortBonythonPropWashAssessment.docx
Title:	Port Bonython Bulk Commodities Export Facility Ship Propeller Wash Assessment
Project Manager:	Malcolm Andrews
Author:	Jesper Nielsen
Client:	ARUP
Client Contact:	Sin Nyap Tan
Client Reference:	

Synopsis: **This report details the methodology and findings from an assessment of the fate of sediments resuspended from the bed by the action of ships propellers at the proposed bulk export facility at Port Bonython.**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	25/11/2013	MJA		JN	
1	09/01/2014	MJA		JN	
2	13/01/2013	MJA		JN	
3	17/01/2013	MJA		JN	

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
ARUP	PDF	PDF	PDF	PDF							
BMT WBM File	PDF	PDF	PDF	PDF							
BMT WBM Library	PDF	PDF	PDF	PDF							

Contents

List of Figures

List of Tables

1 Introduction

Flinders Ports propose to develop a new bulk export commodities facility at Port Bonython in upper Spencer Gulf, South Australia. The facility will include a Jetty extending approximately 2.8Km from the shoreline into water depths of approximately 20m AHD. The facility is intended to accommodate approximately 280 vessel calls annually, the largest vessels being “Cape Size” bulk carriers. An Environmental Impact Statement is underway for which ARUP is the lead consultant.

ARUP has commissioned BMT WBM to conduct a study which aims to assess the fate of sediments suspended from the bed by the wash generated from the propellers of ships using the proposed facility. The objectives of the study include developing a numerical model to analyse the tidal currents in the vicinity of the proposed facility and to simulate sediments suspended during departure operations.

Spencer Gulf is a large expanse of water where a number of rather complex physical processes are prevalent. A 3D numerical hydrodynamic model encompassing the entire gulf was developed for this study using the state of the art TUFLOW-FV software, http://www.tuflow.com. This report demonstrates that the model is highly capable of replicating the hydrodynamic processes within the vicinity of the proposed facility.

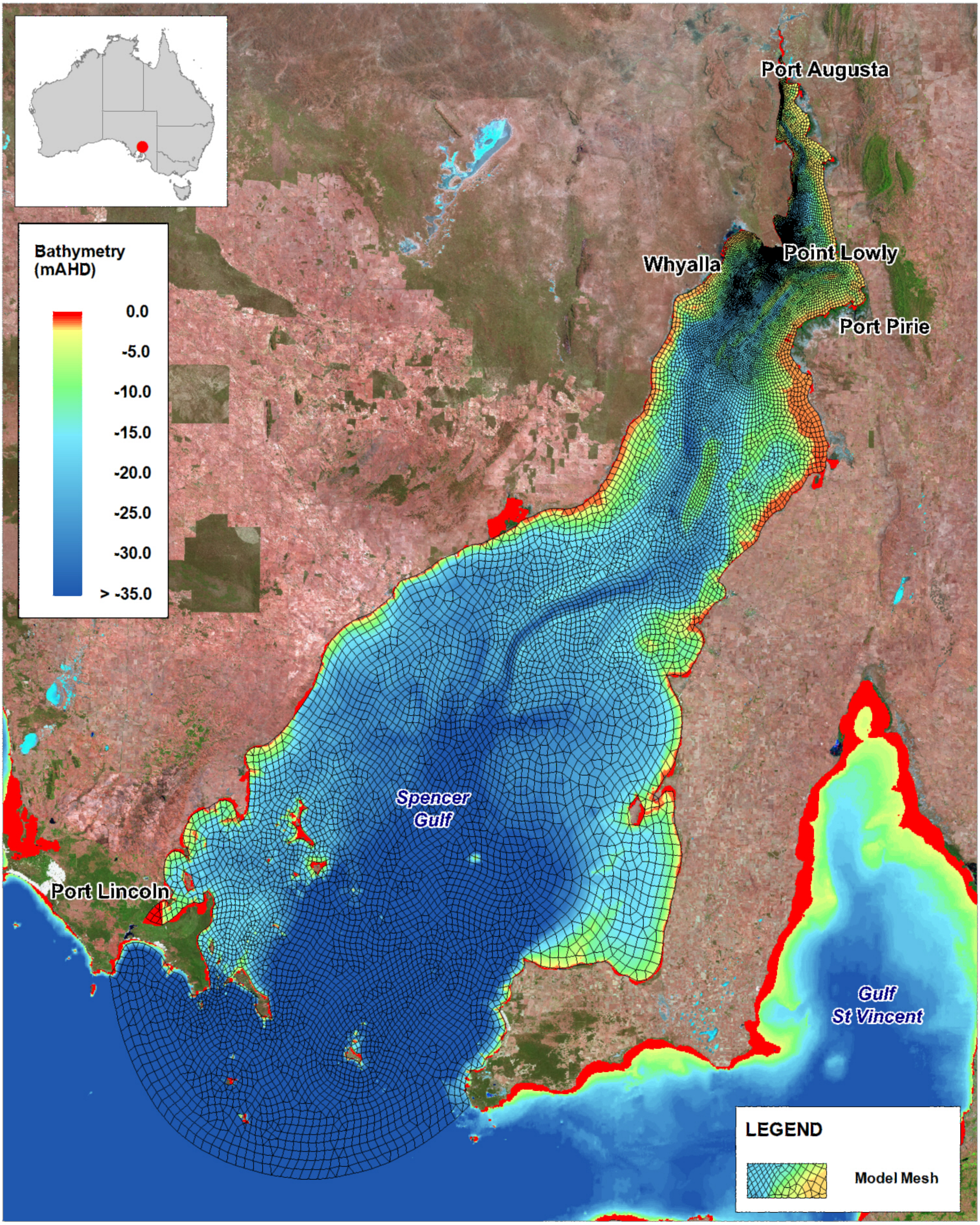
1.1 Hydrodynamic Model Configuration

1.1.1 Overview

To provide both a tool for assessing the prevailing currents in the vicinity of the proposed facility and the hydrodynamic field for the TUFLOW-FV sediment module, a 3D hydrodynamic model of Spencer Gulf was developed using TUFLOW-FV.

1.1.2 Model Mesh

The TUFLOW-FV hydrodynamic model extends from the far Northern reaches of Spencer Gulf out into the Southern Ocean. The mesh consists of ~25000 cells ranging in size from ~120m side length in the vicinity of the proposed facility to ~3000m at the open ocean boundary. Figure 1-1 and Figure 1-2 depicts the model mesh and bathymetry over the entire model domain and in the vicinity of the proposed facility. The water column is discretised into ~2 metre vertical layers from the surface down to ~30 metres from where the discretisation becomes progressively coarser.



Title:

Model Mesh

Figure: 1-1

Rev: A

N

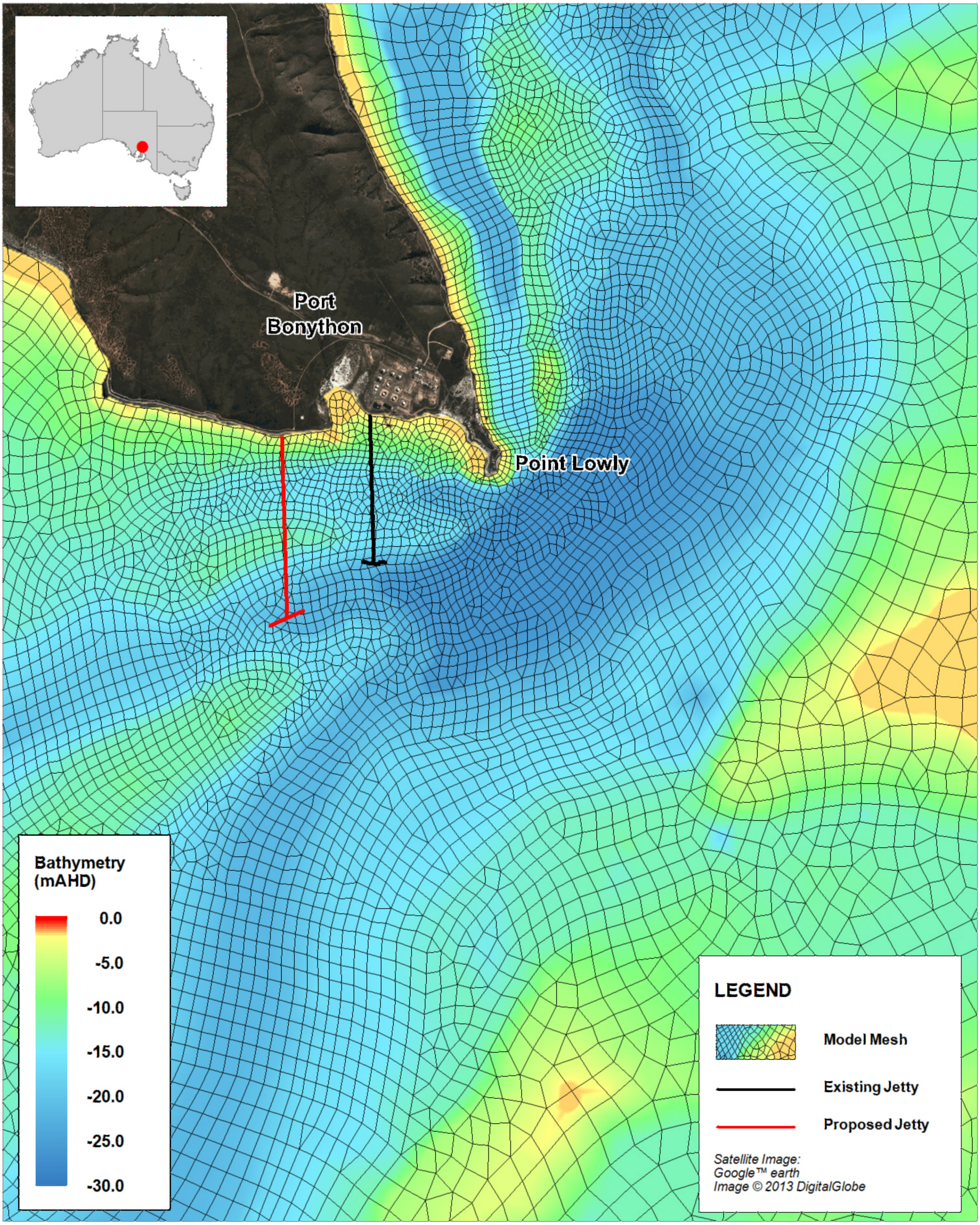
0 25 50km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B19279_I_JLB Port Bonython Bulk Export Facility DAB\DRG\COA_002_131122 Model Mesh Spencer Gulf.wor



Title:

Model Mesh Detail

Figure:

1-2

Rev:

A

N

0 1.5 3km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B19279_I_JLB Port Bonython Bulk Export Facility DAB\DRG\COA_001_131122 Model Mesh.wor

1.1.3 Bathymetry

The bathymetry data used in the modelling was sourced from a digital elevation model (DEM) produced from a combination of navigational charts and targeted echo soundings performed in the region of Point Lowly. All bathymetry data was reduced from the various local datum's to AHD. Beyond Spencer Gulf bathymetry data was sourced from the Geosciences Australia's 250m DEM.

1.1.4 Boundary Conditions

Boundary forcing of the 3D TUFLOW-FV hydrodynamic model was sourced entirely online from freely accessible global models. Tidal water levels and salinity and temperature profiles were applied at the open ocean boundary. It was found that applying ocean currents and the sea surface anomaly, also sourced from global models, provided no net benefit when calibrating the model as these boundary conditions were attenuated in the lower part of Spencer Gulf. Temporally and spatially variable fields of atmospheric forcing were applied to the surface of the TUFLOW-FV model. It was found that applying a mean sea level pressure (MSLP) field over the model's surface did not provide a net benefit when calibrating the model as the influence is small compared to water flow head differences. Refer to Table 1-1 for a list of the boundary conditions used for the TUFLOW-FV model and where further information regarding these global models can be found.

Table 1-1 Boundary Conditions for TUFLOW-FV Model

Variable	Where Applied	Source
Tide Predictions	Open Ocean Boundary	http://science.nasa.gov/missions/topex-poseidon/
Temperature Profiles	Open Ocean Boundary	http://hycom.org/
Salinity Profiles	Open Ocean Boundary	http://hycom.org/
Wind	Water Surface	http://rda.ucar.edu/datasets/ds093.0/
Air Temperature	Water Surface	http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis2.html
SW Radiation	Water Surface	http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis2.html
LW Radiation	Water Surface	http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis2.html
Precipitation	Water Surface	http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis2.html
Relative Humidity	Water Surface	http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis2.html

1.1.5 Model Warmup

Seasonal variation in the atmospheric conditions over Spencer Gulf results in both temporal and spatial temperature and salinity gradients over Spencer Gulf.

To achieve the temperature and salinity gradients existing in Spencer Gulf the model needed to be "warmed up". As the variation in the temperature and salinity within the gulf follows an annual cycle the "warmup" was run for 2 years. The year 2009 was simulated twice allowing for the gradients to develop. Such long simulations take a significant amount of computational effort and to minimise this, the 2 consecutive 1-year long simulations were performed using a model identical to that described in Section 1.1.2 but without the fine elements surrounding the proposed facility. Depth averaged results were interpolated onto the finer mesh during a big spring tide when the water column is assumed to be mostly well mixed in the upper Gulf. The fine model was then run for 1.5 months to allow the vertical profiles to develop before the design simulations were performed.

1.2 Hydrodynamic Model Calibration / Validation

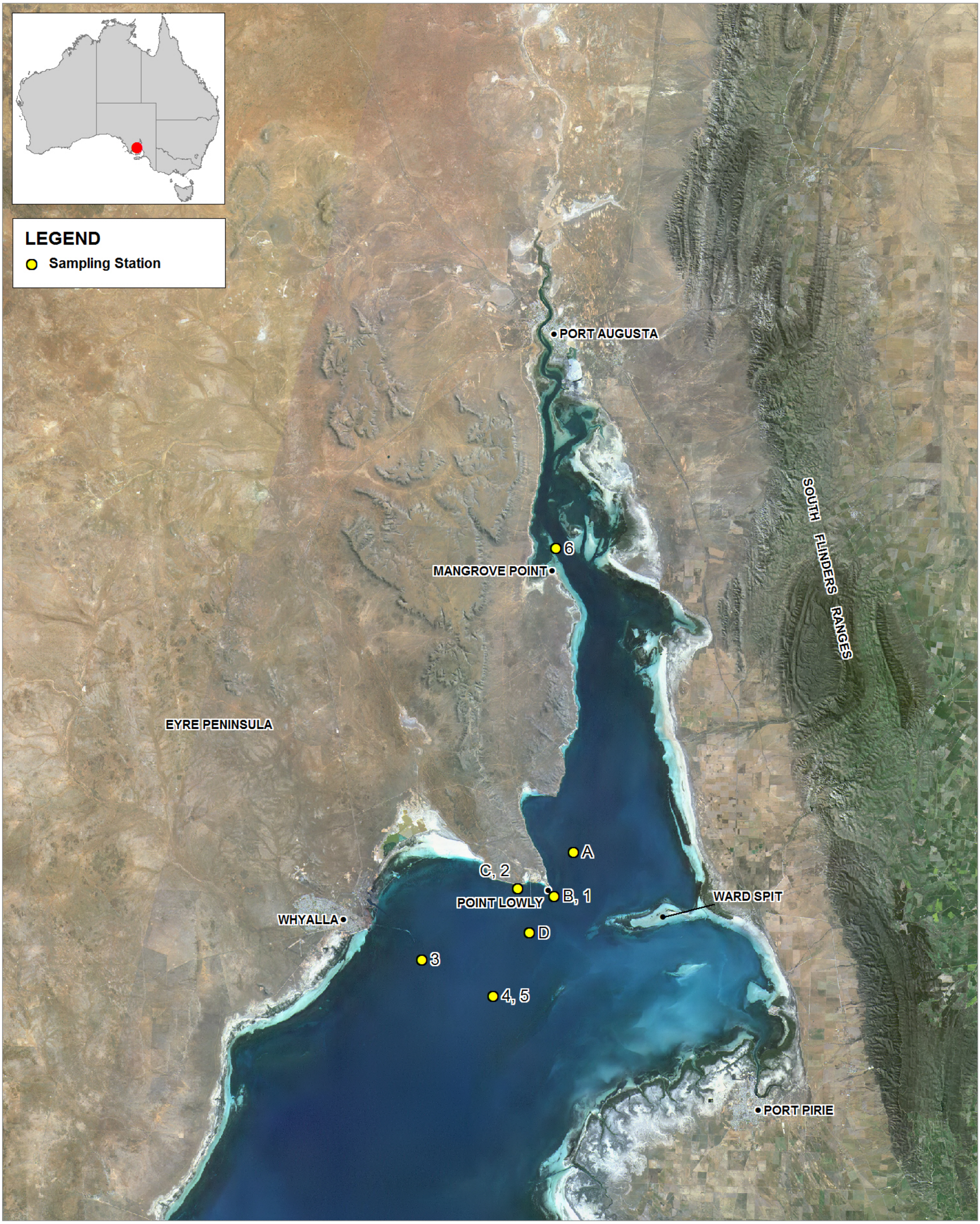
1.2.1 Overview

There is an abundance of high quality data in the vicinity of the study area as a result of previous studies and this data has been made available. The approximate 40 day data set spanning late April through to early June 2009 has been used in this study to calibrate the model. Variations in the current field in response to the cycling seasons or passing weather systems are only minor when compared to the variations seen between the Spring and Neap tides. As this study focusses on suspended sediments which advect within the prevailing currents a set of design simulations which cover the broad range of tides does not also need to specifically address the effects of seasonal variations or passing weather systems. The data set, spanning 3 spring-neap tide cycles, is sufficiently long to show that the model is well validated.

Refer to Figure 1-3 for the locations of the data recording instruments and Table 1-2 for the respective deployment depths. The numeric site names depict where conductivity, temperature and depth (CTD) instruments were deployed and the alphabetic site names depict where acoustic doppler current profilers (ADCP) were deployed. In some cases both a CTD and an ADCP instrument were deployed at the same location. Instruments deployed in the same location are highlighted with matching colours.

Table 1-2 Depths of Sampling Stations (40-Day Deployment 2009)

Site	Instrument	Depth (m)
A	ADCP	~17
B	ADCP	~26
C	ADCP	~10
D	ADCP	~24
1	CTD	~26
2	CTD	~10
3	CTD	~12
4	CTD	~9
5	CTD	~21
6	CTD	~7



Title:

Location of Sampling Stations (40-Day Deployment 2009)

Figure: **1-3**

Rev: **A**

N

0 10 20km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B17415_I_brh_AdditionalODXModelling\DRG\WQU_006_090928_NthnSpencerGulf Sampling Stations.wor

1.2.2 Water Levels

Water levels were recorded by 4 of the CTD instruments and used to calibrate / validate the TUFLOW-FV model. Figure 1-4 provides an example of the plots used where a complete set can found in Appendix B. Around the 24th of May a low pressure system migrated from the Southern Ocean up through Spencer Gulf. The anomaly seen in the data during this period is not as well replicated by the model. A composite wind field which uses both Global model data and recorded wind speeds from around the upper Spencer Gulf might successfully address this shortfall. Extending the TUFLOW-FV open ocean boundaries further out into the Southern Ocean to where HYCOM can more reliably predict the sea surface anomaly may also help. The inclusion of a MSLP boundary condition which reliably resolves such migrating weather systems could also benefit the calibration. However, since the purpose of this model is to assess the trajectory of resuspended sediment in Spring and Neap tidal flows it is not considered necessary to fully represent the water level signals from meteorological events. The model is sufficiently well calibrated to reliably simulate the water levels within the Port Bonython region of Upper Spencer Gulf.

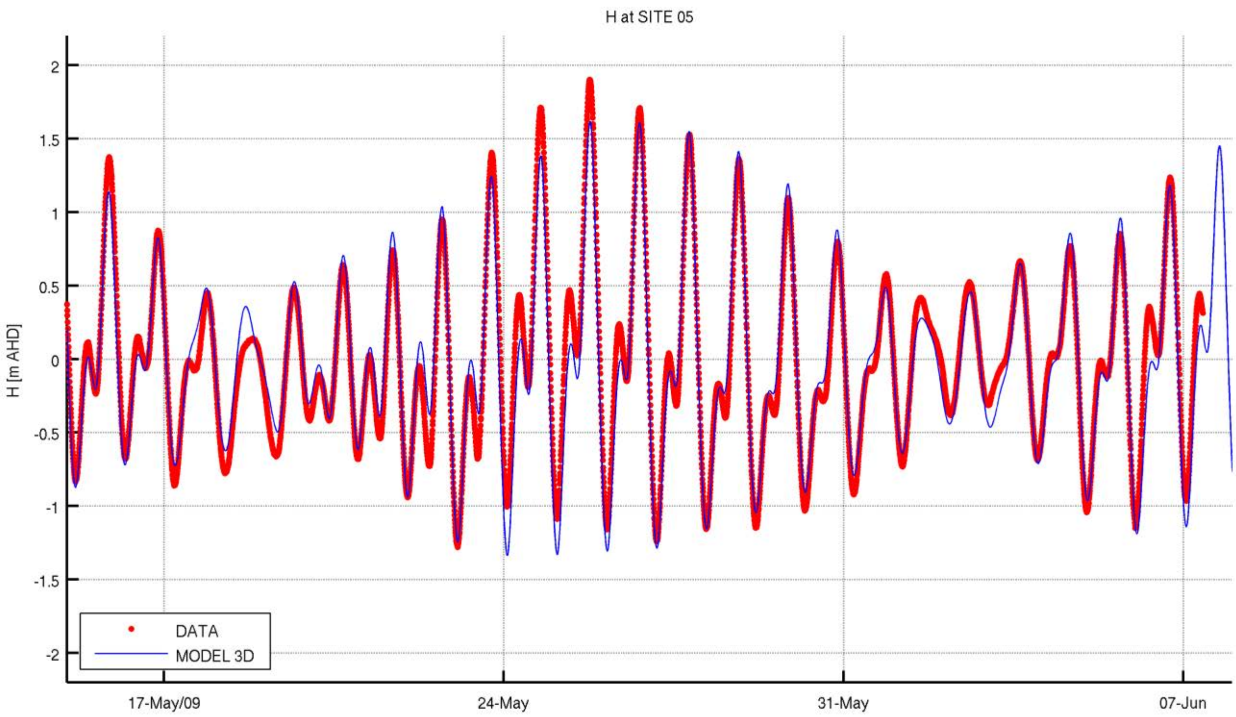


Figure 1-4 Example Water Level Calibration

1.2.3 Currents

1.2.3.1 Timeseries

Current speeds and directions throughout the water column were recorded by all 4 of the ADCP instruments and used to calibrate / validate the TUFLOW-FV model. Figure 1-5 provides an example of the plots used where a complete set can be found in Appendix C. Both the data and model results have been depth averaged for the comparisons. Around Point Lowly the model tends to over predict the current speeds on the flooding tide and slightly under predict the current speeds on the ebbing tide. Overall this model is well calibrated and can reliably simulate currents within the vicinity of the proposed facility.

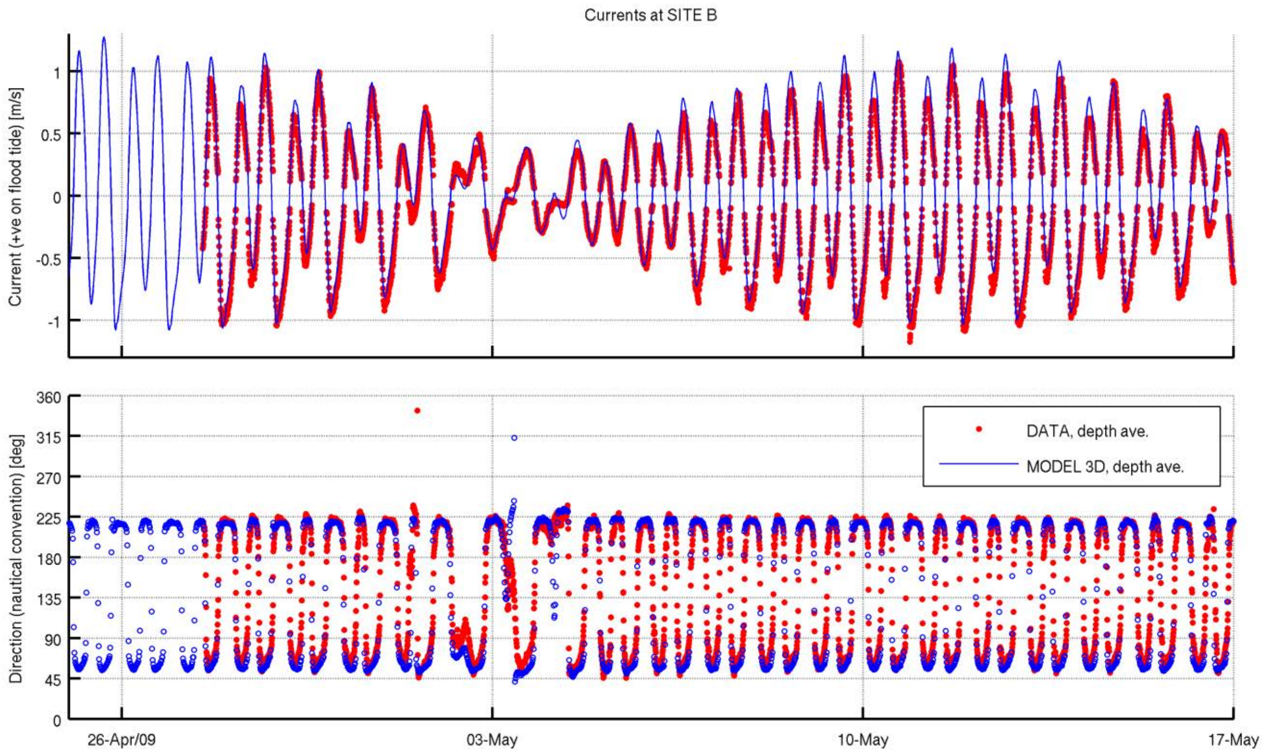


Figure 1-5 Example Current Timeseries Calibration

1.2.3.2 Transects

A downwards facing boat mounted ADCP was used to record the current speed and directions throughout the water column across 6 transects spanning between Point Lowly and Ward Spit. This data was used in further calibrating / validating the TUFLOW-FV model. Figure 1-6 provides an example of the plots used where a complete set can be found in Appendix D. The transects were performed in a back and forth nature however they have been presented as if they all started at Point Lowly and finished at Ward Spit. This was performed for ease of viewing. Unfortunately the ADCP used was not capable of sounding all the way to the bed and due to large waves prevailing during the data collection campaign frequent gaps appear in the data.

It should be noted that the approximately 6km long transect took approximately 1 hour to complete and that the changes in the current field can be considerable during this time. This is most noticeable in the 1st transect (Appendix D) which was performed around high water. Although the currents between Point Lowly and Ward Spit are not always aligned the current field presented in the 1st transect appears more “complex” than reality because of the temporally changing current field. The model results were extracted at 15 minute intervals to align with the data.

The transects reveal that the ebbing current speeds between Point Lowly and Ward Spit are slightly under predicted by the model. This is consistent with the findings in Section 1.2.3.1. The discrepancy is exacerbated in the transect calibration because the ADCP’s inability to measure the slower currents at greater depths biases the depth averaged velocities upwards. Overall this model is well calibrated and will reliably simulate the current speeds and directions throughout the water column between Point Lowly and Ward Spit.

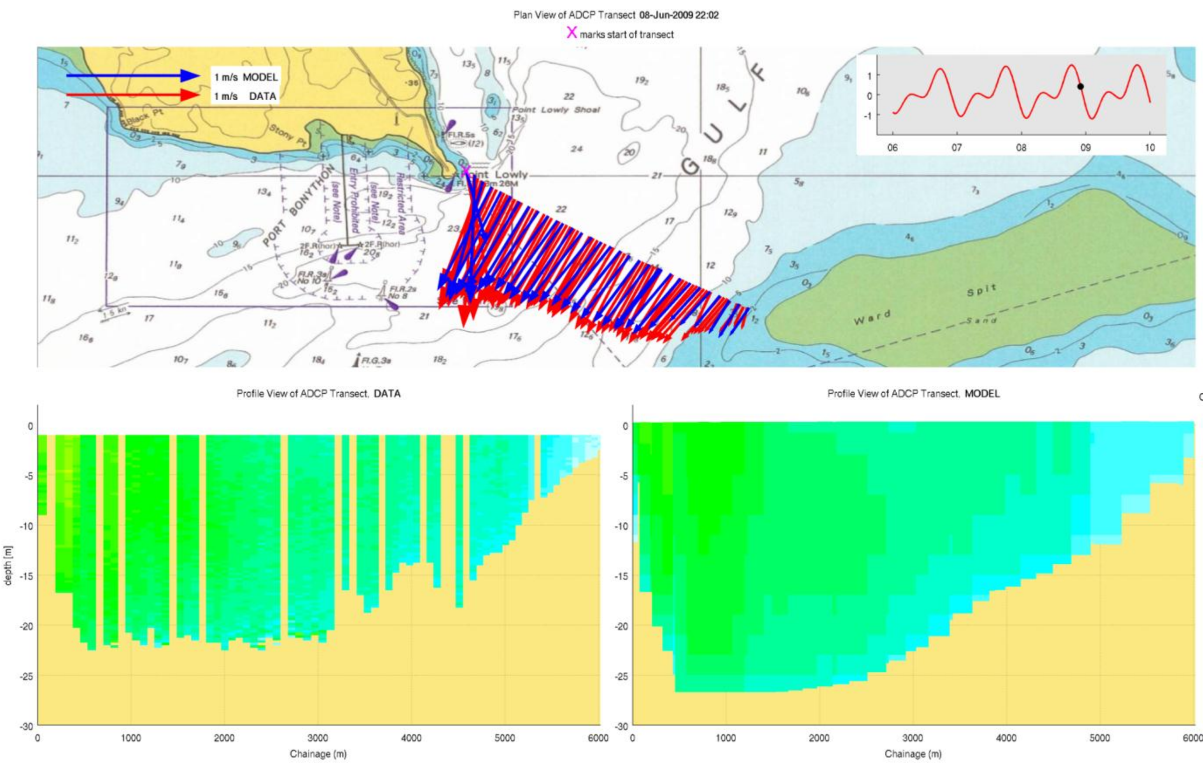


Figure 1-6 Example Current Transect Calibration

1.2.4 Temperature

Water temperatures were recorded by 6 of the CTD instruments and used to calibrate / validate the TUFLOW-FV model. Figure 1-7 provides an example of the plots used where a complete set can found in Appendix E.

The water temperature within the upper Gulf between mid-March and mid-June is decreasing as the days get cooler and shorter and nights cooler and longer. Due to the shallower depths the water in the upper Gulf responds more quickly to the cooling climate than the greater Gulf. The oscillations in the water temperature signal align with the semidiurnal tide where the peaks occur during high water after warmer water from the greater Gulf has moved Northwards on the flooding tide. The model tends to over predict the measured water temperatures at a number of locations although by no more than 1 degree. Overall this model is well calibrated and will reliably simulate the water temperature in the Upper Spencer Gulf.

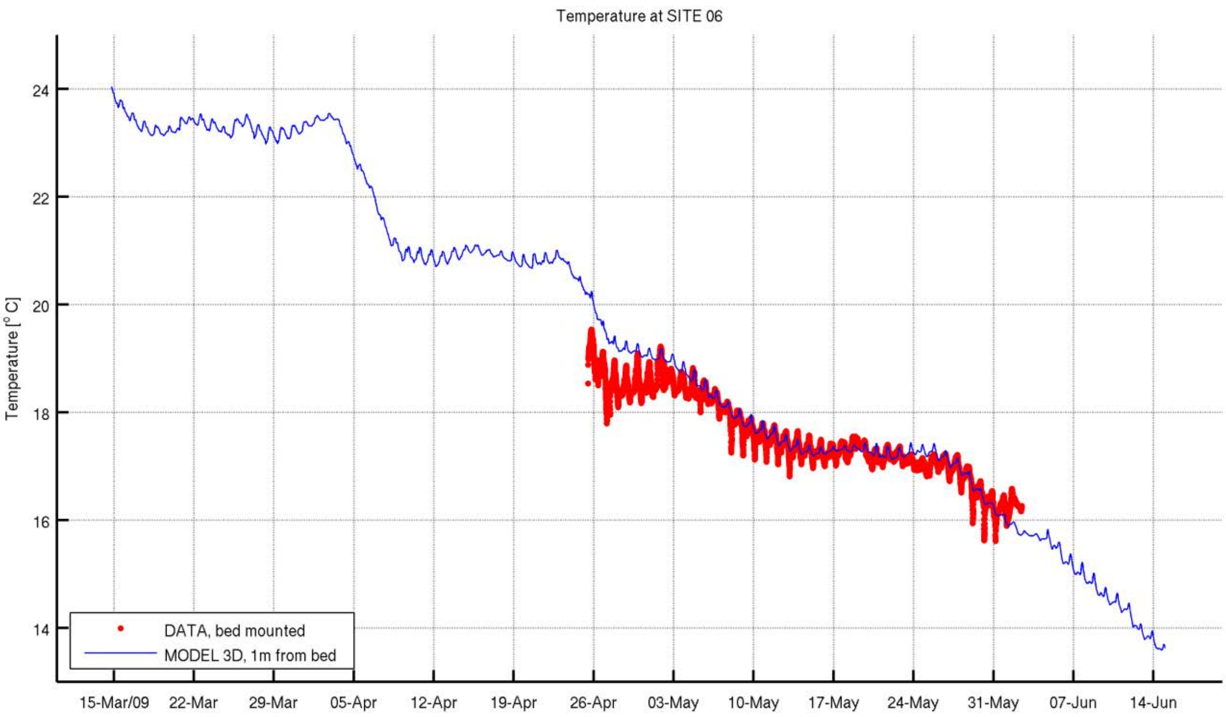


Figure 1-7 Example Water Temperature Calibration

1.2.5 Salinity

Water salinities were recorded by 4 of the CTD instruments and used to calibrate / validate the TUFLOW-FV model. Figure 1-8 provides an example of the plots used where a complete set can found in Appendix F.

Figure 1-8 can be used to help demonstrate one of the interesting coastal phenomena within Spencer Gulf – the accumulation and ensuing ejection of hyper-saline water. During the summer months high evaporation rates in the upper Gulf drive the salinity upwards and a horizontal salinity gradient is established from the ocean towards the head of the Gulf. Around May during the neap tides when the vertical mixing is minimal, due to the low current speeds, the more saline and hence heavier water in the upper Gulf begins to “slip under” the fresher surface water and head towards the ocean. Figure 1-8 which depicts periods of elevated salinities with minimal variation throughout the tidal cycle, corresponding to the neap tides, demonstrates that the model is capable of simulating this process in the upper Gulf.

The daily average salinity near the bed is lower during the spring tides than during the neaps. Such a signal implies that the higher current speeds and thus greater turbulence during the spring tides act to mix the relatively fresher water at the surface with the water underneath thus reducing the salinity near the bed. In shallower waters salinity levels oscillate with a frequency corresponding to the semidiurnal tidal cycle, a consequence of local horizontal salinity gradients. During the Spring tides, again due to the enhanced vertical mixing, these oscillations are also experienced in deeper water. The model is competent at simulating the salinity processes in the upper Spencer Gulf.

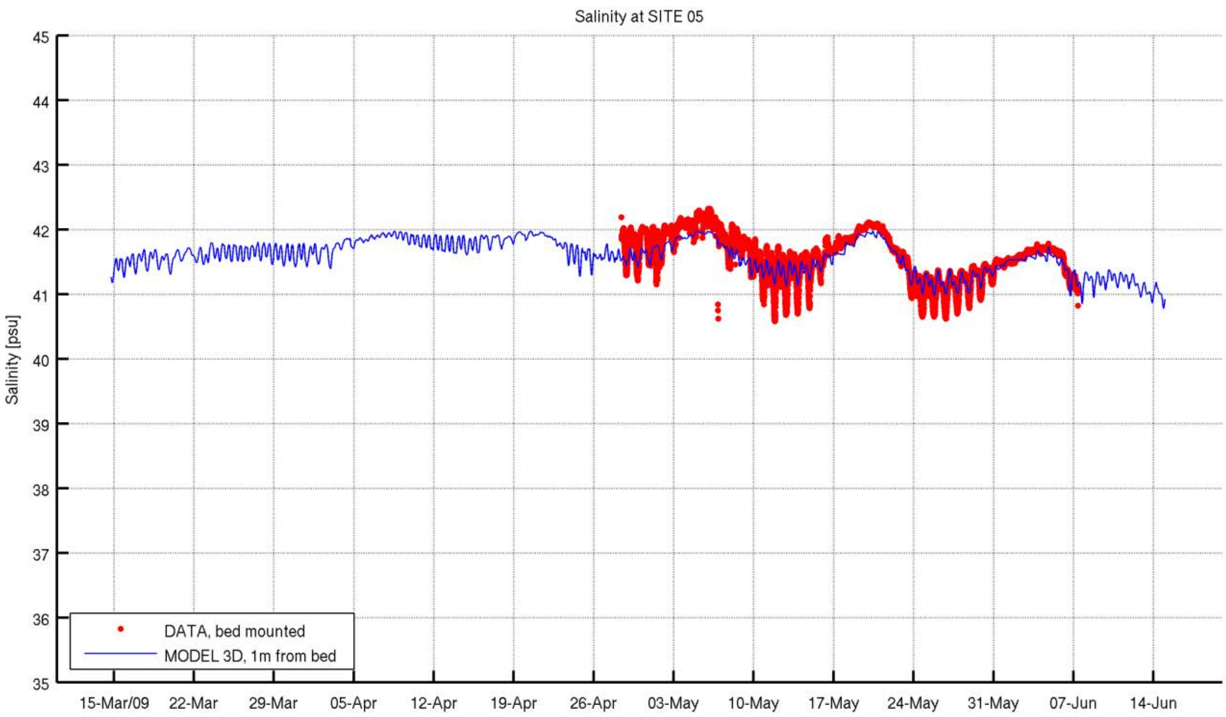


Figure 1-8 Example Salinity Calibration

1.3 Sediment Plume Model Configuration

1.3.1 Overview

The sediment module within TUFLOW-FV was used to simulate the fate of the sediments suspended from the bed by the wash generated from the propellers of "Cape Size" vessels serviced by the proposed facility. Simulated sediments were released at derived rates (Kg/s) and subsequently advected and dispersed within the 3D hydrodynamic field.

The impact of propeller wash from tugs was not considered in this assessment because:

- Currently it is anticipated that the tug berth will be at least 1.7km from the shore, in a water depth of around 10-12m where sediment sampling and testing have shown the sediments (D_{50} = 6mm) to be coarser than those further inshore (D_{50}=0.25mm).
- It is expected that the tugs will operate on low power until connected to the ships i.e.in the shipping channel.

1.3.2 Sediment Inputs

The expected loads (kg/s) of fine sediments suspended from the bed by the action of fully loaded "Cape Size" vessels at the proposed facility at Port Bonython were provided by BMT JFA. The methodology undertaken and assumptions made are outlined in Appendix A. The study provided sediment inputs for the first 3 kilometres of the vessels departure – from the berth to just beyond the southward turn (Figure 1-9). The varying rate at which the simulated fine sediments were loaded into the water reflected the variations in UKC, the ships power output and the composition of the seabed. Table 1-3 provides a summary of the sediment loads.

Table 1-3 Adopted Sediment Inputs

	Fine Sediments
Sediment Load (Kg/s)	1.6 – 3.4
Chainage from Berth on Departure (Km)	0 - 3
Duration of Sediment Load (minutes)	26

The jet of water resulting from propeller thrust (refer Section 1.3.3) resuspends both coarse (sands and gravels) and fine (silts and clays) sediments from the bed. Only the fine sediments are of interest in this study as they have the potential to remain in suspension and advect within the prevailing currents beyond the shipping routes into areas of environmental significance, which are located along the shoreline. Previous assessments have indicated that the coarse sands and gravels settle out within a fraction of an hour. The generally low percentage of fine sediments within the suspended sediment plumes is reflective of the in-situ bed which is dominated by sands, gravels and shells probably due to the high tidal currents.

The sediment loads were derived following best practice modelling techniques and are based on the proposed ship movements and vessel size outlined in the draft EIS. No distinction between silts and clays has been made and instead a single "Fine Sediments" class has been adopted in the modelling. The simulated “Fine Sediments” have the settling characteristics more alike to clays than silts to give conservative results. Refer to Table 1-4 for the characteristics of the simulated sediments.

A still water settling velocity of 0.1mm/s is used (refer Table 1-4). However, it should be noted that during high tidal flows the material will remain suspended and not settle (bed material is resuspended in these conditions). Therefore, a settling time for these sediments is not meaningful. In the modelling undertaken the particles are tracked until concentrations fall to a nominated level. At this time some sediment may have settled and some will still be in suspension.

Table 1-4 Characteristics of Simulated Sediments

	Fine Sediments
Percentage by Mass of Suspended Sediments (%)	4.5 – 12.5
Still Water Fall Velocity, W_{so} (m/s)	1.0 E-04
Critical Shear Stress Erosion, T_{ce} (N/m^2)	0.2
Critical Shear Stress Deposition, T_{cd} (N/m^2)	0.1
Sediment Particle Density, ρ_s (Kg/m^3)	2650

1.3.3 Thrust Inputs

A vessel uses its propeller, to provide thrust to the vessel to allow manoeuvring or to maintain a constant speed against the drag forces acting on the hull. The propeller thrust inputs both momentum and turbulence into the water at the depth of the propeller. These forces, applied to the water by the propellers, act to accelerate the water away from the vessel. The energy within the jet of water with added momentum diffuses by turbulent processes into the surrounding current field.

To account for these processes in the simulations a force, derived following the PIANC guidelines (PIANC 1997), dependent on the vessel’s power output was applied to the water column in a direction antiparallel to the vessel’s heading. The force was applied at a depth equivalent to the depth of the vessel’s propeller. To be conservative the force (1800 KN) was derived assuming the vessel was operating at 75% of full power which is usually equivalent to the power output when steaming at the vessel’s service speed or ‘full ahead’.

1.3.4 Scenarios

A set of 3 simulations were performed to assess the plumes of fine sediments suspended from the bed by the actions of ships' propellers. Each of the simulations represented a fully laden "Cape Size" vessel, the largest class of vessel to be serviced at the proposed facility, departing via the route depicted in Figure 1-9. Spencer Gulf Port Link will require all "Cape Size" vessels to depart from the Port of Whyalla and Port Bonython 2 hours before high tide to ensure safe passage past the Yarraville Shoals. The simulated departures as seen in Figure 1-10 abide by this restriction. The simulations were designed to assess the plumes of fine sediments under a range of conditions. The only difference between the three simulations was the time at which the simulated vessel departed the proposed facility. For operational reasons Spencer Gulf Port Link may not allow "Cape Size" vessels to depart on the smaller high tides as experienced during the second simulated departure but this scenario was included for completeness.

The plumes of fine sediments generated as vessels approach (tug assisted) the proposed facility were not directly simulated in this study. Although the under keel clearance (UKC) would be equivalent to departing vessels as the approach route passes over the Northern extents of Fairway Bank (Figure 1-9) the unloaded vessel would require significantly less power to manoeuvre by virtue of its significantly lower mass. The bed sediments on the approach route do however consist of a higher percentage of fines as those within the 1st 3km of the departure route. For reasons such as this a detailed assessment of the hydrodynamics in the vicinity of the proposed facility has also been undertaken in this study to complement the 3 sediment plume simulations.

The sediment loads used in the 3 simulations were those derived by BMT JFA as outlined in 1.3.2. The suspended sediment was assumed to be initially evenly distributed throughout the water column. The 3 simulations were each 2 days in length, allowing sufficient time for the plumes of fine sediments to disperse and settle.

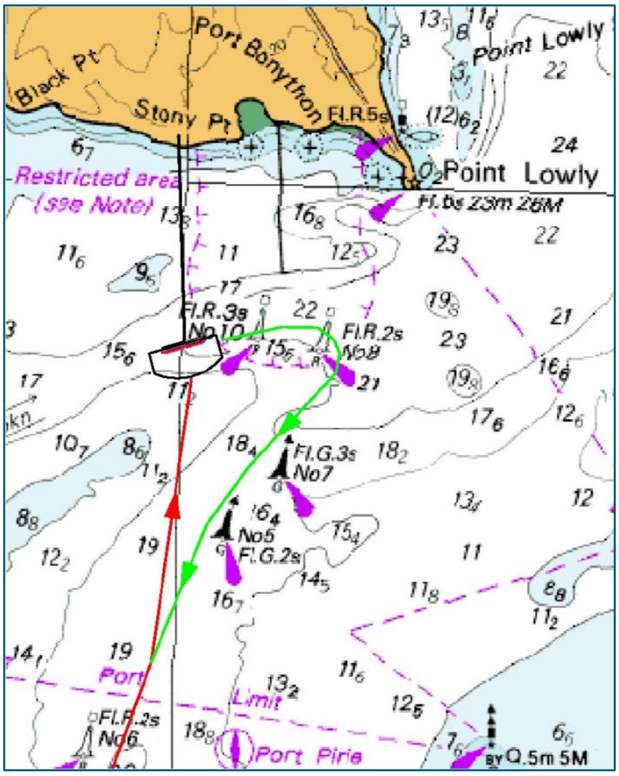


Figure 1-9 Vessel Approach (red) and Departure (green) for Proposed Facility

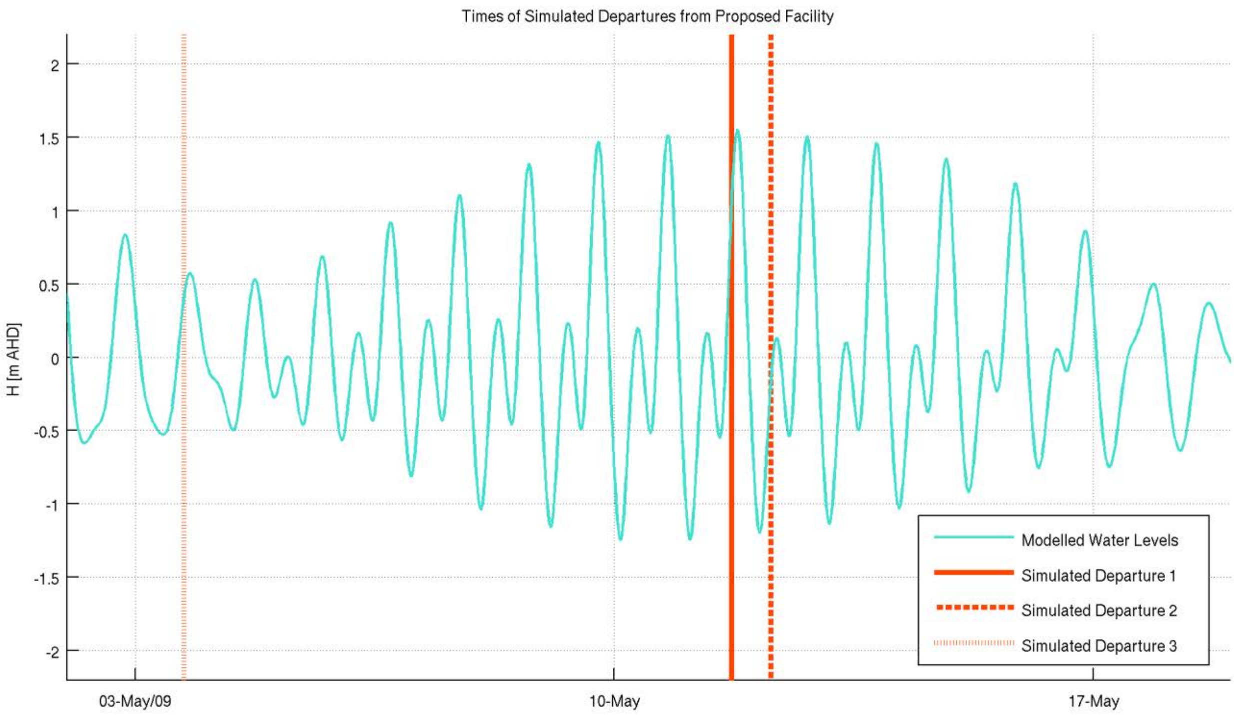


Figure 1-10 Times of Simulated Ship Departures

2 Results

2.1 Prevailing Currents

Figure 2-1 through to Figure 2-4 provide an insight into the tidal current field (depth averaged) in the vicinity of the proposed facility. The shape of the tide in the Upper Spencer Gulf varies considerably however the expected current fields, as relevant to this study, are captured in the following 4 figures. The tidal currents during smaller tides flow in the same direction however with less pronounced flow reversals and circulations. The current velocities, as expected, are lower in smaller tides and can be considerably lower during the “dodge tides”.

Figure 2-1 depicts the current field during a large flooding tide. Depth averaged currents up to 0.8m/s can be expected at the berths of the proposed facility, flowing from the Western side of Fairway Bank in an East-north-easterly direction past Point Lowly and continuing into the Upper Gulf.

Figure 2-2 depicts the current field during the high water of a large spring tide. Current speeds at the proposed facility approach 0m/s during this time. The figure depicts how the currents experienced between Point Lowly Shoal and the mainland reverse sooner than those between Point Lowly Shoal and Ward Spit and an anticlockwise circulation develops.

Figure 2-3 depicts the current field during a large ebbing tide. Depth averaged currents of approximately 1m/s can be expected at the berths of the proposed facility. The ebbing flows head South from the Upper Gulf, Swinging West around Point Lowly, passing the proposed facility and flowing past the Western side of Fairway Bank.

Figure 2-4 depicts the current field during low water of a large spring tide. Current speeds at the proposed facility are under 0.4 m/s. A clockwise circulation develops where water flows around from the berths at the proposed facility up along the coast of Port Bonython. The circulation is less pronounced on smaller tides.

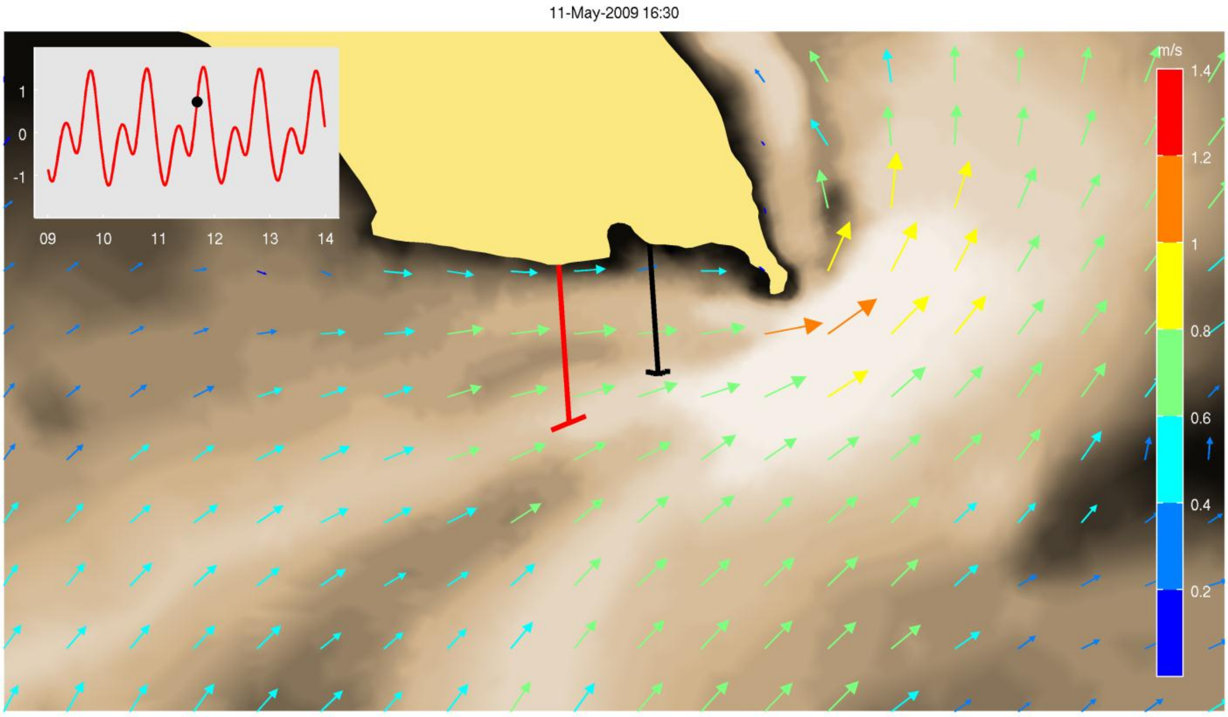


Figure 2-1 Current Field, Flood Tide

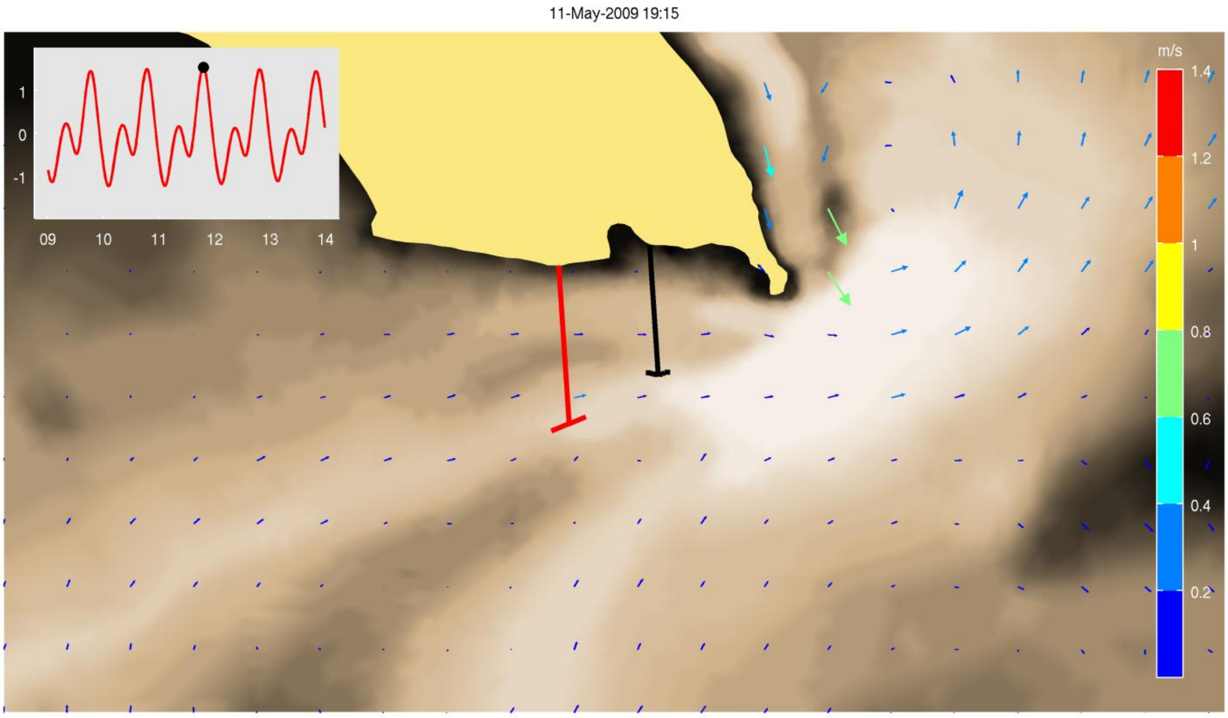


Figure 2-2 Current Field, High Water

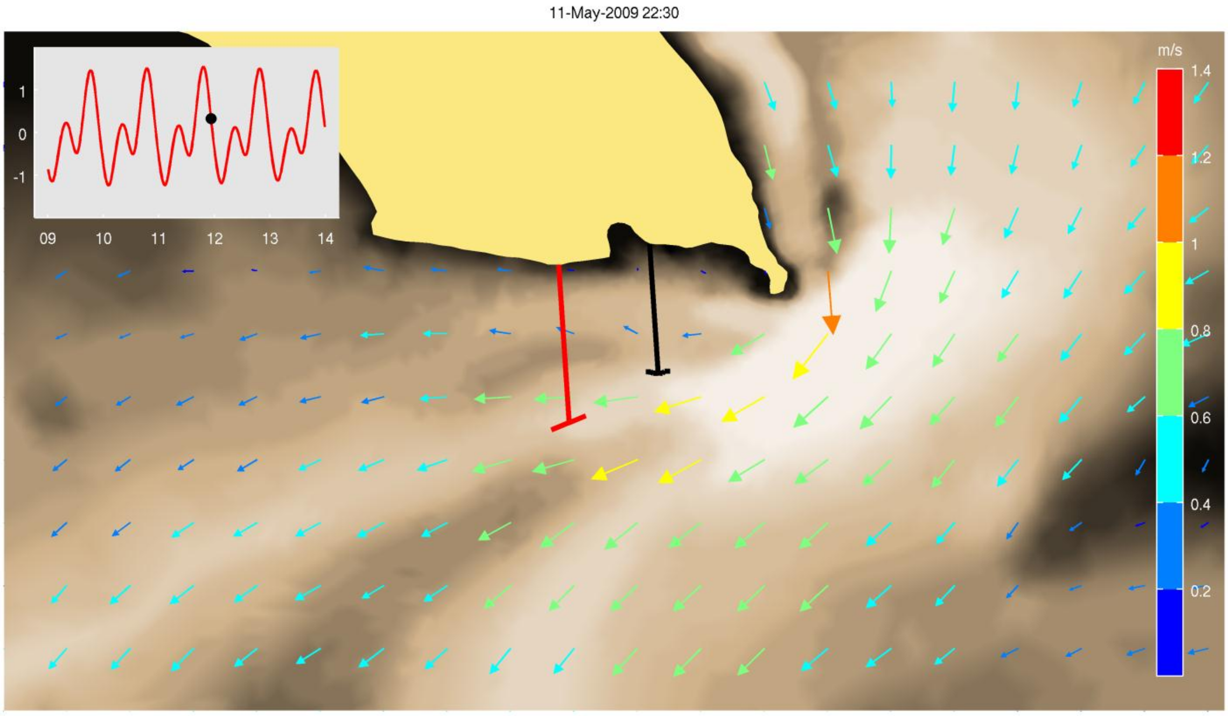


Figure 2-3 Current Field, Ebb Tide

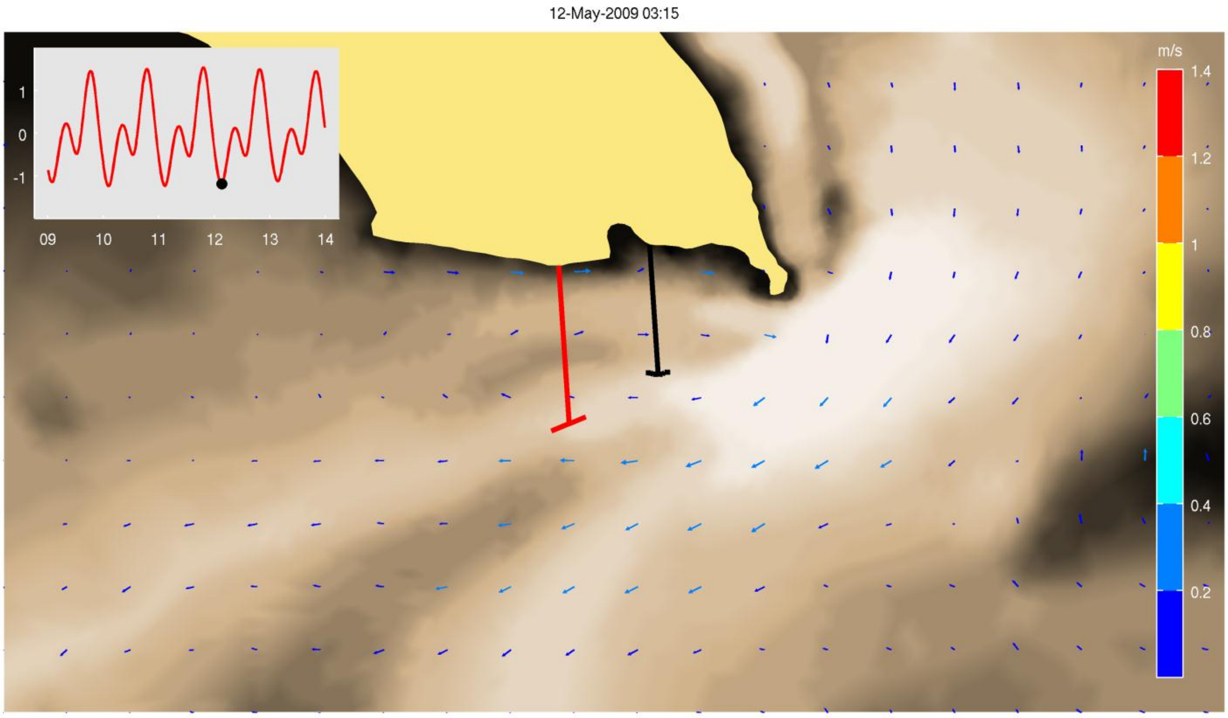


Figure 2-4 Current Field, Low Water

2.2 Sediment Plume Scenarios

Figure 2-5 through to Figure 2-7 depict the maximum simulated concentrations experienced in the vicinity of the proposed facility at Port Bonython for the respective simulated scenarios. They do not depict the sediment plumes at a specific point in time but at the maximum concentration reached during the 2 day simulation period. It should be noted that sediment loads were only applied over the first 3 Km of the vessels departure, extending from the berth to just past where the vessel turns South.

Slightly higher plume concentrations can be expected directly behind the departing vessels than those presented in this report for 2 reasons:

- Coarse sediments are not included in the modelling for reasons discussed in Section 1.3.2.
- Where the actual plume of fine sediments visible directly behind the departing vessel is smaller than the approximate 120m (side length) cells used in the modelling the concentration will be higher as the cell area is larger than the actual plume extents. Therefore, the simulated plume will initially be of a slightly lower concentration.

Figure 2-5 depicts the simulated maximum plume concentrations for departure scenario 1. The plume of fine sediments advects with the flooding tide to the East-Northeast, following the turn of the tide the plume of sediments is well below background levels and relevant water quality objectives (refer Section 3.2). Scenarios 2 and 3 are shown in Figure 2-6 and Figure 2-7 respectively. Due to smaller tides and hence lower prevailing currents the plumes did not advect as far before dispersing and settling. Refer to Figure 1-10 for the timing of the respective departures within the tidal cycle.

A simulation was performed to assess the impacts of the thrust generated by the vessel's propellers. The simulation was performed with no other forcing i.e. the current field was zero (slack water), and the impacts could be clearly assessed. The currents behind the vessel were elevated to almost 0.4 m/s and had reduced to below 0.05 m/s within 500m from the shipping route, refer to Figure 2-8. The currents depicted in the figure are not depth averaged but are the currents at depths equivalent to the location of the vessel's propeller. Propeller thrust induced currents directly behind the departing vessel can be expected to be slightly higher than those presented because, as for the sediment plumes, initially the accelerated water forms a stream of smaller dimension than the approximately 120m (side length) cells.

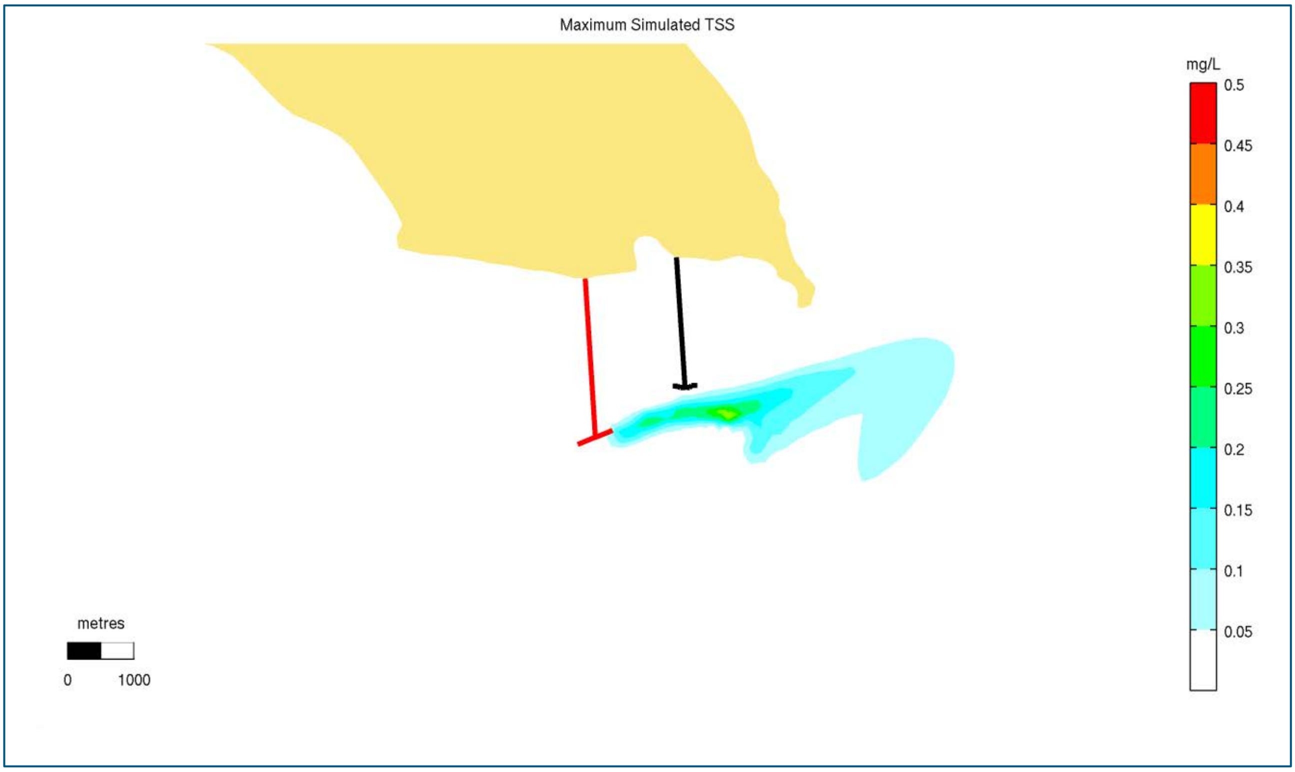


Figure 2-5 Max Simulated Sediment Concentrations, Scenario 1

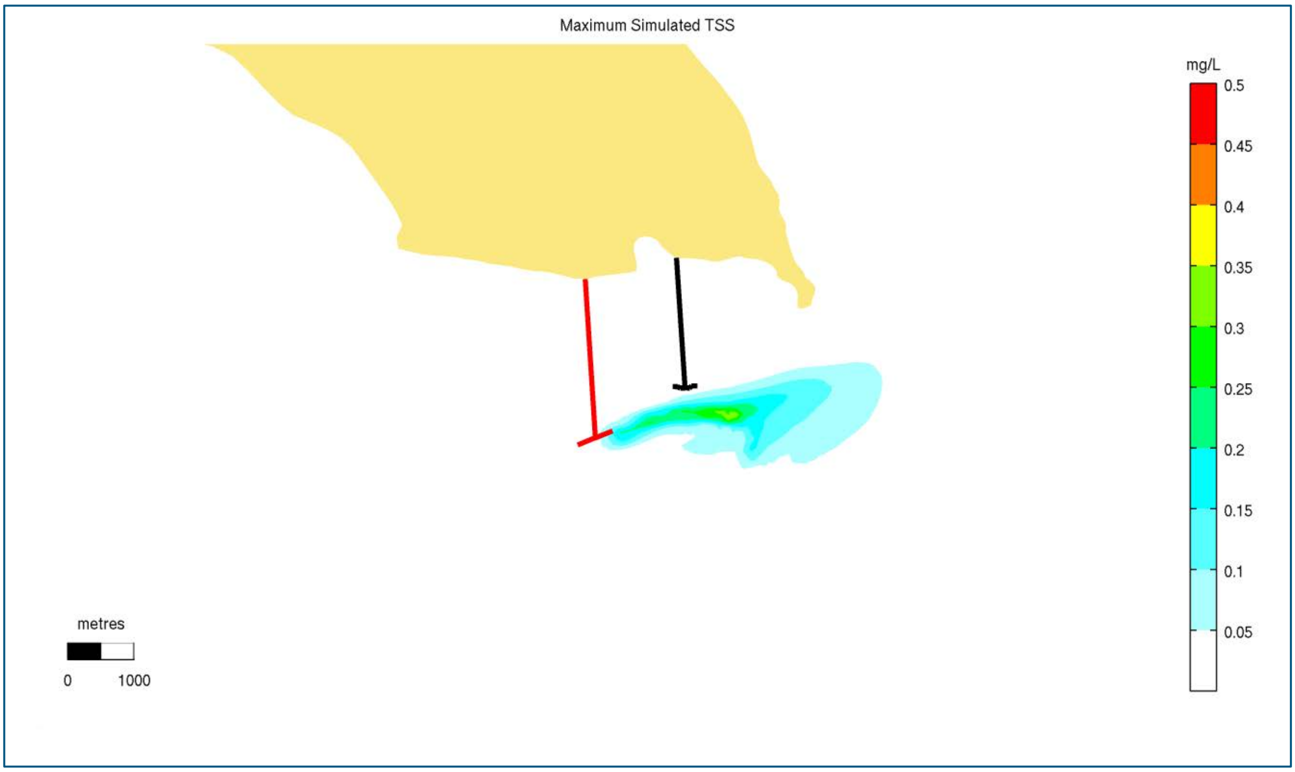


Figure 2-6 Max Simulated Sediment Concentrations, Scenario 2

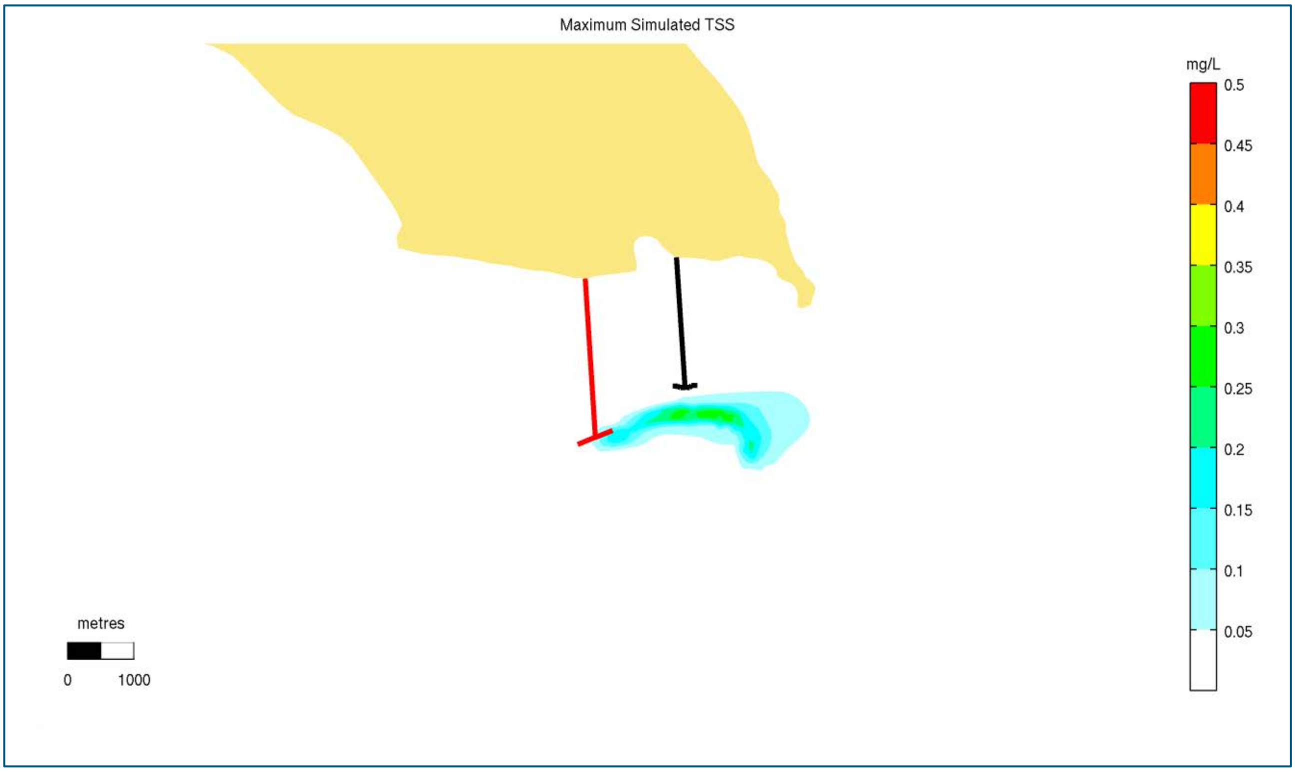


Figure 2-7 Max Simulated Sediment Concentrations, Scenario 3

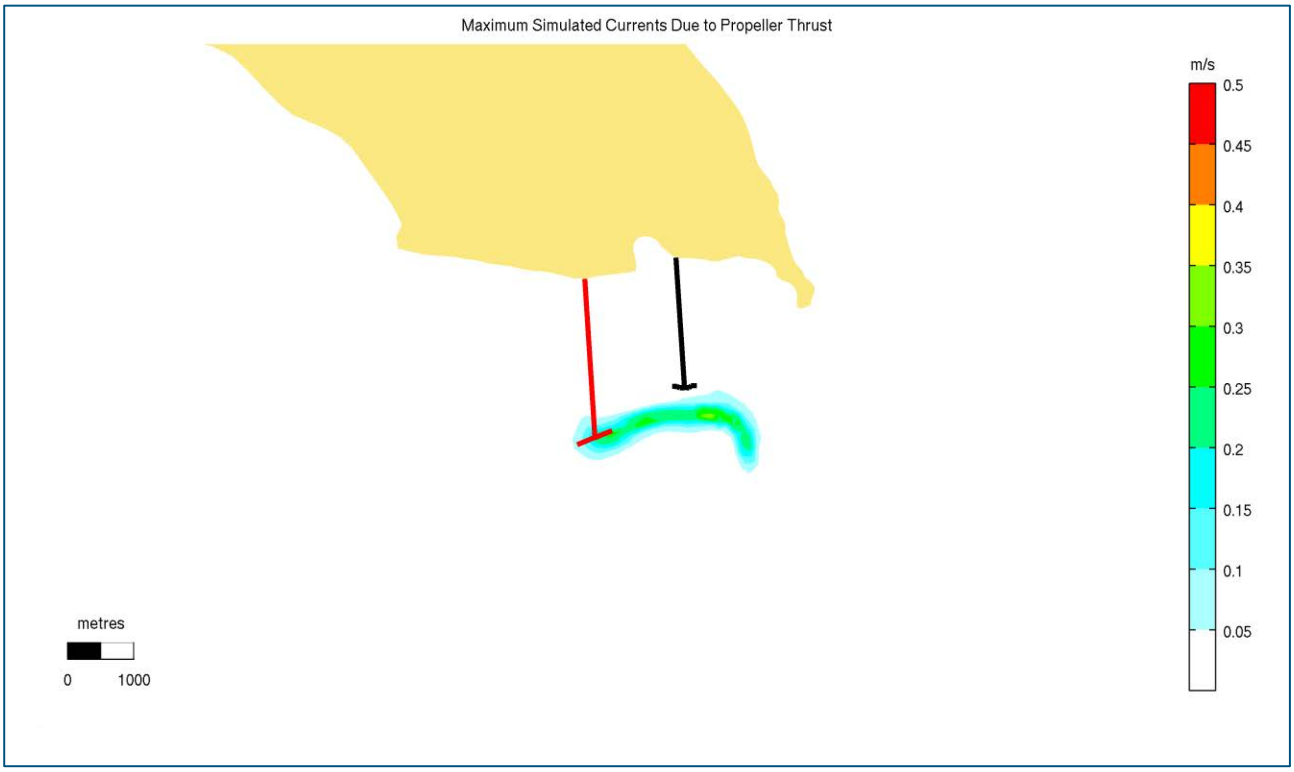


Figure 2-8 Max Simulated Currents Due to Propeller Thrust

3 Discussion

3.1 Prevailing Currents

The ebb and flood currents experienced at the berth of the proposed facility are mostly antiparallel (aligned but of opposite directions) with a very limited tendency to transport suspended particles towards the shoreline of Port Bonython. Around low water a clockwise circulation can develop in the lee of Point Lowly which is capable of transporting suspended particles north towards the shoreline. This circulation is more pronounced in the big spring tides. “Cape Size” vessels will be required by Flinders Ports to depart the proposed facility 2 hours before high tide (during peak flooding currents) to allow ample UKC when navigating past the Yarraville Shoals. The flooding currents during such big spring tides are capable of transporting any suspended particles sufficiently far that on the following ebb tide the particles flow south, to the East of Fairway Bank well away from the circulation.

3.2 Sediment Plume Scenarios

For the reasons discussed in Section 2.2 slightly higher concentrations of sediments can be expected directly behind the departing ship than those presented in this report. Concentrations of suspended sediments beyond the immediate shipping route however are unlikely to be detectible or visible. Background concentrations of suspended solids near Point Lowly range between 2-22mg/L with a median value of 4.6mg/L (BHBP, 2009). Turbidities range from 2.2-22.4 Nephelometric Turbidity Units (NTU) with a median value of 5.5. These concentrations indicate the range along the coastline from Black Point to Point Lowly. Although there are no statutory water quality objectives for this part of the Australian Coast, draft water quality objectives have been published as part of the Adelaide Coastal Water Quality Improvement Plan (EPA, 2013). This recommends an objective (for nearshore coastal waters) of turbidity <1NTU and suspended solids of <2mg/L for the 90th percentile. The modelling demonstrates that the concentrations of suspended sediments attributable to the project will be well below this threshold. The maximum level of suspended solids generated will not exceed 0.35mg/L, and will occur at least three kilometres from the shoreline, where sensitive rocky reef habitat that supports the Giant Australian Cuttlefish occurs.

Bed sediments in the vicinity of the proposed facility can be mobilised during spring tides as evident in the spring-neap signal in the turbidity records (BMT WBM 2013). The sediments mobilised by the propeller wash are the same surface sediments which are mobilised during the spring tides. During Spring tides the high currents will inhibit the settling of the sediments originally suspended by the propeller wash and the sediments may remain in suspension for consecutive tides. As evident in Figure 2-5 which simulates a departure during large spring tides the suspended sediments, although potentially still in suspension, have dispersed to negligible levels beyond the immediate shipping route. Once the sediments do settle they mix back in with the surface sediments from where they originated.

Vessels approaching the proposed facility will be within 400-500m of Fairway Bank (a shallow area), and hence, despite having significantly reduced draft in their unladen state will have an equivalent UKC to fully laden vessels departing the facility. As well they will be under low power due to being unladen. The bed sediments on the approach route consist of fine content similar to that at the wharf. Compared to the power required for the vessels and tugs to manoeuvre at the wharf, vessels will transit in much lower power in the approach channel and hence less sediment resuspension is expected. Furthermore these resuspended sediments will be further offshore than the vessel departure sediments and more likely to be captured by the shore parallel currents. It is again likely that concentrations of suspended sediments in the shipping approach route will be below detectable levels within 500m of the approach route. This means that there is negligible risk of sedimentation reducing light availability to seagrass meadows at Fairway Bank.

4 Conclusion

The TUFLOW-FV model developed for this study is capable of simulating both the water levels and currents in the vicinity of the proposed facility as well as the processes which drive temporal and spatial changes in the water temperature and salinity in the Upper Spencer Gulf. The model is also suitable for assessing the fate of sediments suspended from the bed by the action of ships propellers.

Plumes of sediments suspended from the bed in the lee of both unladen vessels approaching and laden vessels departing the proposed facility are unlikely to impact on the nearshore water quality for the following reasons:

- Limited fines (silts and clays) in the natural bed in the vicinity of berths and arrival and departure routes;
- Ebb and flood currents are mostly parallel to the shoreline, and would carry any sediments suspended away from sensitive nearshore ecological habitats;
- Vessels depart during the flooding tide (a Flinders Ports operational restriction) meaning that initially there are strong shore parallel currents and it is more than 5 hours before sediments could be transported towards the coast by the weak clockwise circulation which develops in the lee of Point Lowly during low water; and
- Vessels approaching the proposed facility will abide to all UKC restrictions and will transit under low power as they approach the berth. Therefore any suspended sediments generated will be below water quality thresholds and several kilometres from shore. The modelling demonstrates that these will not be transported towards the shoreline or sensitive ecological habitats.

5 References

BMT WBM, 2013. Port Bonython Bulk Commodities Export Facility Preliminary Hydrodynamics and Coastal Processes Baseline Assessment and Impacts. Report prepared for Arup. R.B19279.001.03.Preliminary_WQ_Coastal_Baseline and Impacts.pdf, July 2013.

Environmental Protection Authority, 2013. Adelaide Coastal Water Qaulity Improvement Plan. Report 2: draft water quality objectives. July, 2013.

PIANC, Guidelines for the design of armoured slopes under open piled quay walls. Report of Working Group 22 of the Permanent Technical Committee, 1997

Saha, S., et al. 2010. NCEP Climate Forecast System Reanalysis (CFSR) 6-hourly Products, January 1979 to December 2010. Research Data Archive at the National Center for Atmospheric Research, Computational and Information Systems Laboratory. http://rda.ucar.edu/datasets/ds093.0. Accessed§ 30 Oct 2013

NCEP_Reanalysis 2 data provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web site at http://www.esrl.noaa.gov/psd/

Appendix A BMT JFA - Sediment Loads Report

BMT JFA Consultants
"Where will our knowledge take you?"

Technical Note

From:	Prema Bhautoo	To:	Malcolm Andrews
Project Number:	236.07	Project Name:	**Port Bonython Propellor Wash Induced Turbidity Assessment**
Date:	31/10/2013	Doc Ref:	Tn-236.07-2
Subject:	Propellor-wash induced sediment re-suspension rates for Port Bonython		

1 Objective

The objective of this study is to determine likely rates of sediment re-suspension resulting from ship movements in the area of the proposed jetty offloading facility in Port Bonython, South Australia. The results from the study are intended to be applied in 3-dimensional hydrodynamic sediment plume modelling conducted by BMT WBM as part of the environmental impact assessment studies.

2 Methodology

A methodology was developed to estimate the likely rates of sediment re-suspension generated by propeller induced currents. The detailed methodology is presented in a flowchart in Appendix A and summarised below:

1. Determine Under Keel Clearance (UKC) using vessel and bathymetry data
2. Calculate propeller jet induced bed velocities
3. Estimate re-suspension rates based on sediment characteristics

The above calculation methodology was applied along the first 3km of the departure route.

3 Study Inputs

3.1 Design Vessels

Cape class vessels are the largest vessels expected to service the port. Vessel characteristics are provided in Table 1.

Table 1: Design vessel specifications

Cape Vessel	
DWT (t)	180,000
LOA (m)	290
Beam (m)	48.5
Laden draft (m)	18.0*

*As vessel draft information was not provided, laden draft was assumed based on a similar sized Cape vessel.

Due to the relatively shallow tug draft and comparatively large available UKC, turbidity induced by the tug's propeller is considered to be negligible.

3.2 Water Levels

Tidal planes for Spencer Gulf are shown in Table 2.

Table 2: Spencer Gulf tidal planes

Tidal Plane	LAT (m)
HAT	3.2
MHHW	2.7
MLHW	1.8
MSL	1.6
MHLW	1.4
MLLW	0.5
LAT	0

3.3 Bathymetry

In order to calculate the UKC and subsequent re-suspension rates, the bed elevation along the first 3km of the departure route was interpolated from the provided bathymetry dataset.

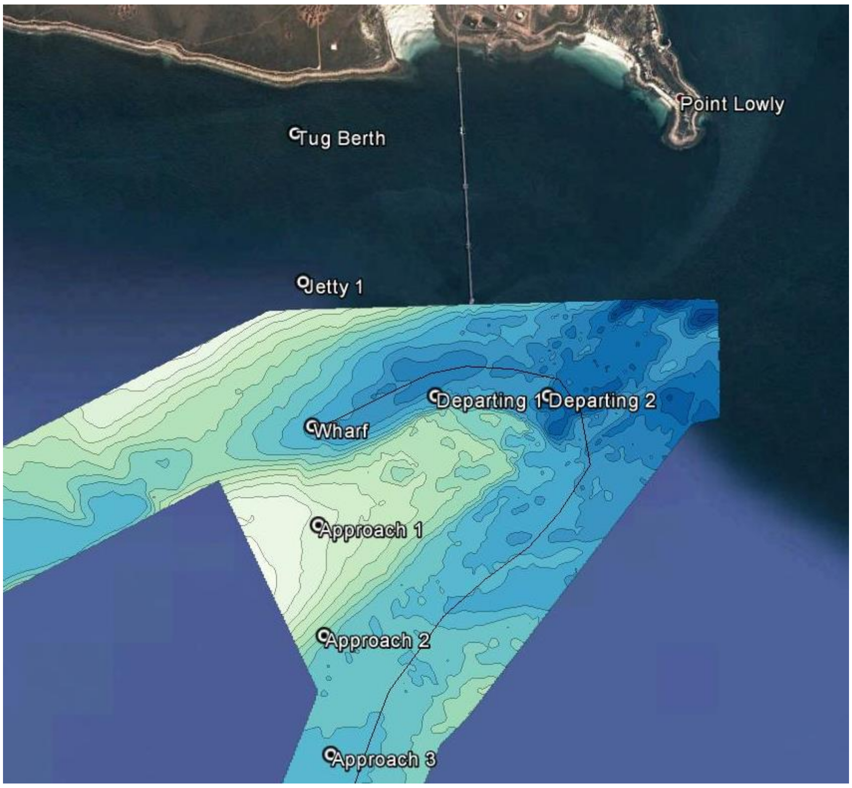


Figure 1 Sediment sampling sites and adopted departure route (black line)

3.4 Sediment characteristics

The sediment at the site has been characterised by sediment sampling and subsequent particle size analysis in March 2013 by BMT WBM. Summary results from this testing is provided in Table 3. The sediment is generally classified as a gravelly sand, or sandy gravel, and contains between 12.5% and 4.5% of fines less than 60μm in size.

Table 3: Summary PSD analysis results (March 2013)

Material type	Composition by mass (%)		
	Wharf	Departing 1	Departing 2
Clay (<0.002mm)	6	2	3
Silt (0.002 – 0.06mm)	6.5	2.5	3
Sand (0.06 – 2mm)	58.5	26.5	36
Gravel (2 – 60mm)	29	69	58

4 Calculations

The key calculations and assumptions applied to calculate the predicted rate of sediment re-suspension are outlined in the following sections.

4.1 Under Keel Clearance (UKC)

4.1.1 Squat Calculation

Squat calculations were determined in accordance with PIANC (1997) *Approach Channels - A Guide for Design.*

The Huuska/Guliev (ICORELS) equation was used to calculate squat along the departure route. The equation is valid for unrestricted waterways, channels and canals.

$$S_b = 2.4 \frac{\nabla}{L_{pp}^2} \frac{F_{nh}^2}{\sqrt{1 - F_{nh}^2}} K_s$$

4.1.2 Minimum Depth/draft Ratio

A minimum depth to draft ration of 1.10 was adopted for this study, in accordance with PIANC 1997.

4.2 Propellor Wash induced bed velocities

Maximum propeller wash induced velocities along the sea bed were calculated in accordance with CIRIA (2007) guidelines.

$$u_{p,\max bed} = c u_{p,o} \left(\frac{D_o}{z_p}\right)^n$$

4.3 Erosion Rates

Erosion rates were determined using the following equation (Whitehouse et. al. 2000):

$$\frac{dm}{dt} = m_e(\tau_o - \tau_e)$$

5 Results

The results of the calculations are documented in the excel spreadsheet.

6 References

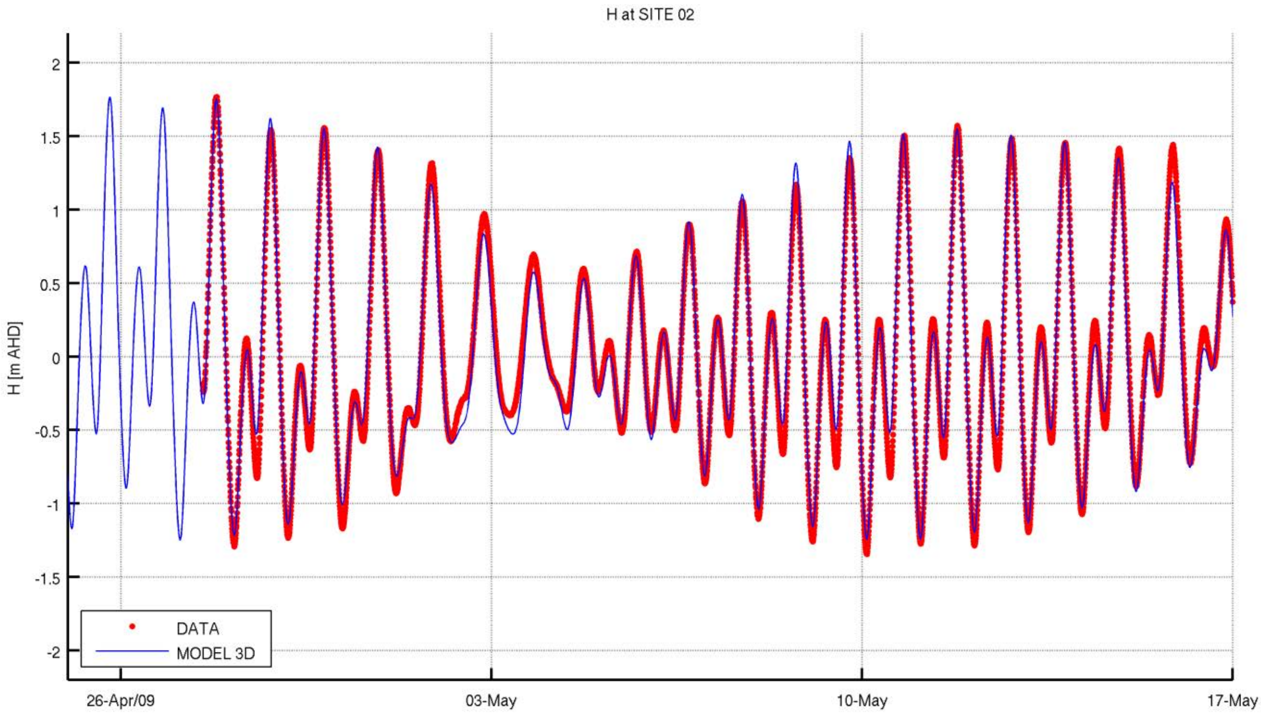
CIRIA (2007). *The use of Rock in Hydraulic Engineering (2nd Edition).*

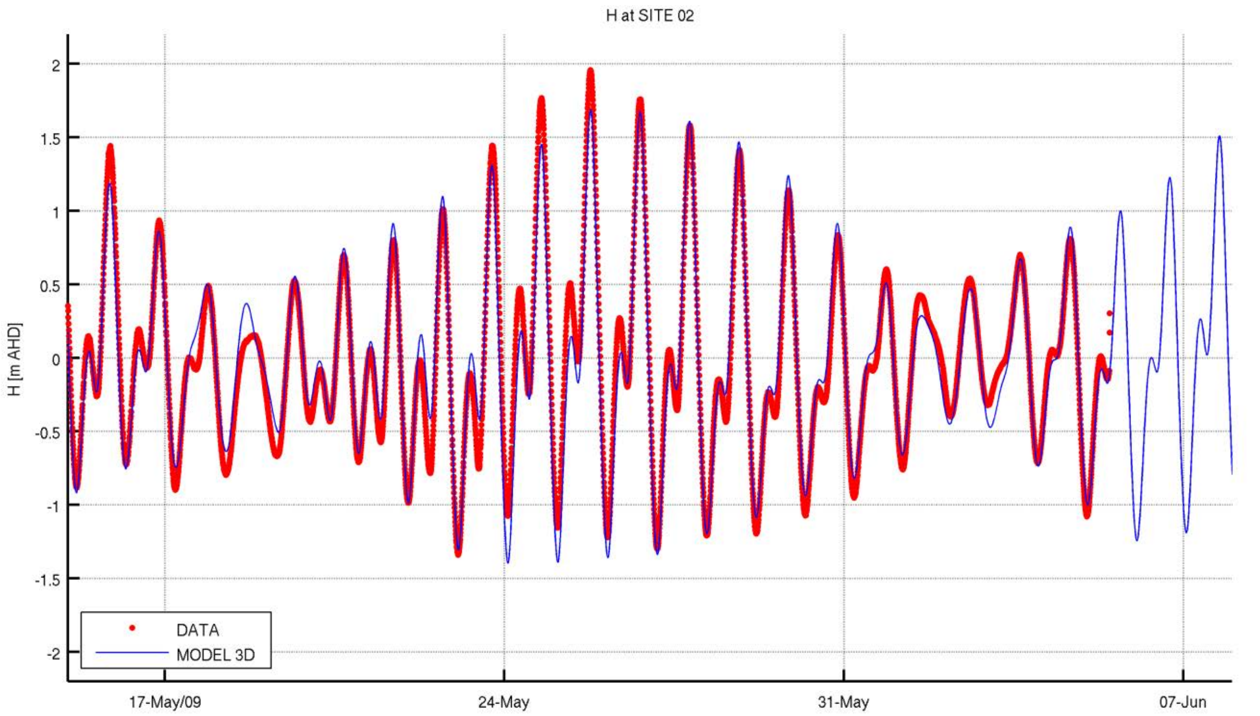
Masselink, G., Hughes, M. And Knight, J. (2011) *Introduction to Coastal Processes and Geomorphology (2nd Edition).* Hodder and Stoughton: London.

PIANC, (1997). *Guidelines for the Design of Armoured Slopes under Open Piled Quay Walls*, Bulletin, 96, Brussels Belgium.

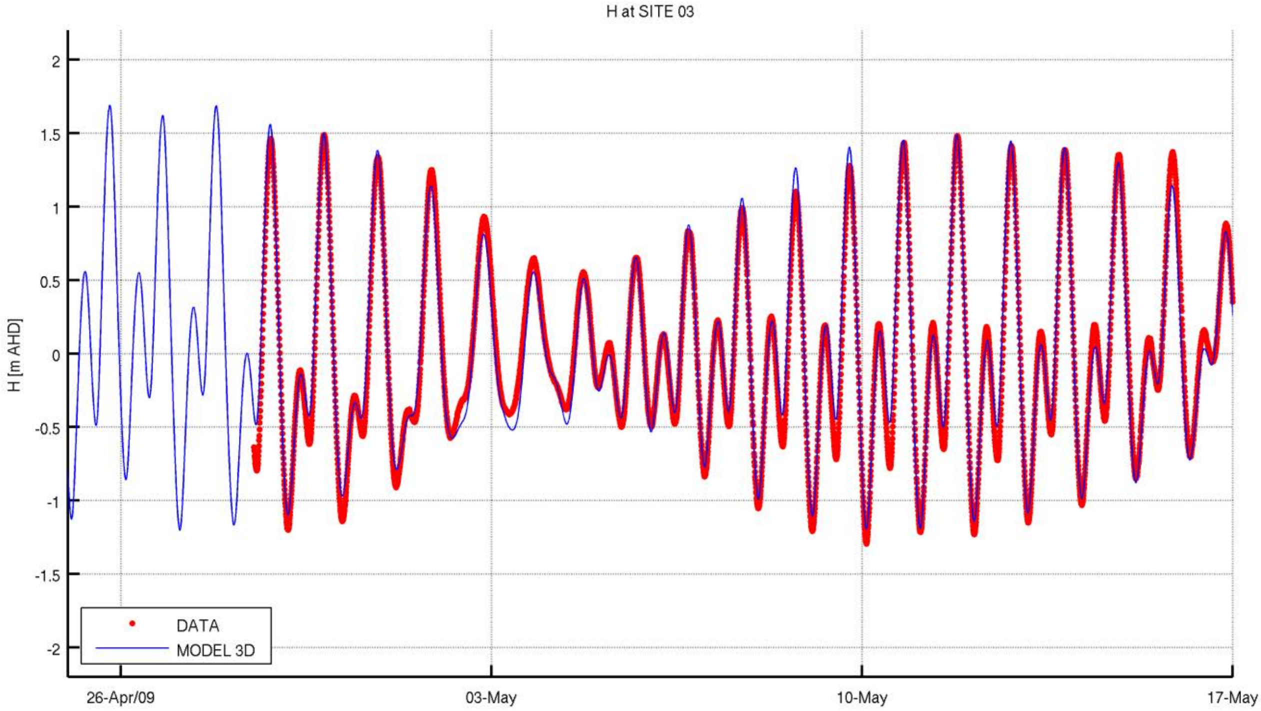
Whitehouse, R.J.S., Soulsby, R., Roberts, W. and Mitchener, H.J. (2000). *Dynamics of Estuarine Muds*. Thomas Telford Publications, London.

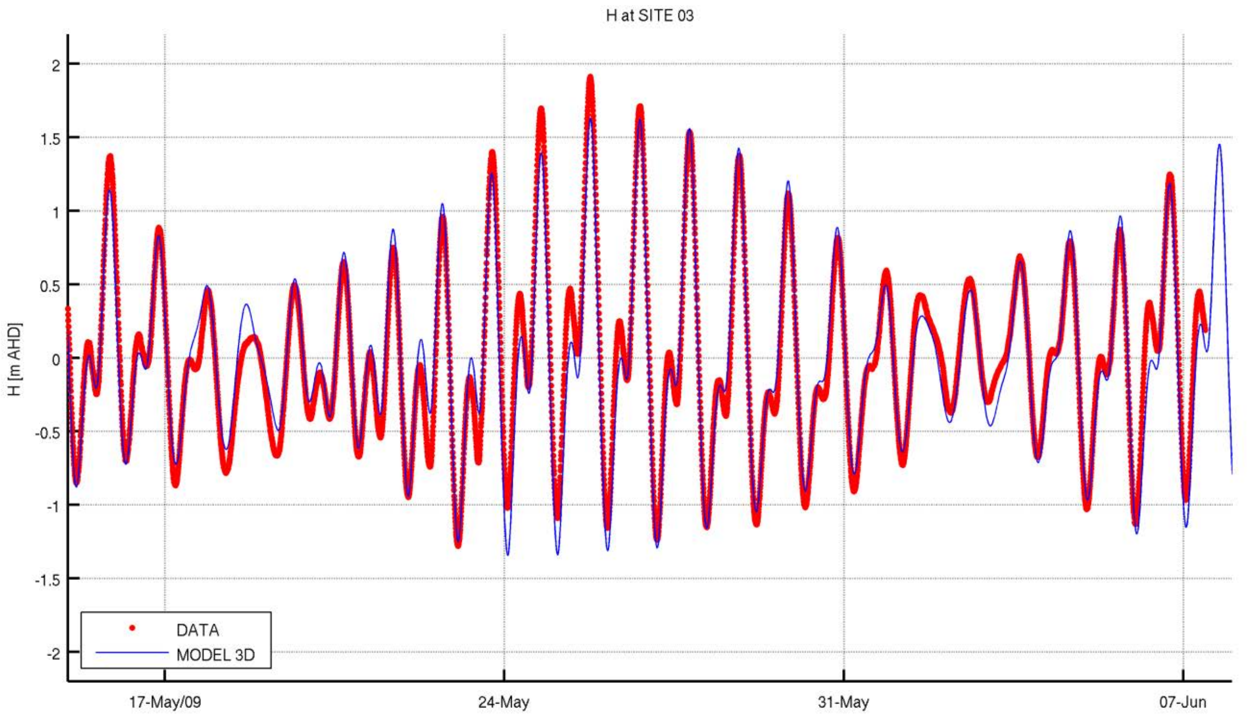
Appendix B Water Level Calibration



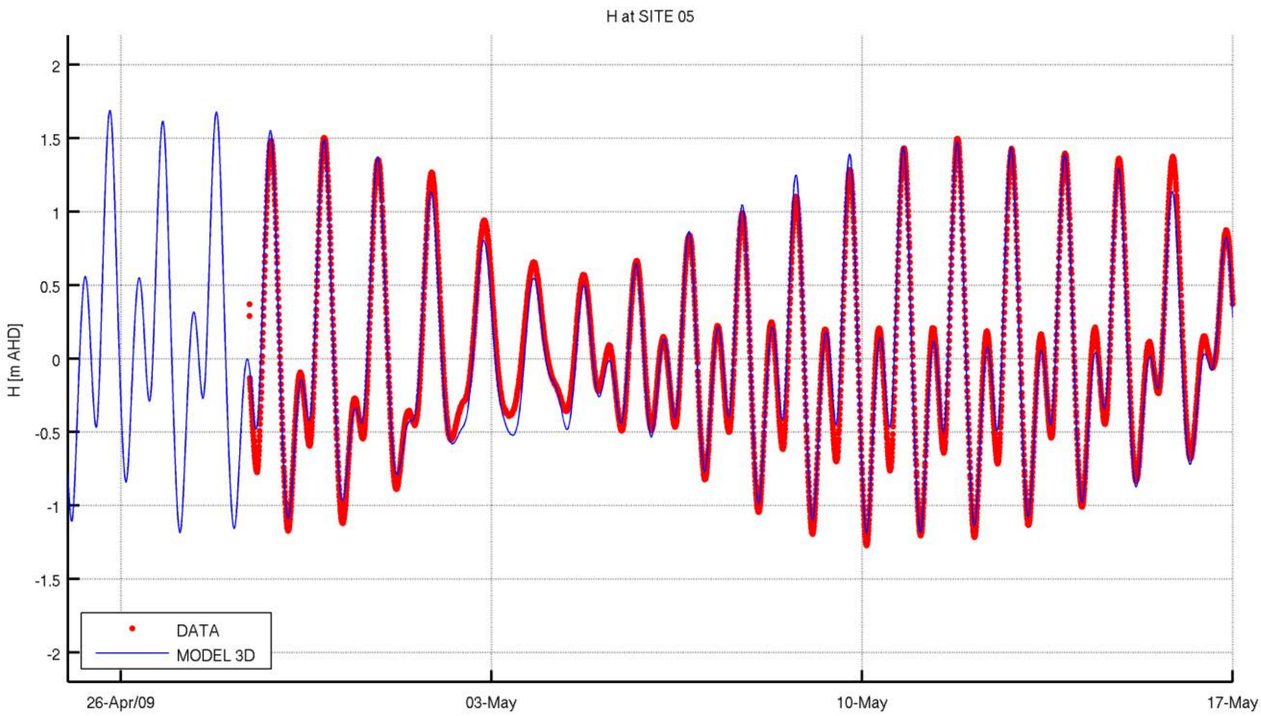


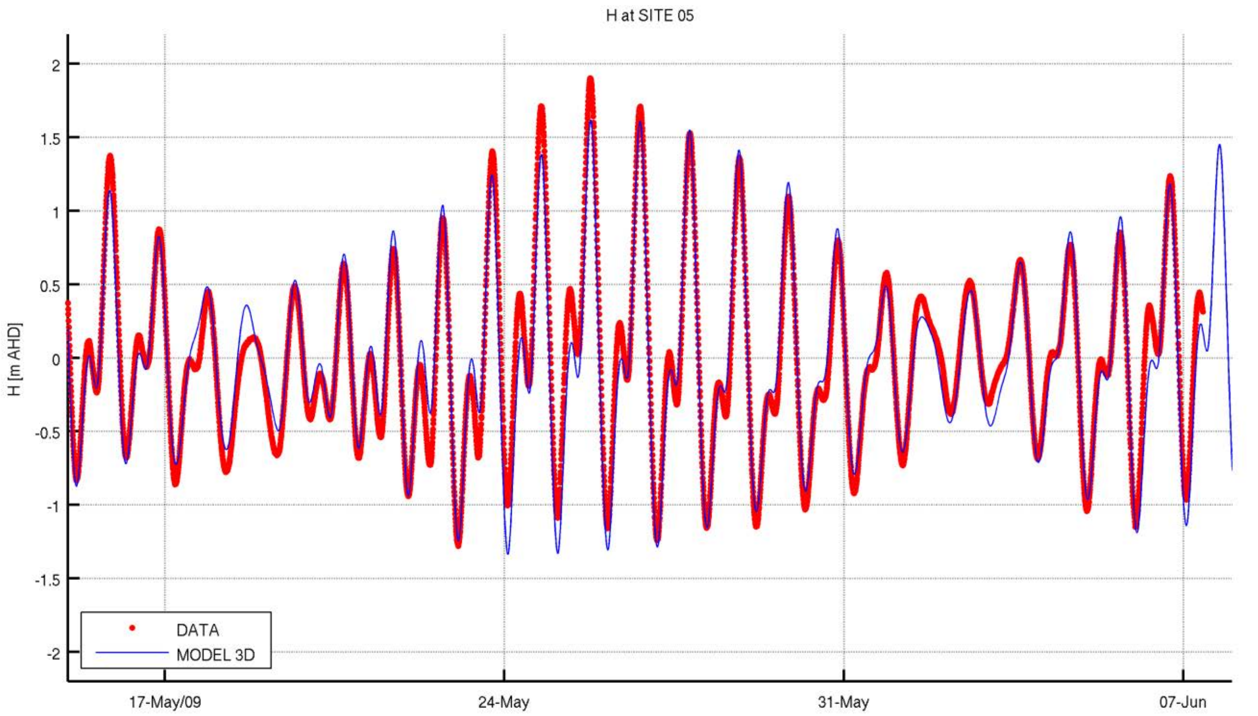
BMT WBM

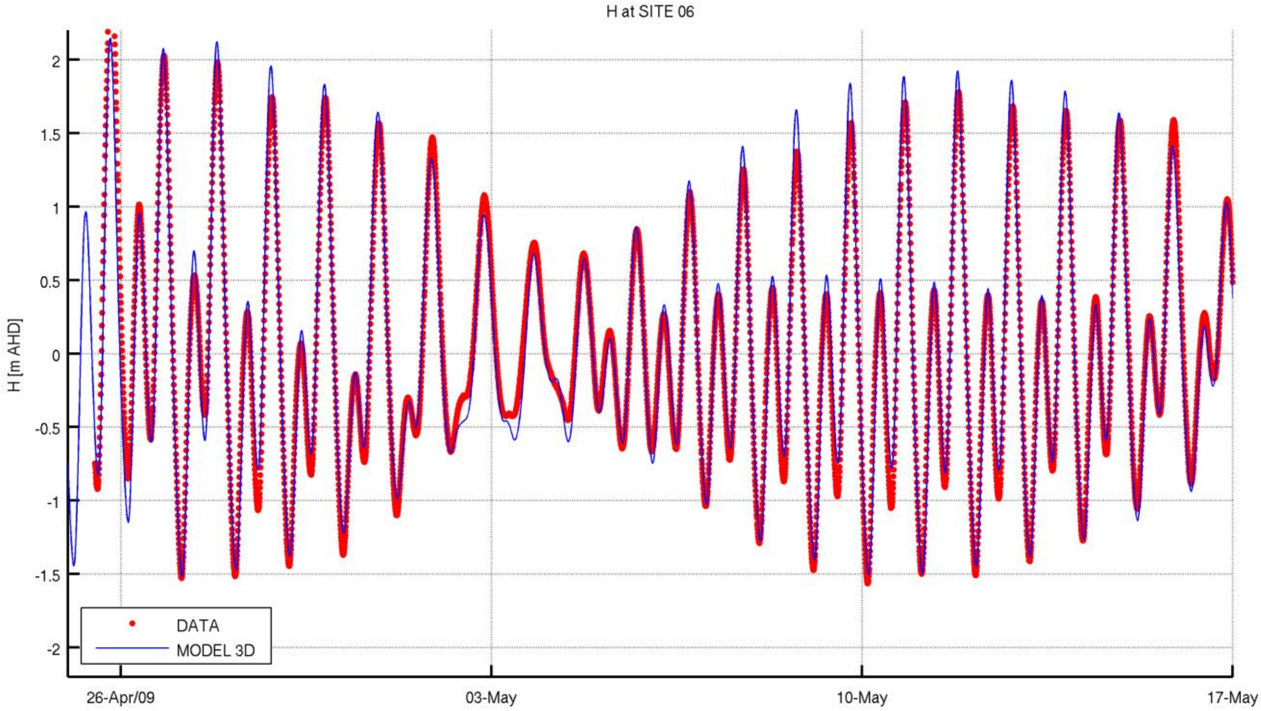

H at SITE 03
H [m AHD]
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
DATA
MODEL 3D
26-Apr/09
03-May
10-May
17-May

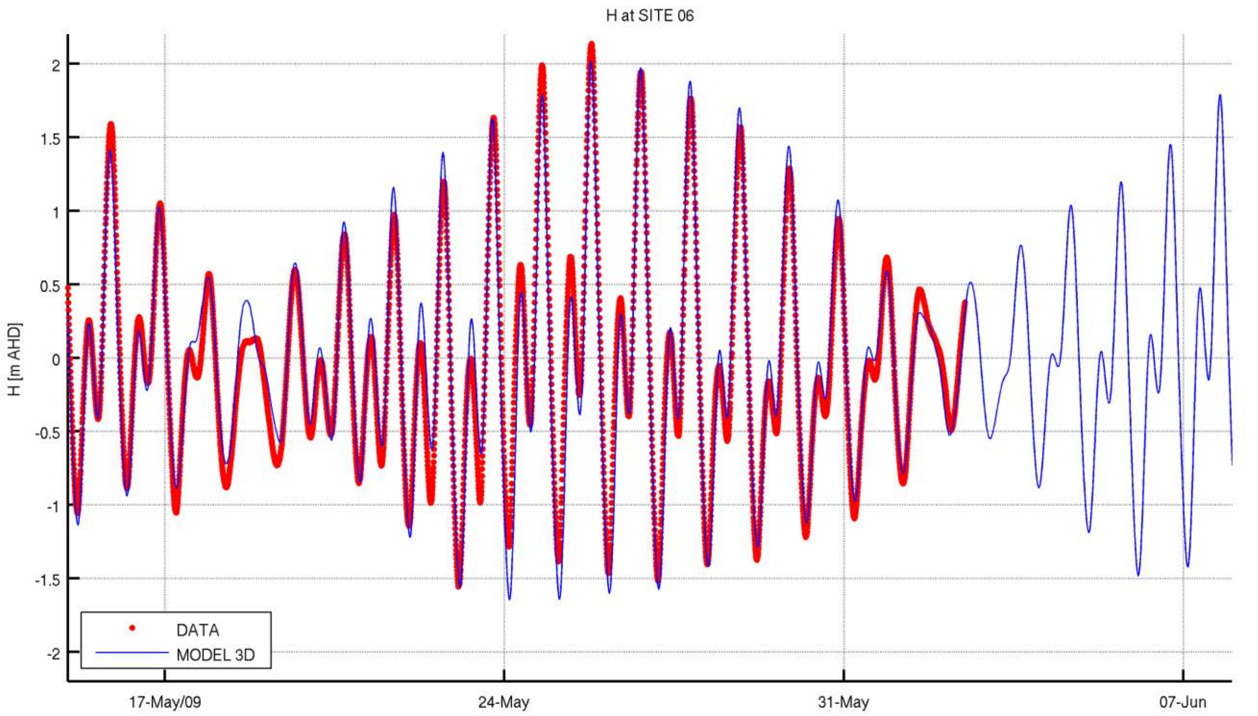

H at SITE 03
H [m AHD]
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
DATA
MODEL 3D
17-May/09
24-May
31-May
07-Jun

Water Level Calibration

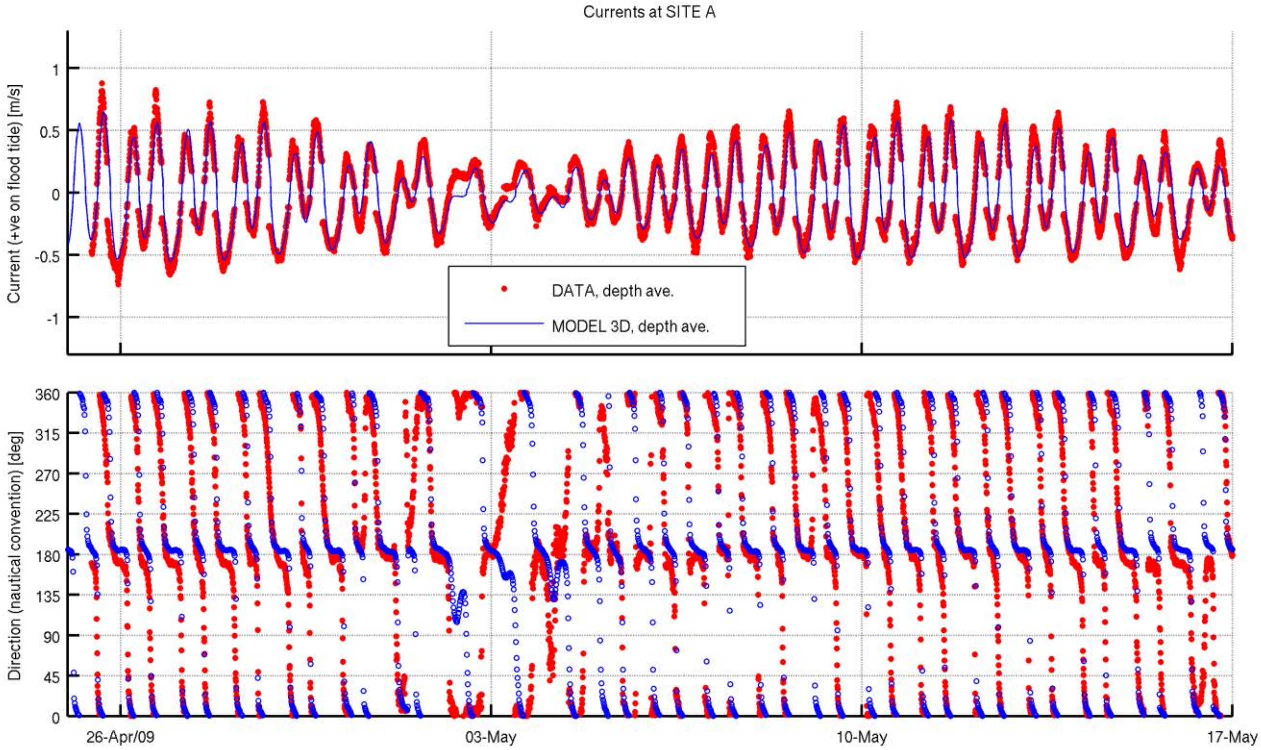


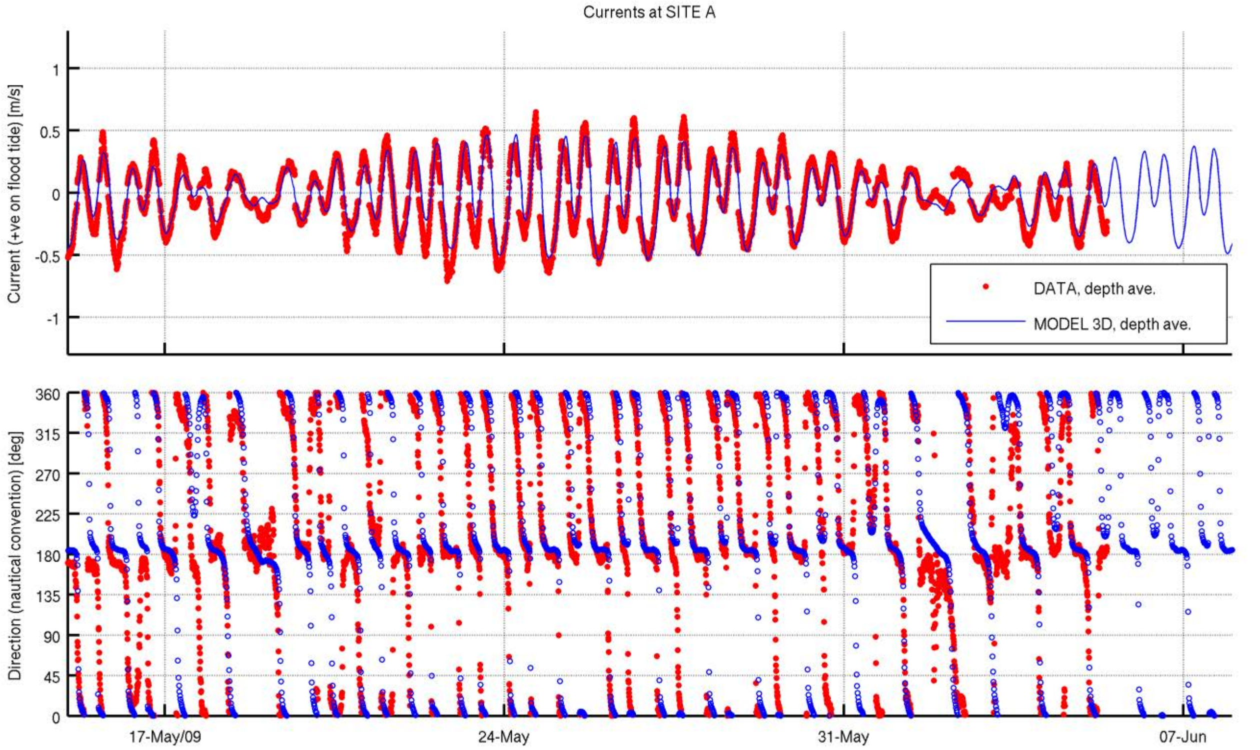


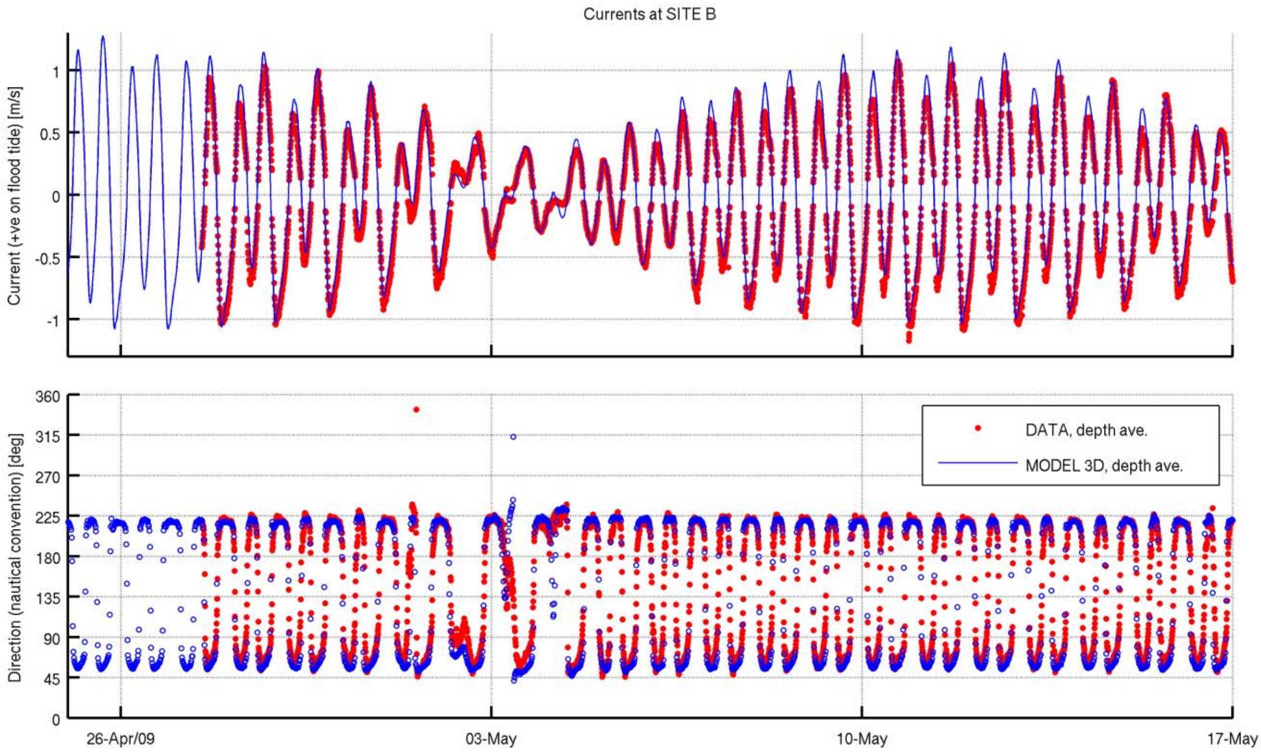

H at SITE 06
H [m AHD]
DATA
MODEL 3D
26-Apr/09
03-May
10-May
17-May

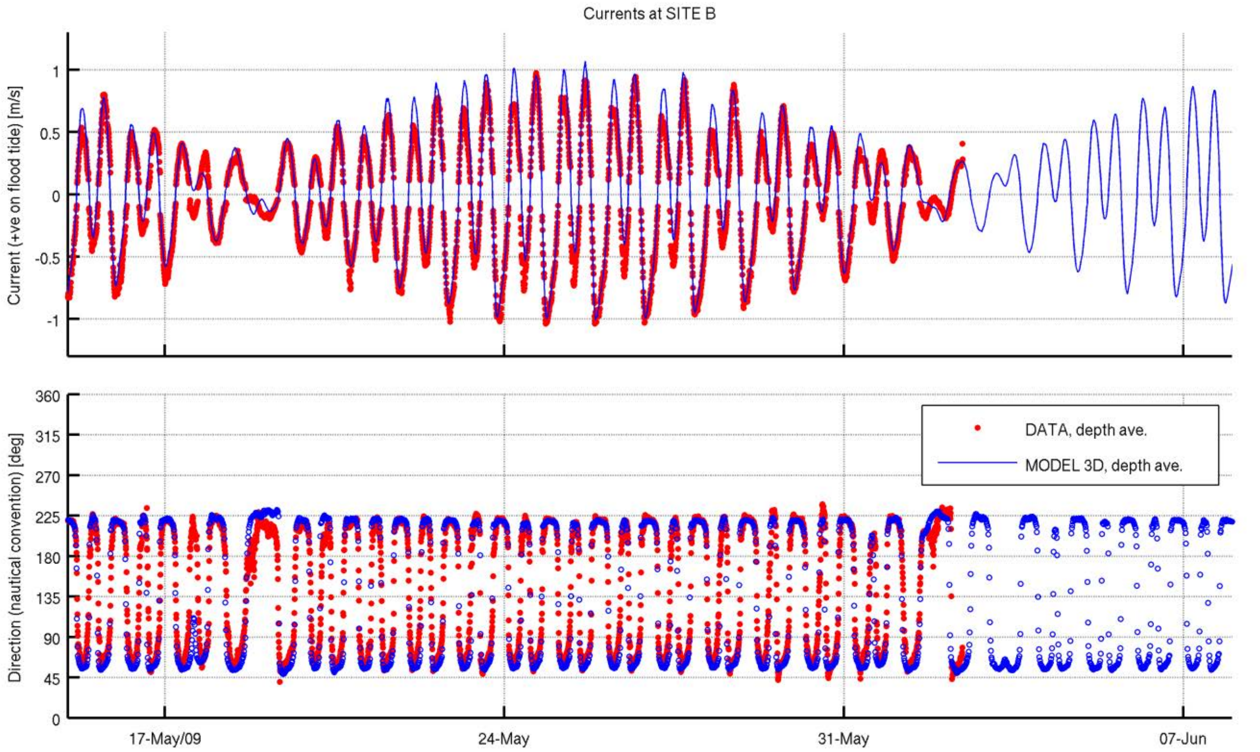

H at SITE 06
H [m AHD]
DATA
MODEL 3D
17-May/09
24-May
31-May
07-Jun

Appendix C Tidal Currents Calibration, Timeseries

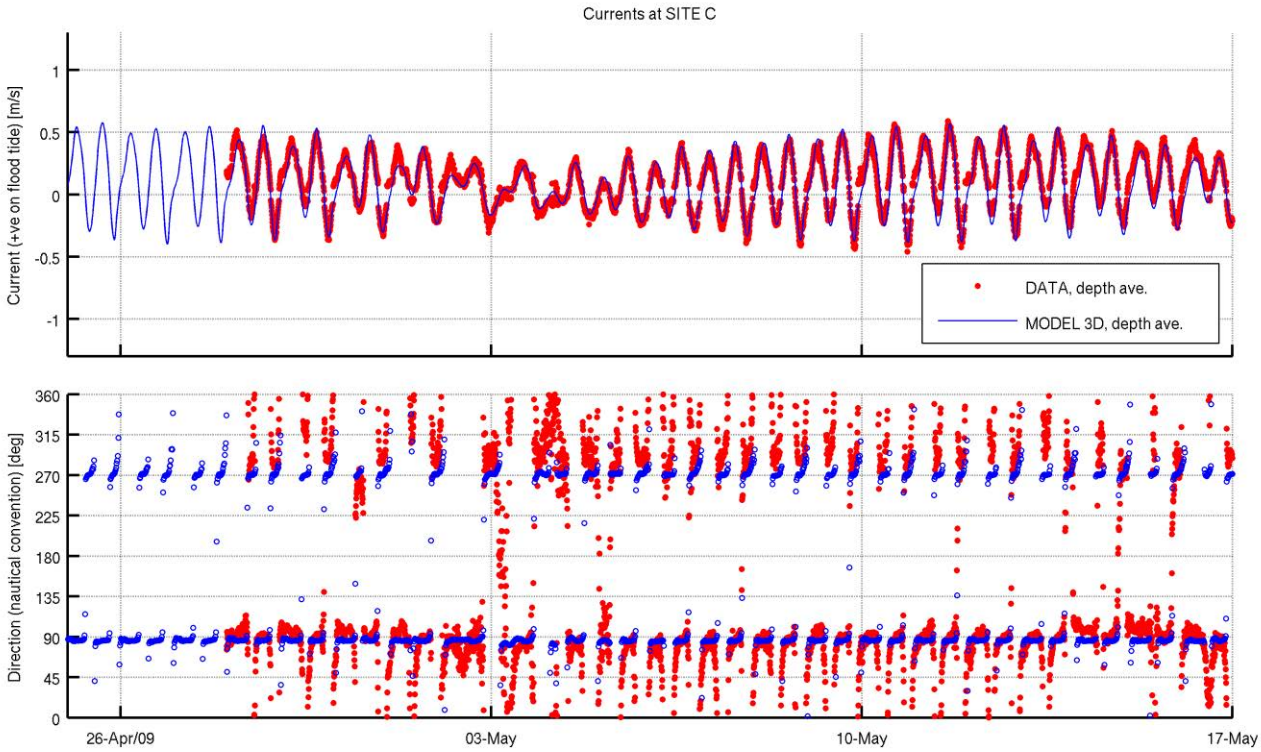


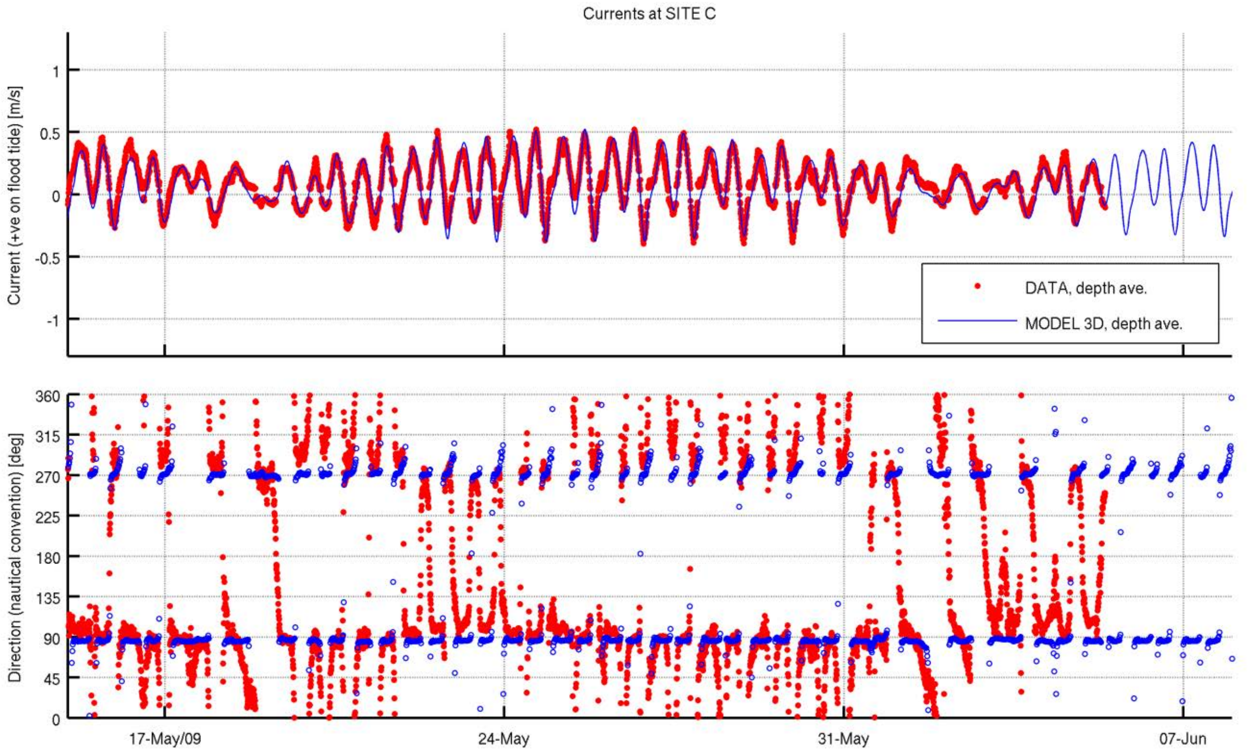



Currents at SITE B
Current (+ve on flood tide) [m/s]
1
0.5
0
-0.5
-1
Direction (nautical convention) [deg]
360
315
270
225
180
135
90
45
0
DATA, depth ave.
MODEL 3D, depth ave.
26-Apr/09
03-May
10-May
17-May

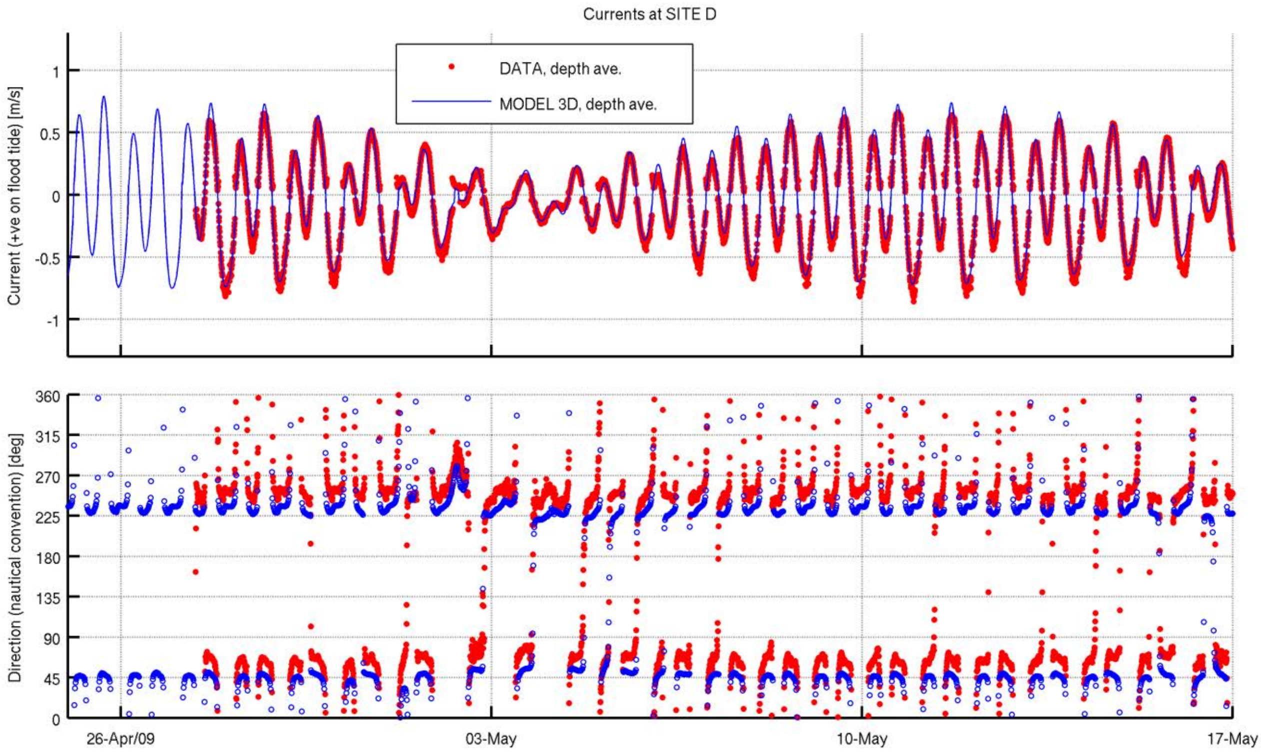

Currents at SITE B
Current (+ve on flood tide) [m/s]
1
0.5
0
-0.5
-1
Direction (nautical convention) [deg]
360
315
270
225
180
135
90
45
0
DATA, depth ave.
MODEL 3D, depth ave.
17-May/09
24-May
31-May
07-Jun

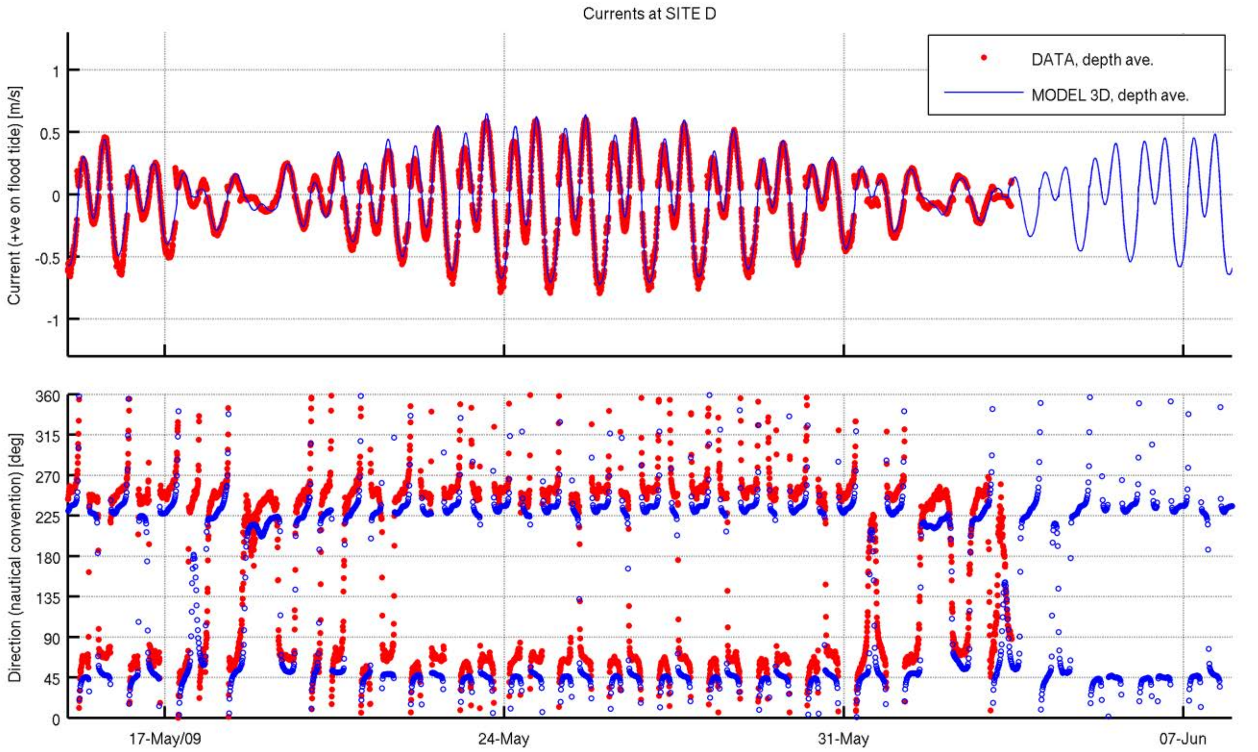
Tidal Currents Calibration, Timeseries



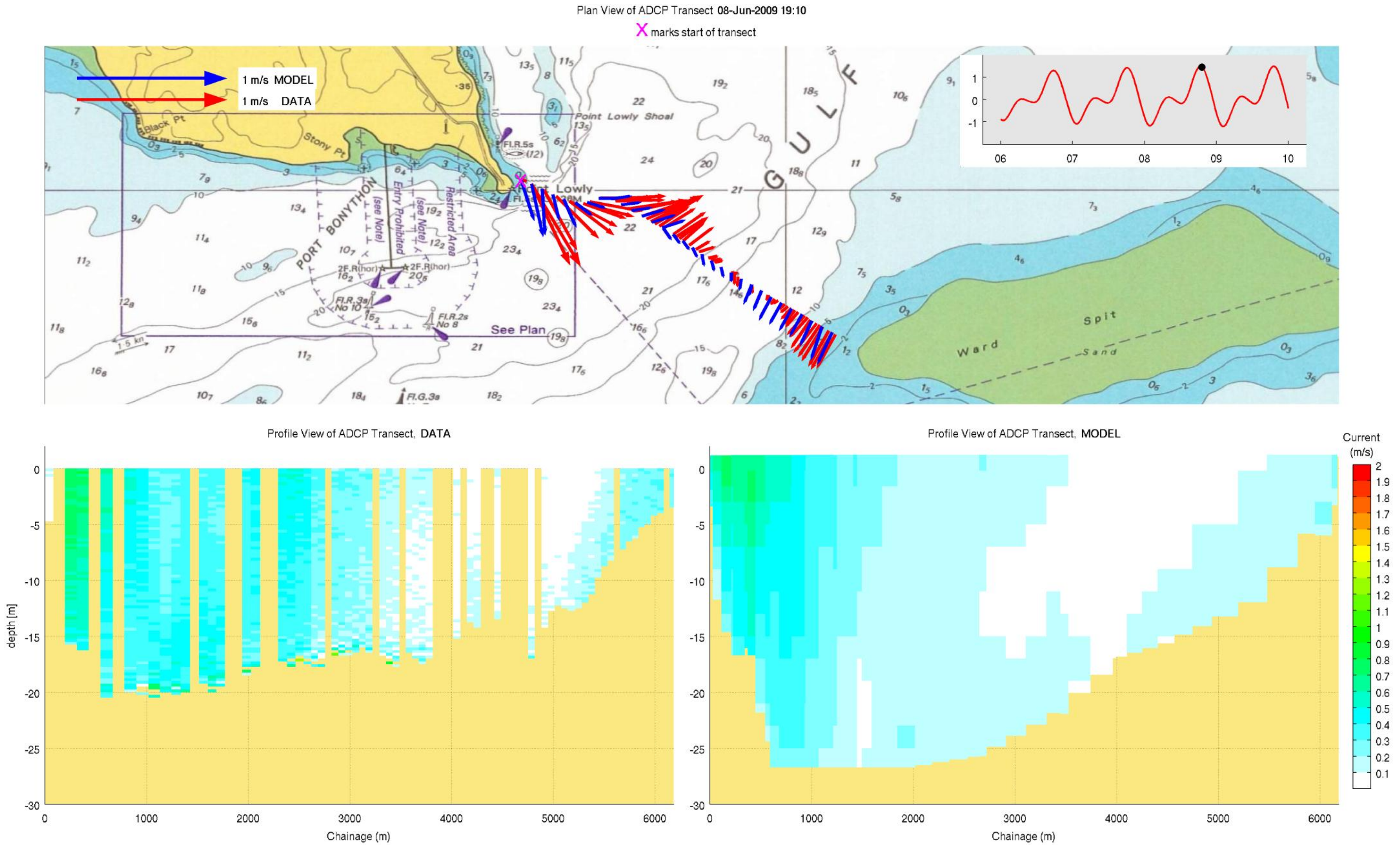


Tidal Currents Calibration, Timeseries



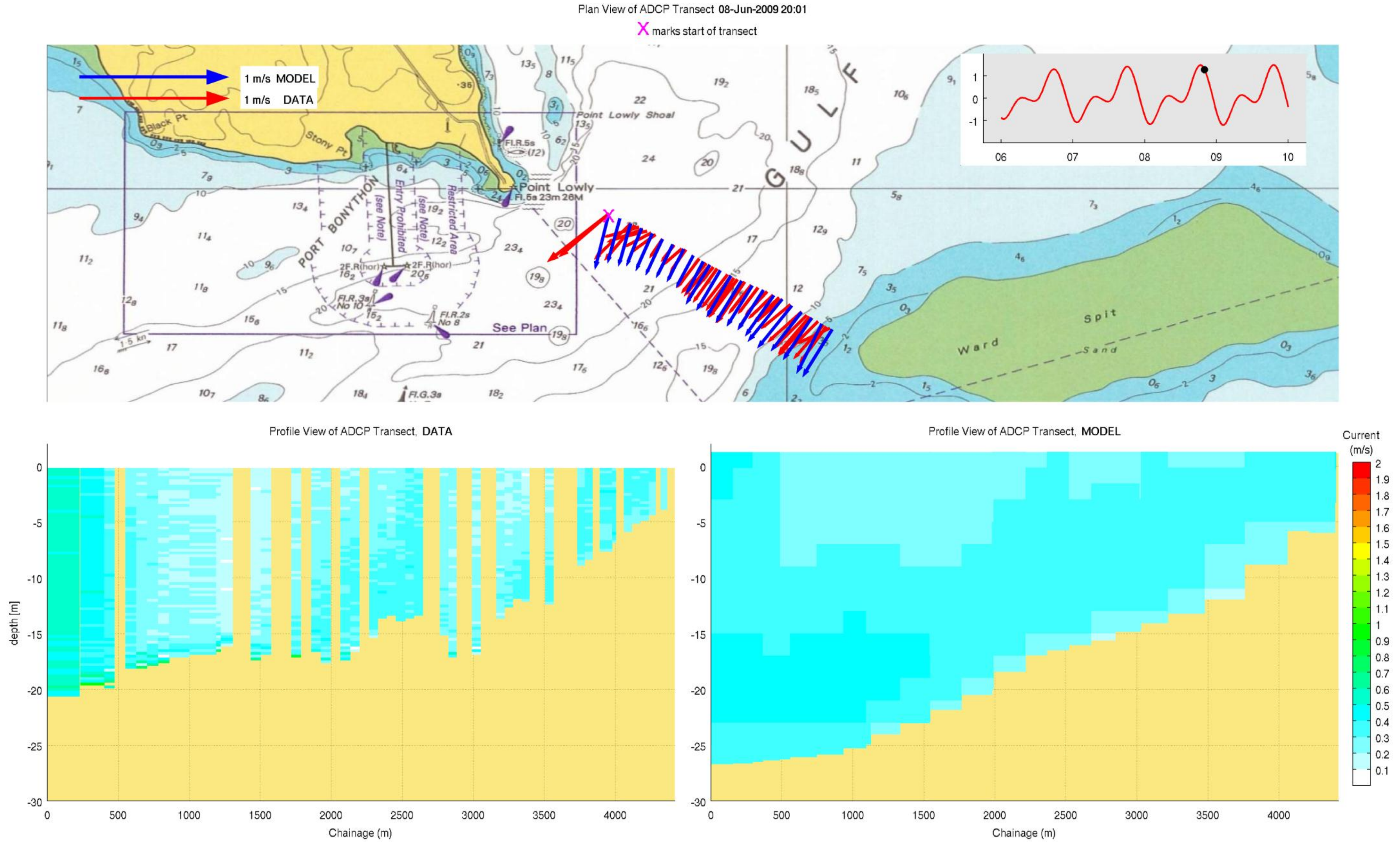


Appendix D Tidal Currents Calibration, Transects



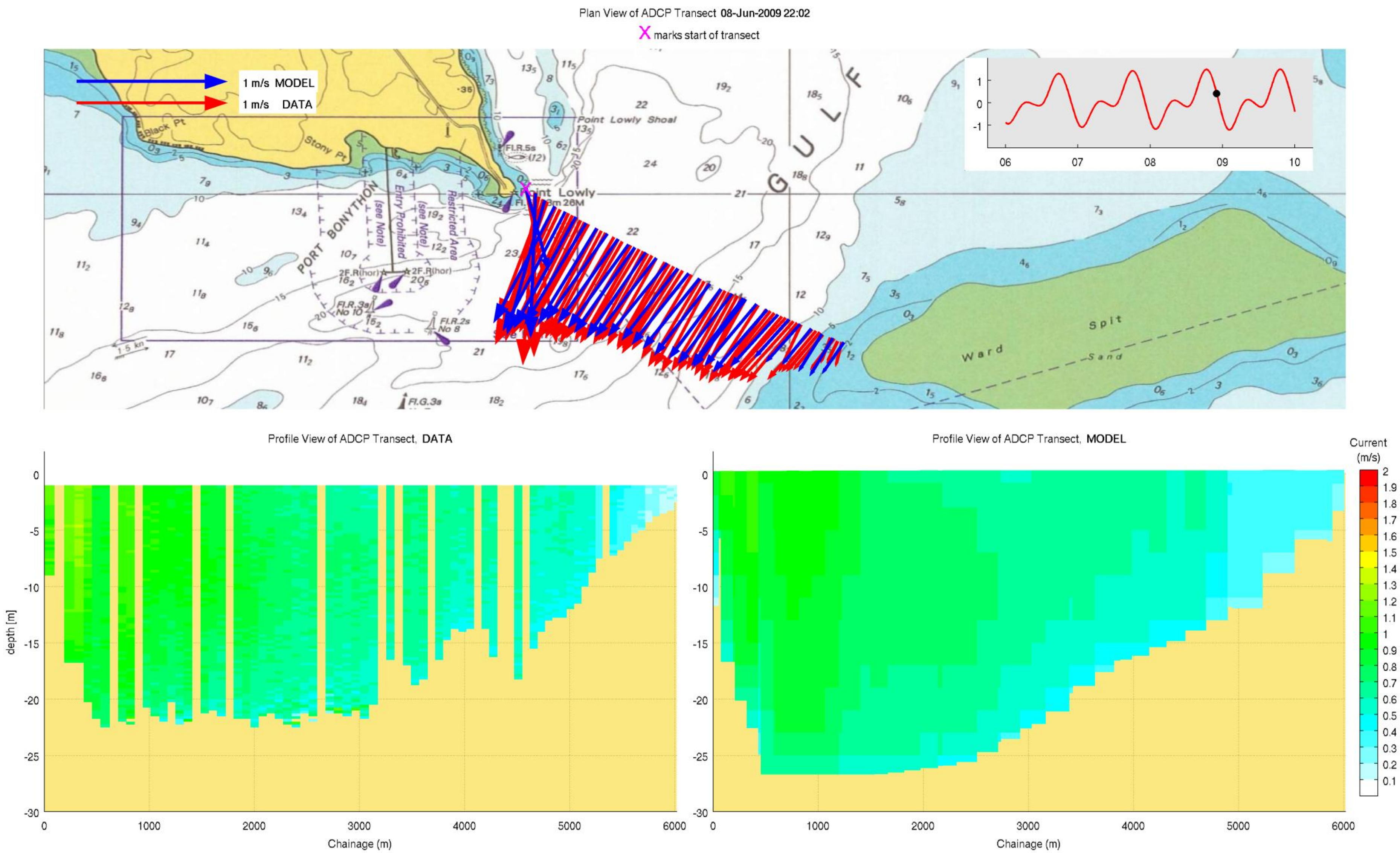
BMT WBM

Tidal Currents Calibration, Transects

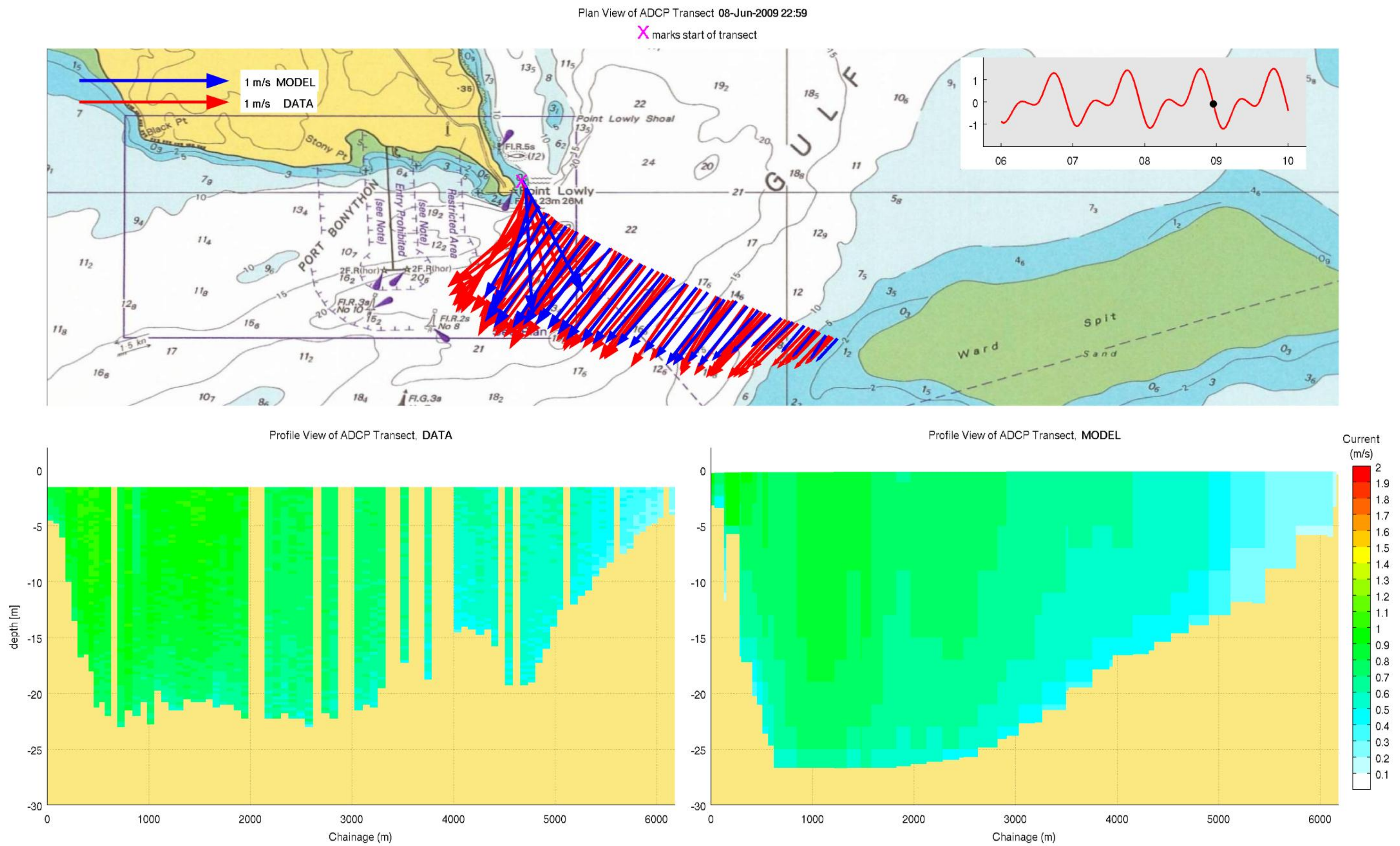


BMT WBM

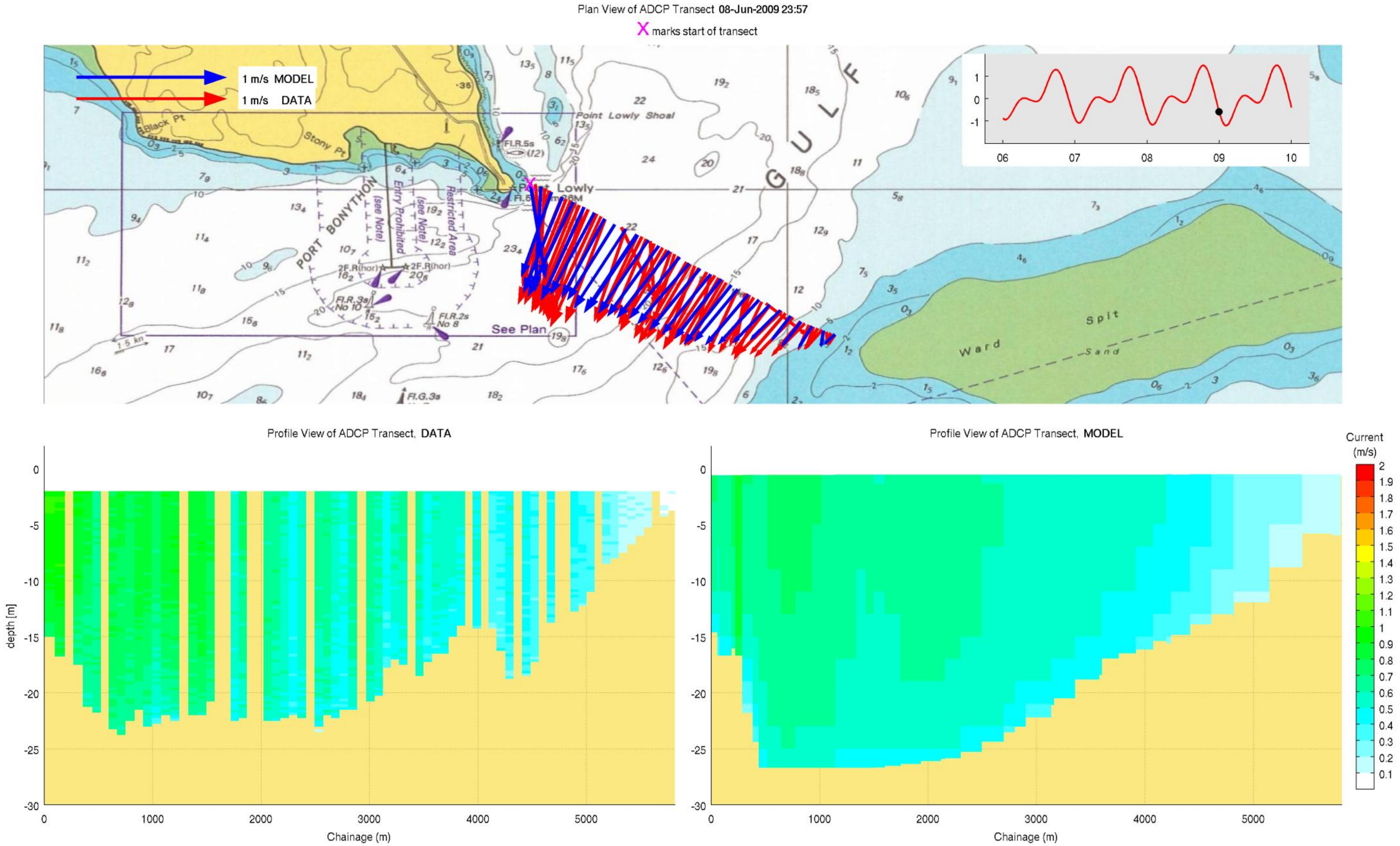
Tidal Currents Calibration, Transects



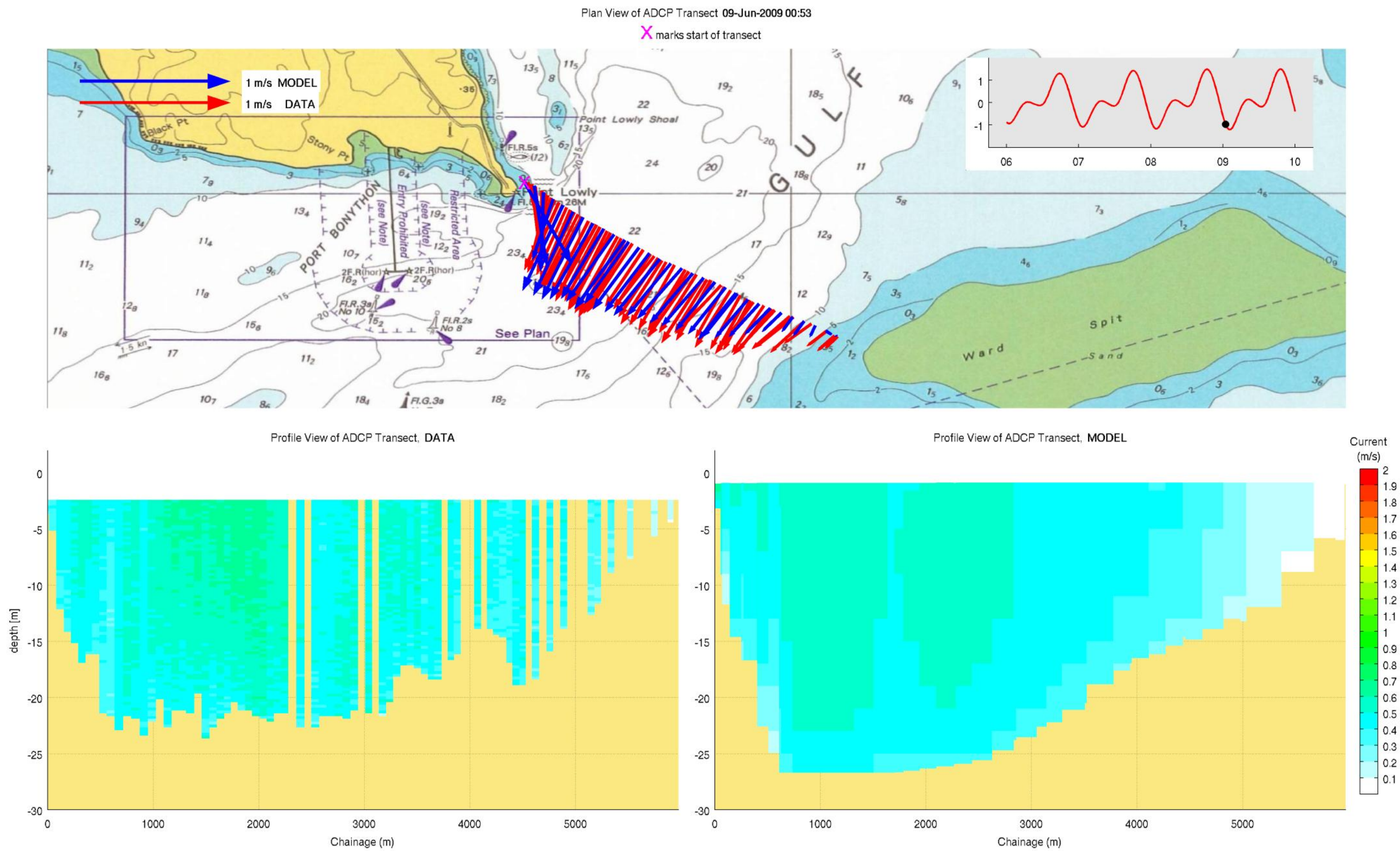
Tidal Currents Calibration, Transects



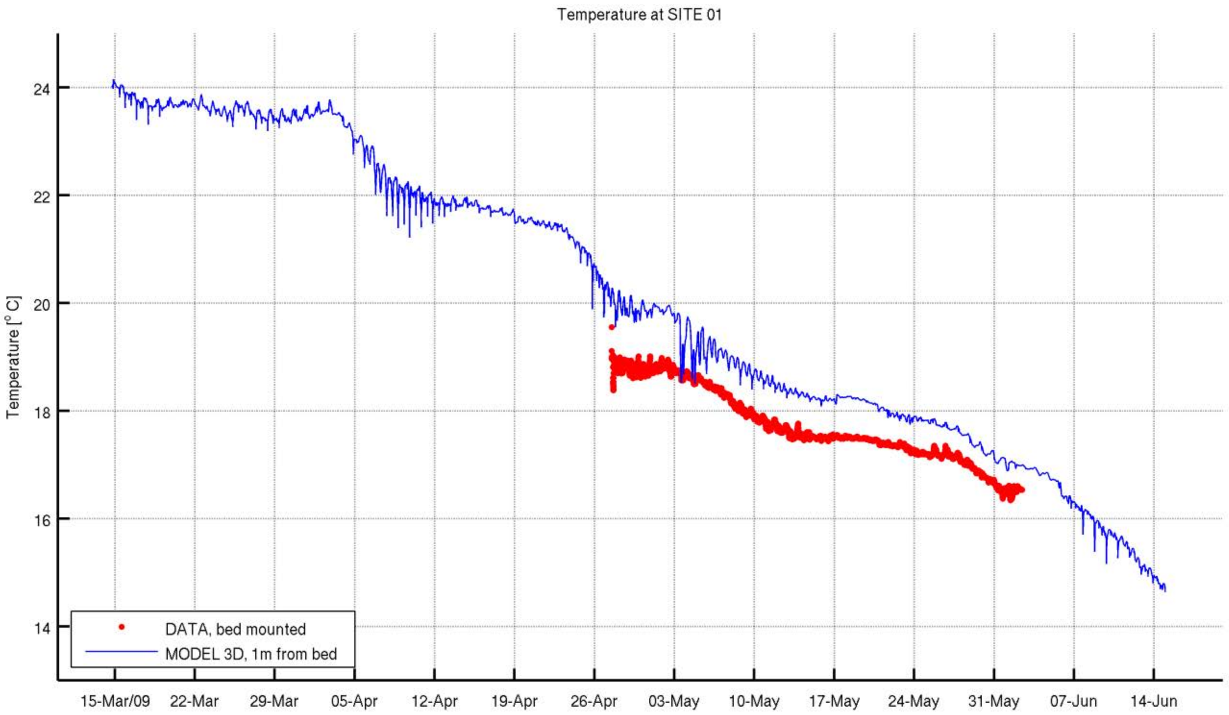
Tidal Currents Calibration, Transects

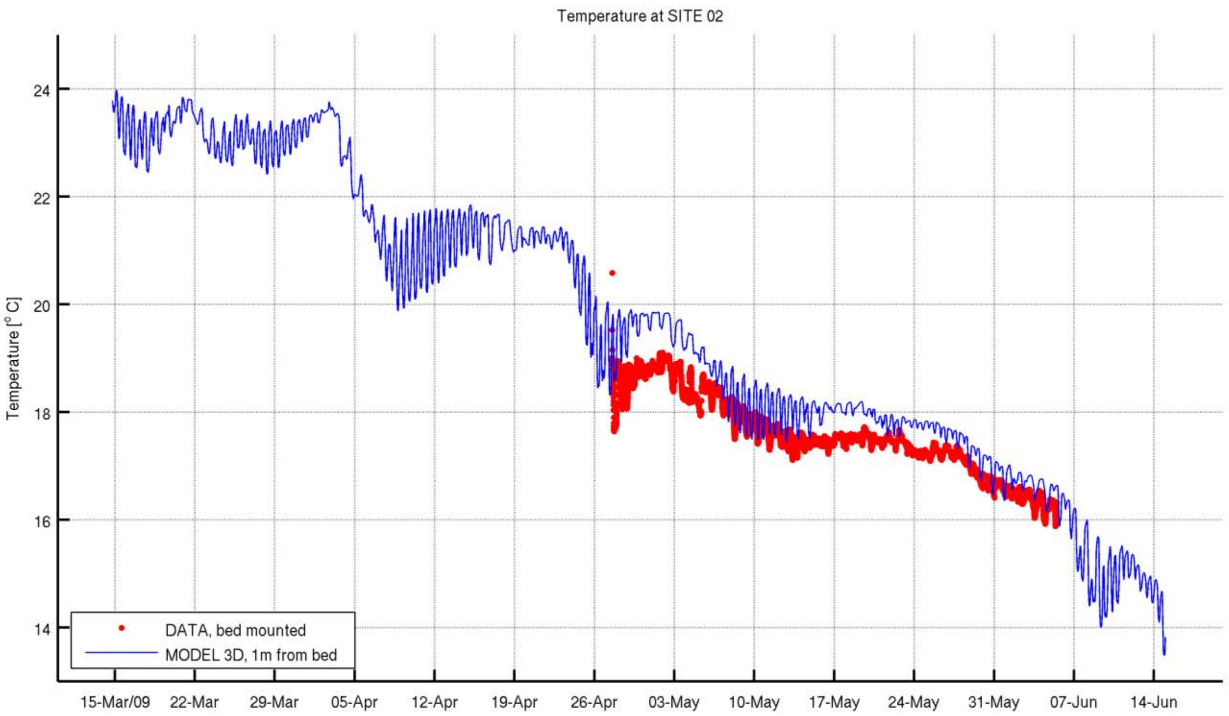


Tidal Currents Calibration, Transects

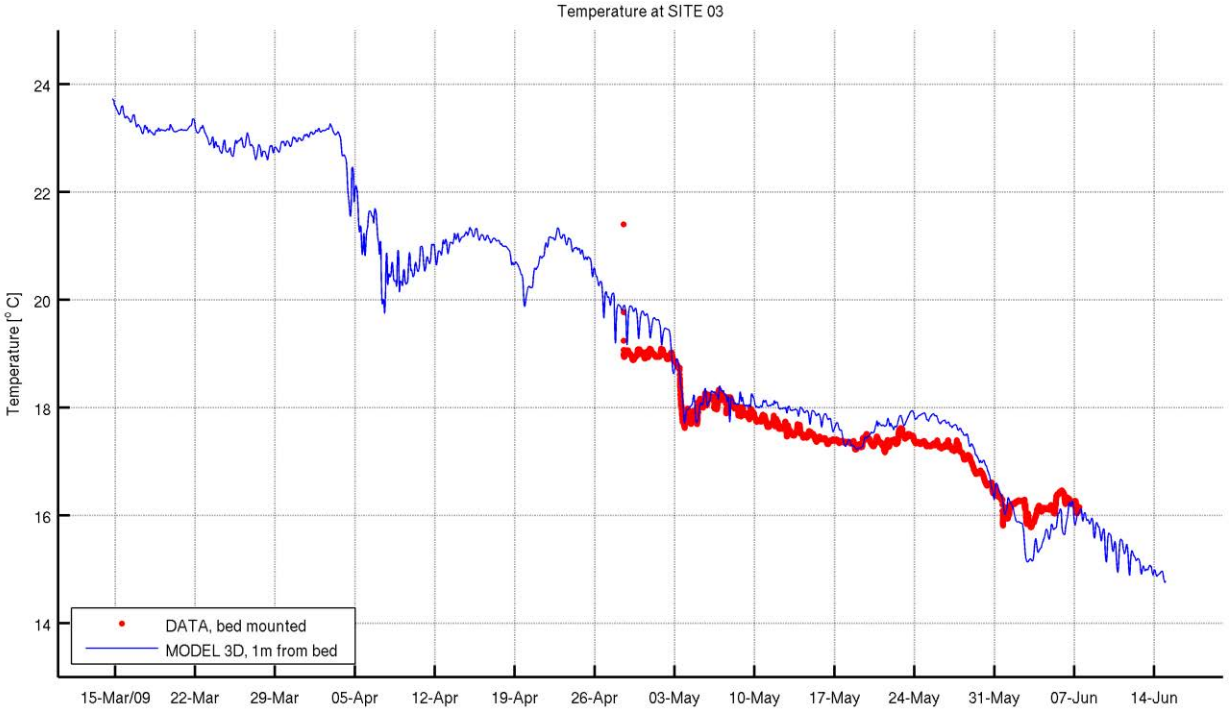


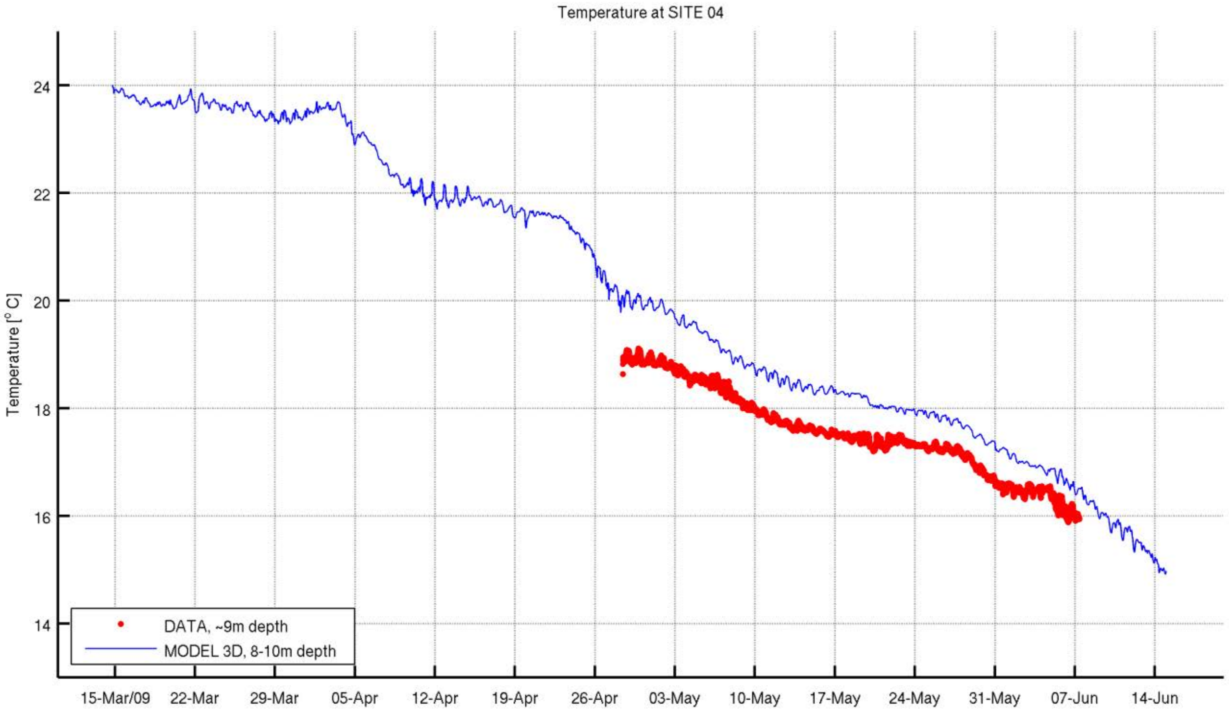
Appendix E Temperature Calibration



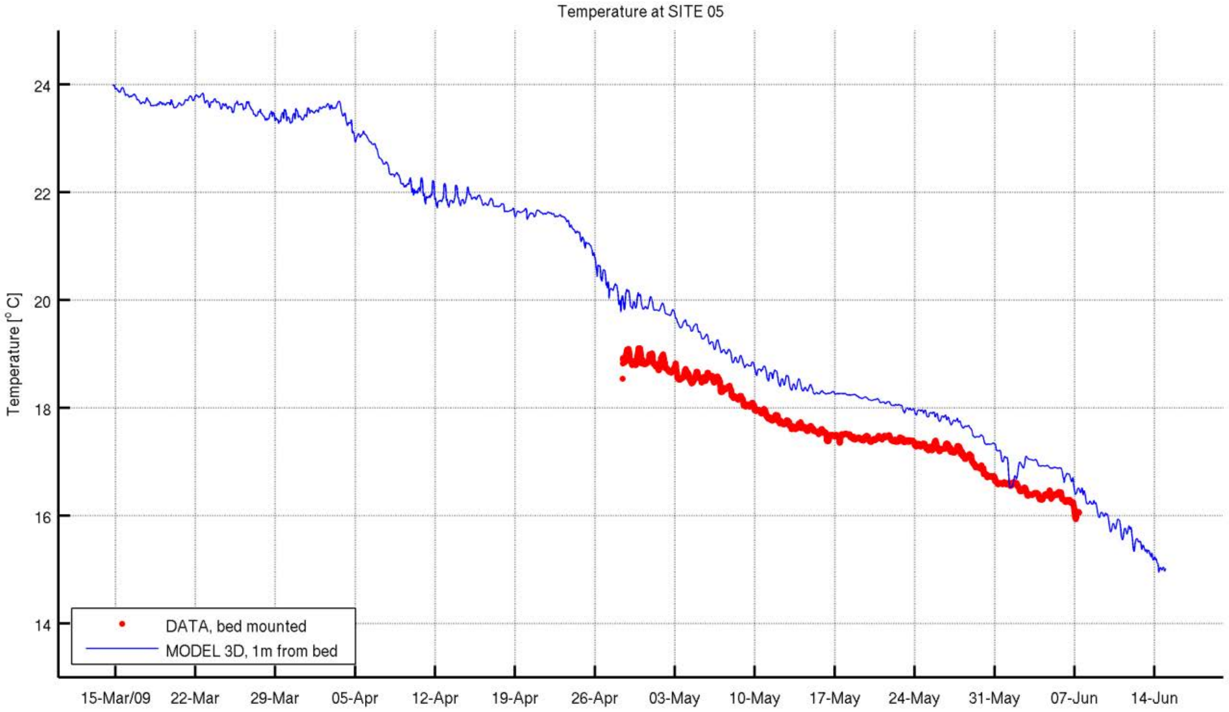


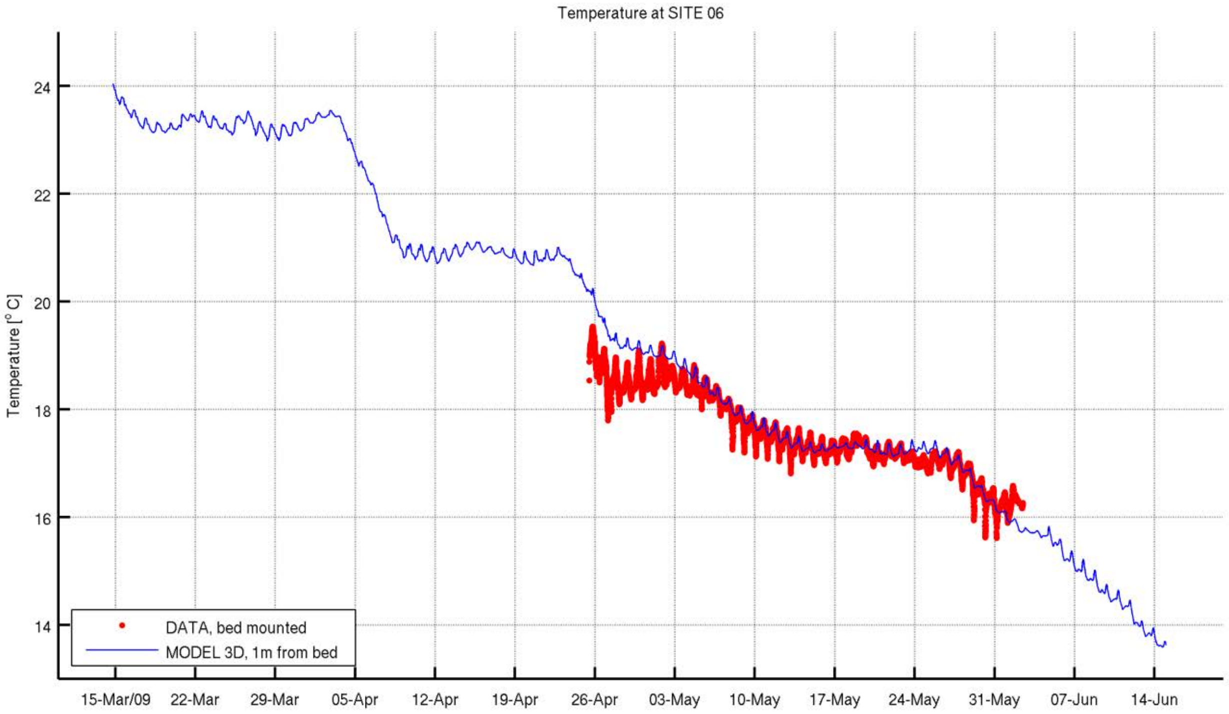
Temperature Calibration



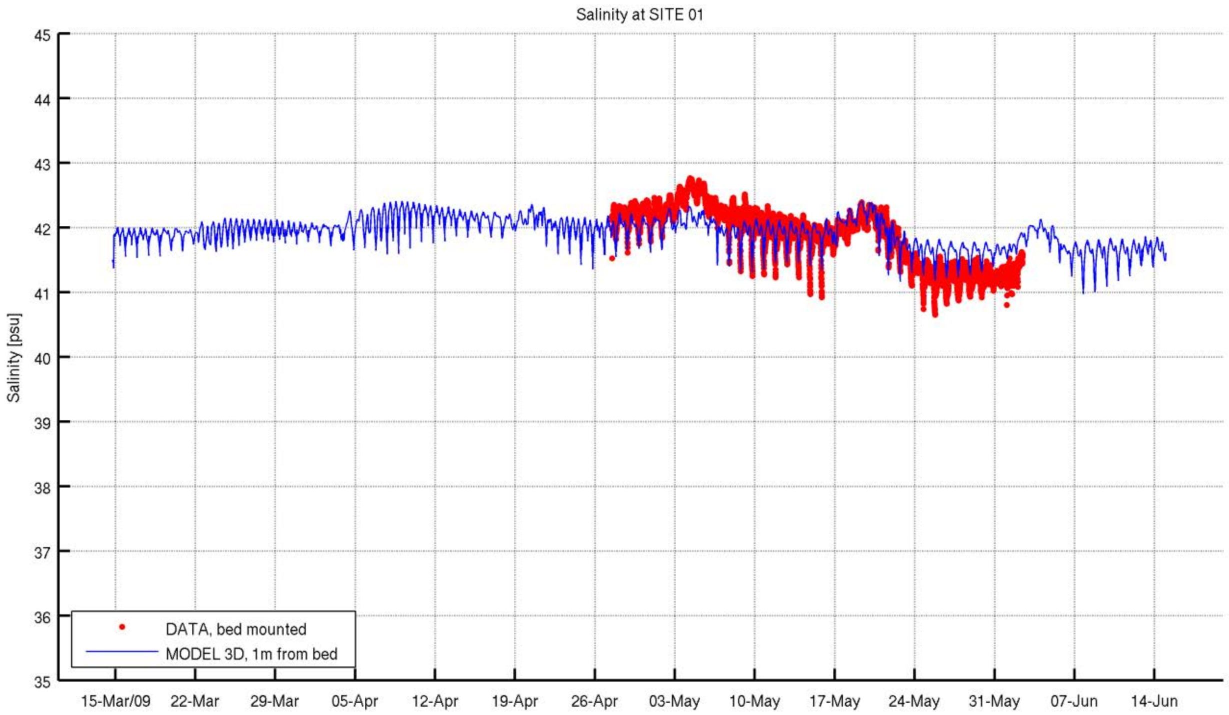


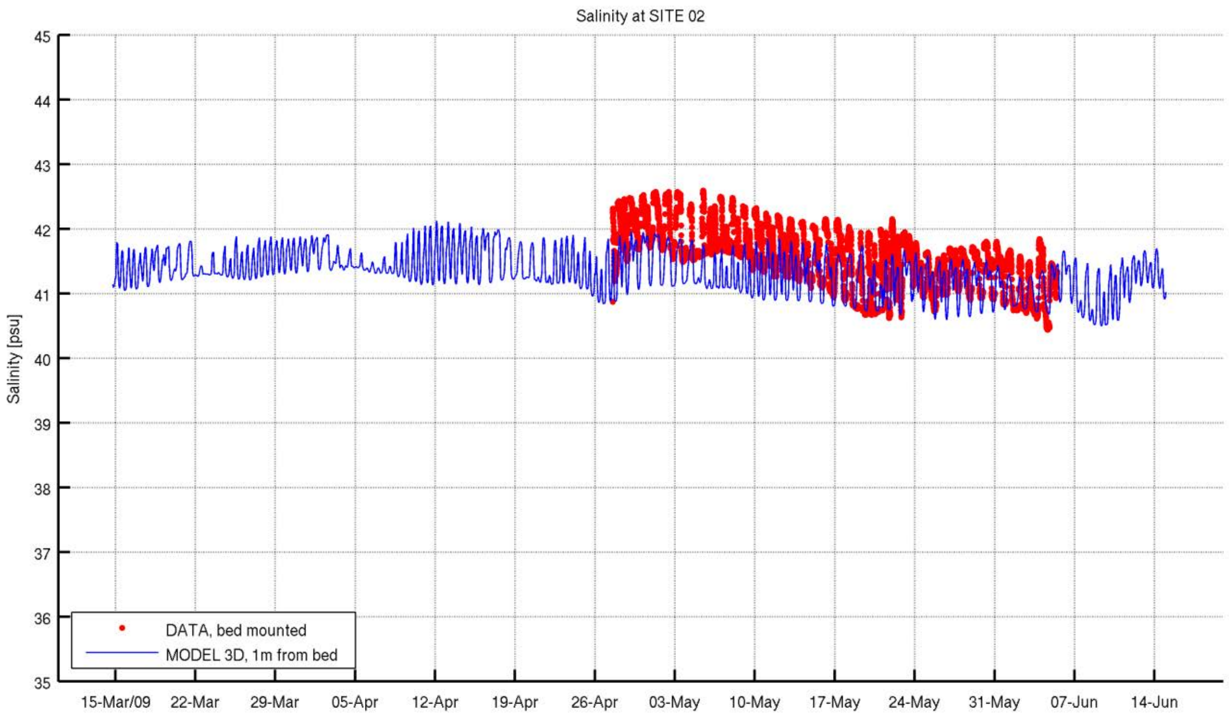
BMT WBM


Temperature at SITE 05
Temperature [° C]
24
22
20
18
16
14
DATA, bed mounted
MODEL 3D, 1m from bed
15-Mar/09
22-Mar
29-Mar
05-Apr
12-Apr
19-Apr
26-Apr
03-May
10-May
17-May
24-May
31-May
07-Jun
14-Jun

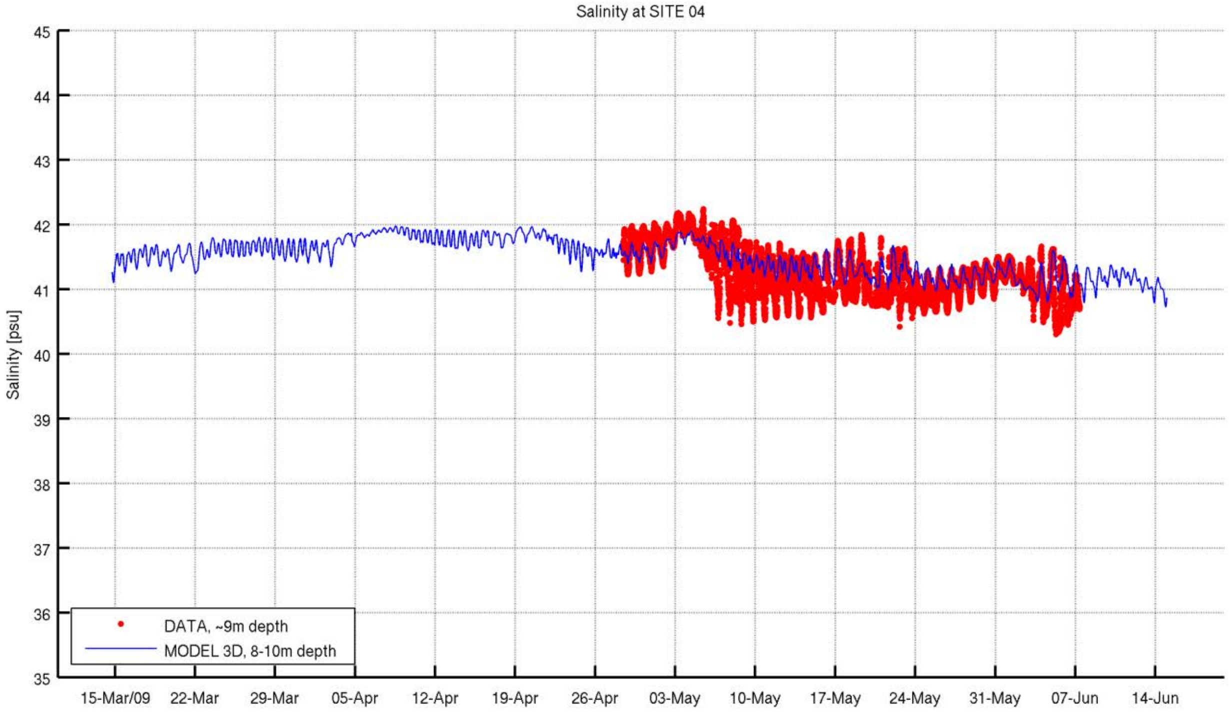

Temperature at SITE 06
Temperature [° C]
24
22
20
18
16
14
DATA, bed mounted
MODEL 3D, 1m from bed
15-Mar/09
22-Mar
29-Mar
05-Apr
12-Apr
19-Apr
26-Apr
03-May
10-May
17-May
24-May
31-May
07-Jun
14-Jun

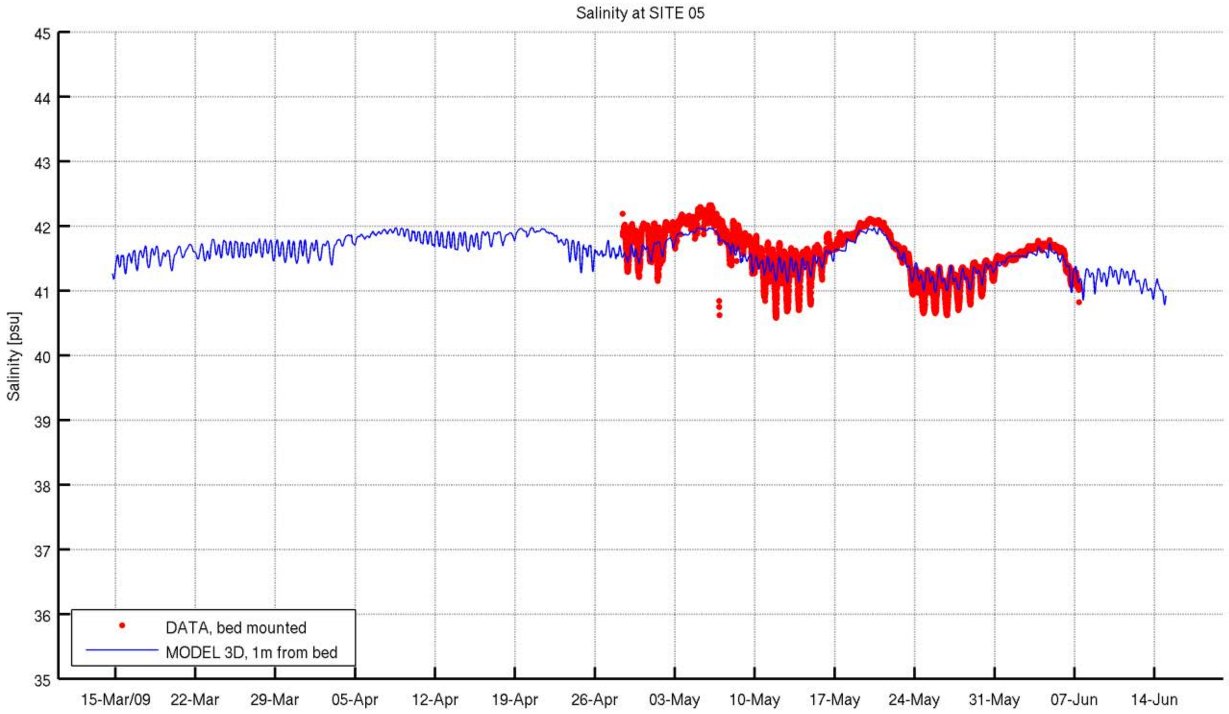
Appendix F Salinity Calibration





Salinity Calibration





BRW.
CLIENT
CHOICE
AWARDS
2013
australia's best professional service firms
WINNER

BMT WBM

BMT WBM Bangalow	6/20 Byron Street, Bangalow 2479 Tel +61 2 6687 0466 Fax +61 2 66870422 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Brisbane	Level 8, 200 Creek Street, Brisbane 4000 PO Box 203, Spring Hill QLD 4004 Tel +61 7 3831 6744 Fax +61 7 3832 3627 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Denver	8200 S. Akron Street, #B120 Centennial, Denver Colorado 80112 USA Tel +1 303 792 9814 Fax +1 303 792 9742 Email denver@bmtwbm.com Web www.bmtwbm.com
BMT WBM London	International House, 1st Floor St Katharine's Way, London E1W 1AY Email london@bmtwbm.co.uk Web www.bmtwbm.com
BMT WBM Mackay	Suite 1, 138 Wood Street, Mackay 4740 PO Box 4447, Mackay QLD 4740 Tel +61 7 4953 5144 Fax +61 7 4953 5132 Email mackay@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Melbourne	Level 5, 99 King Street, Melbourne 3000 PO Box 604, Collins Street West VIC 8007 Tel +61 3 8620 6100 Fax +61 3 8620 6105 Email melbourne@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Newcastle	126 Belford Street, Broadmeadow 2292 PO Box 266, Broadmeadow NSW 2292 Tel +61 2 4940 8882 Fax +61 2 4940 8887 Email newcastle@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Perth	Suite 6, 29 Hood Street, Subiaco 6008 Tel +61 8 9328 2029 Fax +61 8 9486 7588 Email perth@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Sydney	Level 1, 256-258 Norton Street, Leichhardt 2040 PO Box 194, Leichhardt NSW 2040 Tel +61 2 8987 2900 Fax +61 2 8987 2999 Email sydney@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Vancouver	Suite 401, 611 Alexander Street Vancouver British Columbia V6A 1E1 Canada Tel +1 604 683 5777 Fax +1 604 608 3232 Email vancouver@bmtwbm.com Web www.bmtwbm.com

Appendix C

Oil Spill Contingency Plan

Flinders Ports
SOUTH AUSTRALIA

OIL SPILL CONTINGENCY PLAN

UNCONTROLLED COPY if printed

CONTENTS

UNCONTROLLED COPY if printed

PART A MANAGEMENT

SECTION 1 INTRODUCTION

SECTION 2 USING THE OSCP

SECTION 3 LEVELS OF RESPONSE

SECTION 4 OIL SPILL RESPONSE ORGANISATION

PART B ACTION PLAN

SECTION 5 STARTING THE OIL SPILL RESPONSE

SECTION 6 SPILL ASSESSMENT AND MONITORING

SECTION 7 IMMEDIATE RESPONSE

SECTION 8 Marine Response

SECTION 9 SHORELINE RESPONSE

CONTENTS

UNCONTROLLED COPY if printed

SECTION 10 WASTE HANDLING, STORAGE AND DISPOSAL

SECTION 11 COMMUNICATIONS

SECTION 12 RESPONSE TERMINATION

PART C APPENDICES

Advanced Operations Centre	A location, usually in proximity to a marine oil pollution incident, from which field activities are directed.
Adviser	An individual who provides advice on specific response issues as required.
AGAL	Australian Government Analytical Laboratory
AIIMS	Australian Interagency Incident Management System
AMOSC	Australian Marine Oil Spill Centre
AOC	Advanced Operations Centre
Approved Dispersant	Dispersant approved by the National Plan.
Australian Maritime Safety Authority	Commonwealth Agency charged under the Australian Maritime Safety Authority Act 1990 with combating pollution in the marine environment both within and outside the Commonwealth of Australia.
Black Oil	Areas of black coloured oil sometimes appearing with a latex texture.
Brown Oil	Typically a 0.1 to 1.0mm thick layer of water-in-oil emulsion (thickened).
Command	Is the direction of members and resources of an organisation in the performance of the organisations role and tasks. Authority to command is established in legislation or by agreement within the organisation.
Commander	A single agency term. A commander has authority only within that agency.
Containment Equipment	Equipment used to contain or restrict the spread of oil spilt on water.
Control	Is the overall direction of emergency management activities in designated emergencies. Authority for control is established in

	legislation or in an emergency management plan, and carries with it the responsibility for tasking and coordinating other organisations in accordance with the needs of the situation.
Control Agency	Agency having responsibility for ensuring an effective response to an incident.
Dispersant	Chemical used to break-up surface of slicks.
Disposal	The storing or re-processing of recovered pollutant in an environmentally approved site.
Emulsification	The formation of a water-in-oil mixture frequently called ‘mousse’.
EPA	Environmental Protection Authority.
FPSA	Flinders Ports South Australia
GMMO	General Manager Marine Operations
IAP	Incident Action Plan.
IC	Incident Controller.
ICC	Incident Control Centre.
ICS	Incident Control System.
IMT	Incident Management Team.
Incident Management Team	A group comprising the Incident Controller and the individuals appointed to be responsible for the functions of the finance and administration, planning, operations and logistics, together with any other individual appointed by the Incident Controller from time to time.

LGA	Local Government Authority.
Light Sheen	A light almost transparent layer of oil.
LO	Logistics Officer.
Logistics Section	The functional group responsible for the supply of services and resources to support and sustain the operational response to an incident.
MLO	Media Liaison Officer. Incident Management Team role. The MLO is responsible for managing the media response during an incident.
National Plan	National Plan to combat pollution of the sea by oil and other noxious and hazardous substances is a plan issued by AMSA combining the efforts of the Commonwealth and State Governments and the oil and shipping industry to combat oil spills in the Australian marine environment.
OH&S	Occupational Health and Safety.
OO	Operations Officer.
Operations Section	The functional group responsible for implementing the operational requirements of the Incident Action Plan and providing operational input to the planning process.
OSCP	Oil Spill Contingency Plan.
Planning Section	The functional group responsible for the provision of information on all aspects of an incident and the response to that incident and the development of an incident action plan as directed by the Incident Management Team.
Pol Rep	Pollution Report. Documentation reporting a pollution incident.
Response Management Hierarchy	1. **General Manager Marine Operations** An individual appointed by a State/Territory Government

	2. Incident Controller The individual responsible for the management of all operations in response to an oil spill.
	3. Officer An individual responsible for the activities of a functional group. Reports to the Incident Controller
	4 Coordinator An individual responsible for the activities of a particular aspect of the response. Reports to the relevant Officer.
	5. Supervisor An individual in charge of a component of a response within a particular sector of the response. Report to the relevant Coordinator.
	6. Team Leader An individual in charge of a group of personnel operating within a particular sector. Reports to the relevant Supervisor.
SAMSCAP	SA Marine Spill Contingency Action Plan
SC	Shoreline Coordinator
Sit Rep	Situation report on an actual or potential marine oil pollution incident or response. These may be issued regularly during any incident.
SMPC	State Marine Pollution Controller
WMU	Waste Management Unit of the operations section, responsible for the management of oil and oiled debris generated by the response.

UNCONTROLLED COPY if printed

1.1 OBJECTIVES

The primary objective of the Flinders Ports South Australia (FPSA) Oil Spill Contingency Plan (OSCP) is to:

- Minimise the potential effects on marine and shoreline environments that could result from a marine oil spill, occurring within the ports, port waters and port facilities.

This objective is to be achieved by:

- Minimising the spread of oil spilt on the sea surface;
- Recovering spilt oil on water;
- Protecting key marine and coastal resources from impact by oil;
- Cleaning oiled shorelines;
- Choosing spill management strategies, which are efficient and do not, themselves damage the environment.

It is the responsibility of all FPSA staff to:

- Be familiar with the OSCP and to know their role in spill response;
- To maintain their spill response skills, and those of their staff, by regular training;
- Maintain their copy of the OSCP so that it is:
  - complete;
  - updated; and
  - readily available.

1.2 SCOPE OF THE PLAN

1.2.1. Geographical Region

The OSCP is designed for use in responding to marine oil spills that occur, or are present, within Port Adelaide and approaches and the regional ports of Port Giles, Klein Point, Port Lincoln, Port Pirie, Thevenard and Wallaroo.

For Shoreline Response the OSCP within the coastline covered by the designated port limits.

(These regions are shown in Figure 1.1 to 1.7 at the end of this Section).

1.2.2 Port Adelaide – Port Limits

The subjacent land underlying, and adjacent land extending from, the waters, rivers, creeks and inlets to high water mark bounded as follows:

Commencing at Point Grey than due west along a line to its intersection with the western boundary of the Harbour of Port Adelaide, then generally south south-easterly along the harbour boundary for 3 nautical miles; then along a line due east to its intersection with the south westerly production of the No 4 Leading Lights; then generally north easterly along the production to its intersection with high water mark on the southern face of the Southern Breakwater; then generally north easterly along high water mark to its intersection with south western boundary of Section 694 Hundred of Port Adelaide; then generally north westerly along the aforementioned boundary across the Southern Breakwater to its intersection with high water mark on the northern face of the Southern Breakwater; then generally north easterly along high water mark to the northern extremity of No. 4 berth; then generally south easterly along high water mark to its intersection with the production southerly of the high water mark of the western face of the breakwater at the R.S.A.Y.S; then generally north easterly along the production across the R.S.A.Y.S Basin; then generally north westerly and north easterly along high water mark to Pelican Point; then generally south easterly and southerly along high water mark to its intersection with a line across the Port Adelaide River perpendicular to the high water mark alignment of No. 12 berth commencing at its intersection with a 180 metre radial line from the north west corner of No. 17 berth; then generally easterly along aforementioned perpendicular line across the Port Adelaide River to its intersection with high water mark; then generally north and easterly along high water mark including Nos 2 and 3 docks to its intersection with the Wave Screen in North Arm; then generally northerly along the western face of the Wave Screen and its production to intersect with high water mark on Torrens Island; then generally northerly along high water mark to the point of commencement at Point Grey. And including:-

Portion of Section 694 Hundred of Port Adelaide being the area described as easement E on FPX 43068. But excluding:-

Allotment 5 FP 102960.

1.2.3 Port Giles – Port Limits

The subjacent land underlying, and adjacent land extending from, the waters, rivers, creeks and inlets to high water mark of that portion of the western coast of Gulf St Vincent bounded as follows:

Commencing at a point on high water mark one nautical mile due south of the intersection of the centre line of the Port Giles Jetty with high water mark; then by a line bearing due east from high water mark for three nautical miles; then by a line bearing due north for two nautical miles; then by a line bearing due west to high water mark; then generally southerly along high water mark to the point of commencement.

1.2.4 Klein Point – Port Limits

The subjacent land underlying, and adjacent land extending from, the waters, rivers, creeks and inlets to high water mark of that portion of the western coast of Gulf St Vincent within one nautical mile seaward of the intersection of high water mark and the Klein Point jetty.

1.2.5 Port Lincoln – Port Limits

The subjacent land underlying, and adjacent land extending from, the waters, rivers creeks and inlets to high water mark of Port Lincoln bounded as follows:

Commencing at the intersection with high water mark of a line running due north from the north-east corner of King and Porter Streets; then due north along the said line to its intersection with a line 250 metres from and parallel to the port side of the maintained channel; then generally north-easterly by a line 250 metres from and parallel to the port side of the maintained channel to a point adjacent the entrance beacon; the continuing generally north-easterly along the production of that line to its intersection with low water mark; then along low water mark to Point Boston; then due east along a line to its intersection with the eastern boundary of the harbour boundary for 1.2 nautical miles; then due west along a line for 4.8 nautical miles; then along a line bearing $231^0$39T for 1.4 nautical miles. Then due south along a line for 2.6 nautical miles; then generally south-easterly along a line to high water mark at Fanny Point; then along a line bear4ing 68^0T or thereabouts to its intersection with high water mark on Boston Island; then along high water mark on Boston Island to

Hayden Point; then by a line bearing $63^0$45'T to its intersection with the eastern boundary of the harbour of Port Lincoln; then generally south-easterly along the
harbour boundary for 0.7 nautical miles; then generally southwesterly by a line to high water mark on the northern tip of Grantham Island; then due north along a line to
its intersection with high water mark adjacent Section 187 Hundred of Lincoln; then generally north easterly and northerly along high water mark to Billy Lights Point; then by a line generally north-westerly to its intersection with high water mark and the western corner of Allotment 1012, Town of Port Lincoln; then generally northerly and westerly along high water mark to the point of commencement.

1.2.6 Port Pirie – Port Limits

The subjacent land underlying and adjacent land extending from, the waters, rivers, creeks and inlets to high water mark in Germein Bay, Spencer Gulf bounded as follows.

Commencing at a point on a line bearing 282^{o} T and distance 13 nautical miles from Mount Ferguson (Latitude 33^{0}06.34'S,Longitude `138^{0}01.78E); then generally north-easterly along the north-western harbour boundary to high water mark; then generally south-easterly along a line to the Port Germein jetty light; then generally south-westerly along a line joining No. 2 port beacon to the intersection point of a line 250 metres from and parallel to the port side of the maintained channel; then generally southerly and south-easterly by a line 250 metres from and parallel to the port side of the maintained channel to its intersection with high water mark; then generally southerly along high water mark to a point being the prolongation of the southern extremity of No. 1 berth Port Pirie across the Port Pirie River; then generally south-westerly across the Port Pirie River along that prolongation the southern extremity of No. 1 berth Port Pirie; then generally north-westerly and northerly along high water mark to the northern extremity of No. 10 berth; then generally westerly along the No. 10 berth to its intersection with high water mark; then generally northerly along high water mark to the intersection of a line 250 metres from and parallel to the starboard side of the maintained channel; then generally north and north-westerly by a line 250 metres from and parallel to the starboard side of the maintained channel to a point south-west of the No. 17 starboard beacon; then by a line bearing 299^{0}35' for 1.5 nautical miles; then by a line bearing 345^{0}16T to the intersection point of a line bearing 264^{0}30' from No. 1 starboard beacon; then by a line bearing 264^{0}30'T to the intersection with the south-western limit of the harbour of Port Pirie; then generally north-westerly along the south-western limit of the harbour of Port Pirie to the point of commencement.

1.2.7 Thevenard – Port Limits

The subjacent land underlying, and adjacent land extending from, the waters, rivers, creeks and inlets to high water mark of Denial Bay, Murat Bay and Bosanquet Bay bounded as follows:

Commencing at a point at the intersection of high water mark and the production south-westerly of the northern western boundary of Section 212 Hundred of Bonython; then generally southerly along high water mark to the south western corner of Section 275 Hundred of Bonython; then generally west south-westerly along a line joining No. 25 starboard beacon to the intersection point of a line 250 metres from and parallel to the starboard side of the maintained channel; then by that line bearing
166^{0}34'T for 2 nautical miles; then by a line bearing 264^{0}30'T for 2.4 nautical miles; then by a line bearing 220^{0}T to its intersection with the south-western boundary of the harbour of Thevenard; then generally north-westerly along the harbour boundary to a point 2 nautical miles due south of Cape Beaufort; then by a line bearing 57^{0}T to the intersection with a line bearing 46^{0}T from the Entrance beacon (white sector light); then generally easterly by a line joining No. 20 port beacon to the intersection point of a line 250 metres from and parallel to the port side of the maintained channel; then by a series of lines 250 metres from and parallel to the port side of the maintained channel to the intersection point with a line bearing 316^{0}T from Cape Vivonne (white sector light); then by that

line bearing 316^0T for 1.9 nautical miles; then by a line bearing true north to the intersection point on a line joining Denial Bay jetty and Ceduna jetty; then along the said line generally east south-easterly to the intersection point of a line joining Low Point and the point of commencement; then generally southerly along that line to the point of commencement.

1.2.8 Wallaroo – Port Limits

The subjacent land underlying, and adjacent land extending from, the waters, rivers, creeks and inlets to high water mark of that part of Wallaroo Bay bounded as follows:

Commencing at a point on high water mark intersected by a line 150 metres north east and parallel to the northern face of the shipping pier; then generally north-westerly along a line joining high water mark at the south-west extremity of Point Riley to the intersection with a line being the production generally easterly of a line 250 metres from and parallel to the port side of the maintained channel; then generally westerly along that line to its intersection with western boundary of the harbour of Wallaroo; then generally southerly along the harbour boundary for 0.6 nautical miles; then generally east-south-easterly along a line joining the front lead to the intersection with high water mark; then generally north-easterly along high water mark to the point of commencement.

1.3 OIL TYPES

The OSCP has been designed to cover all spillages of oils carried by vessels arriving, transferring cargo and departing the ports. As listed in Table 1.1 at the end of this Section).

1.4 RESPONSE CAPACITY

The OSCP is designed so that spill responses can be changed according to the size and nature of the spill and the resources at risk. The OSCP is not limited to spills below any particular size.

The OSCP is geared to handle spills of up to 10 tonnes.

Spills larger than this will require the assistance of regional, state or national resources. This is discussed in Section 3.

1.5 FLINDERS PORTS RESPONSIBILITIES

Flinders Ports has a contractual obligation to plan, resource and respond to all spills of up to 10 tonnes Tier 1 spill that occur in Port Waters (as defined in Section 1.2), or that occur outside Port limits but which may impact on port operations.

Flinders Ports also has an obligation to have in place arrangements for the combating of a spill that may exceed 10 tonnes or will impact on areas outside the Port limits.

The OSCP has been prepared as required by the Government, to be consistent with the SA Marine Spill Contingency Action Plan ("SAMSCAP") which is the State plan for the response to an oil spill of any size.

Whilst the OSCP has been prepared for a response to a Tier 1 oil spill the SAMSCAP may be activated if the size of the spill is assessed at greater than that of Tier 1 or the spill is outside the Port limits.

Activation of the SAMSCAP, and hence mobilisation of the associated resource, will be initiated by the State Marine Pollution Controller (SMPC) hence the need for the FP Incident Controller to ensure that the SMPC is informed of any incident and regularly updated on the incident response progression.

1.6 ASSISTANCE IN FIELD OPERATIONS

The SAMSCAP is used for the management of all oil spills outside the port limits referred to in 1.2.2 to 1.2.7 inclusive or an oil spill in the port limits if assessed as in excess of the 10 tonnes or otherwise agreed between the FP Incident Controller and the SMPC.

Where SAMSCAP is activated a number of government agencies may be involved in the spill response at an operational level and include:

1. Transport SA
2. Metropolitan Fire Service
3. Department of Environment and Heritage
4. PIRSA
5. DEHAA
6. Environmental Protection Agency

1.6.1 Government Agencies Involved in Field Operations

There are a number of Government agencies, which may if requested, supply support and materials during a spill response, these are detailed in Table 1.2.

It should be noted though that the responsibility for spill cleanup remains with the company or agency responsible for the spill. In the event of State or Federal assistance all costs incurred are recoverable.

1.6.2 SAMSCAP

The National Plan to combat pollution of the sea by oil, noxious and hazardous substances ("The National Plan"), requires each State and the Northern Territory to prepare contingency plans in the event of an oil; noxious or hazardous substances spill in their jurisdiction. In South Australia this is the South Australian Marine Spill Contingency Action Plan (SAMSCAP).

The aim of SAMSCAP is to detail the roles, responsibilities strategies and actions to be carried out in the event of a spill occurring in waters within the scope of SAMSCAP.

In the event that OSCP is having difficulty in coping with a marine spill or that the incident increases to a Tier 2 or 3 then the SMPC may activate SMSCAP.

1.6.3 Australian Marine Oil Spill Centre (AMOSC)

AMOSC is a non-profit organization, which maintains a stockpile of spill response equipment and coordinates the national distribution of equipment held by participating companies. It aims to supply a 24-hour, national Tier 3 response capability.

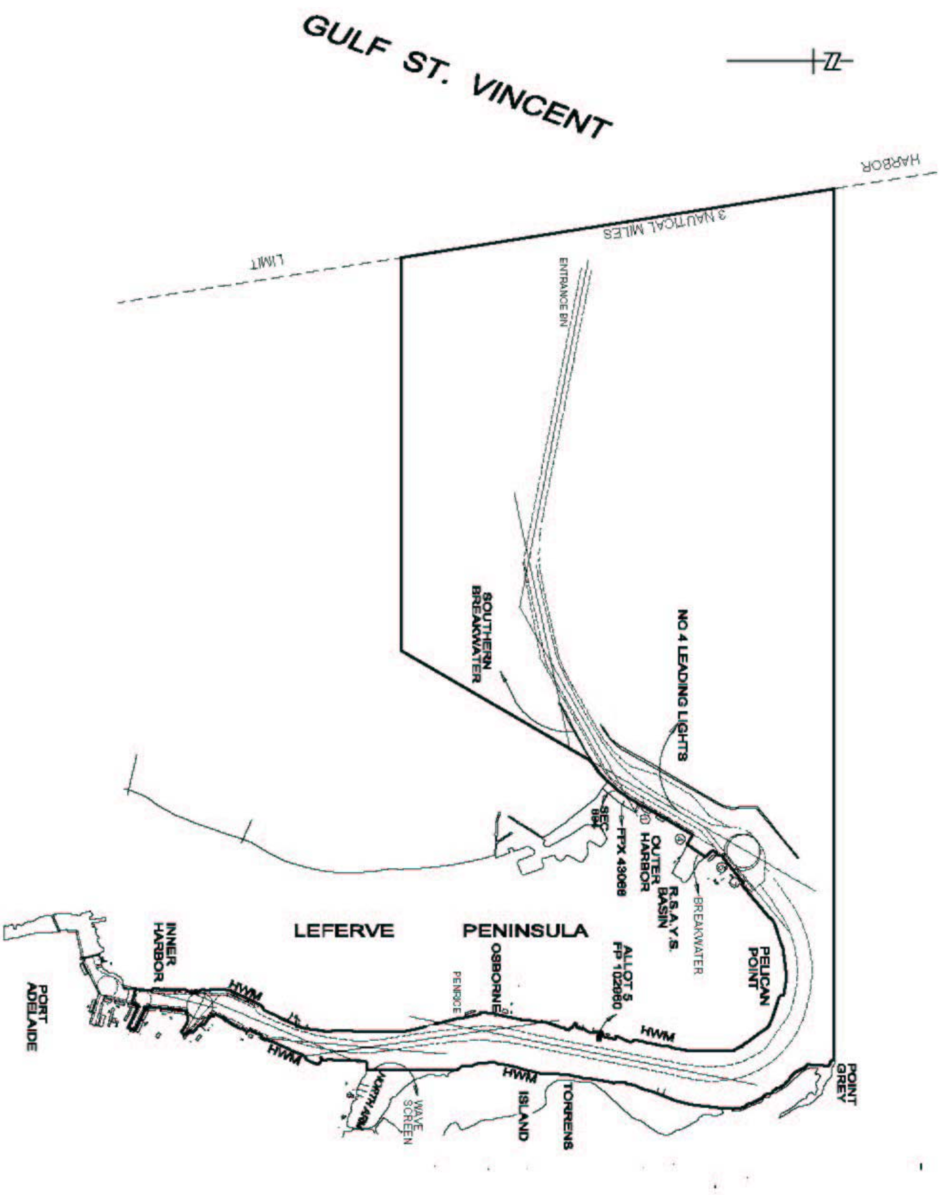
Activation of this resource must be through the SMPC and at Flinders Ports expense (unless the spill is a Tier 2 or 3 in which case it will be a State expense).

AMOSC is located in Geelong, Victoria.

UNCONTROLLED COPY if printed

1.7 FIGURES & TABLES

Figure 1.1 Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Port Adelaide



UNCONTROLLED COPY if printed

Figure 1.2 Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Port Giles

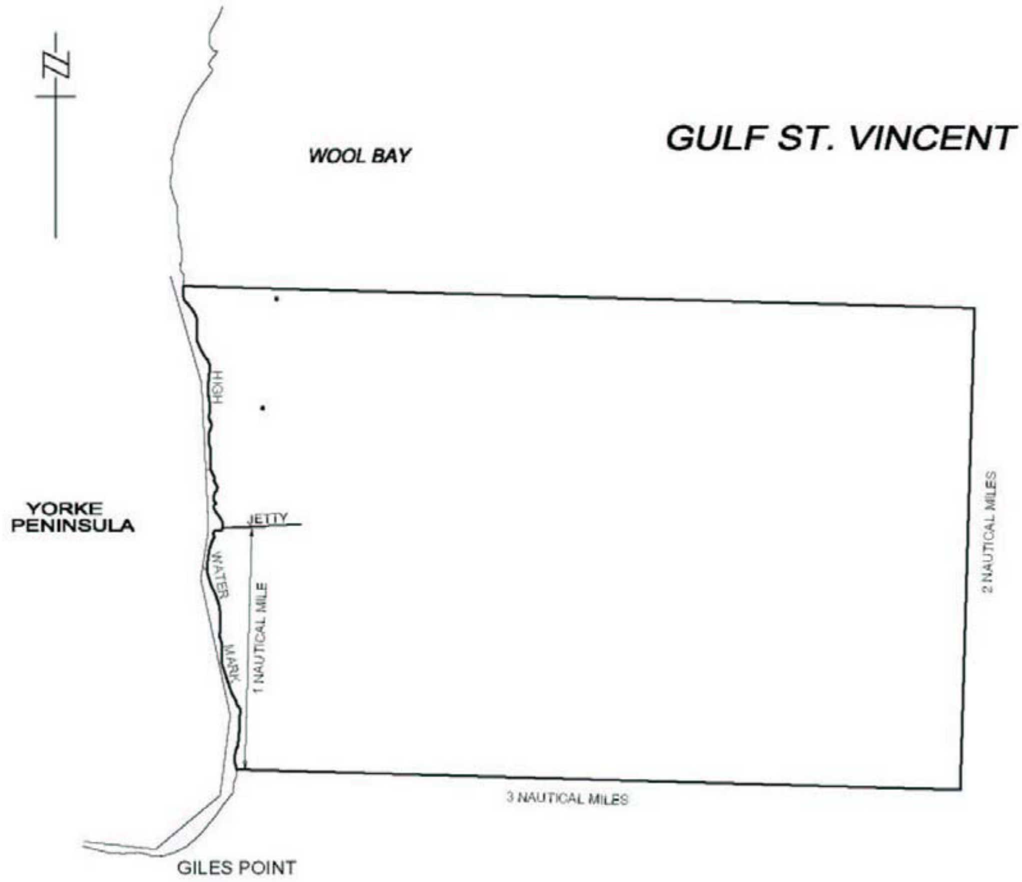


Figure 1.3 Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Klein Point

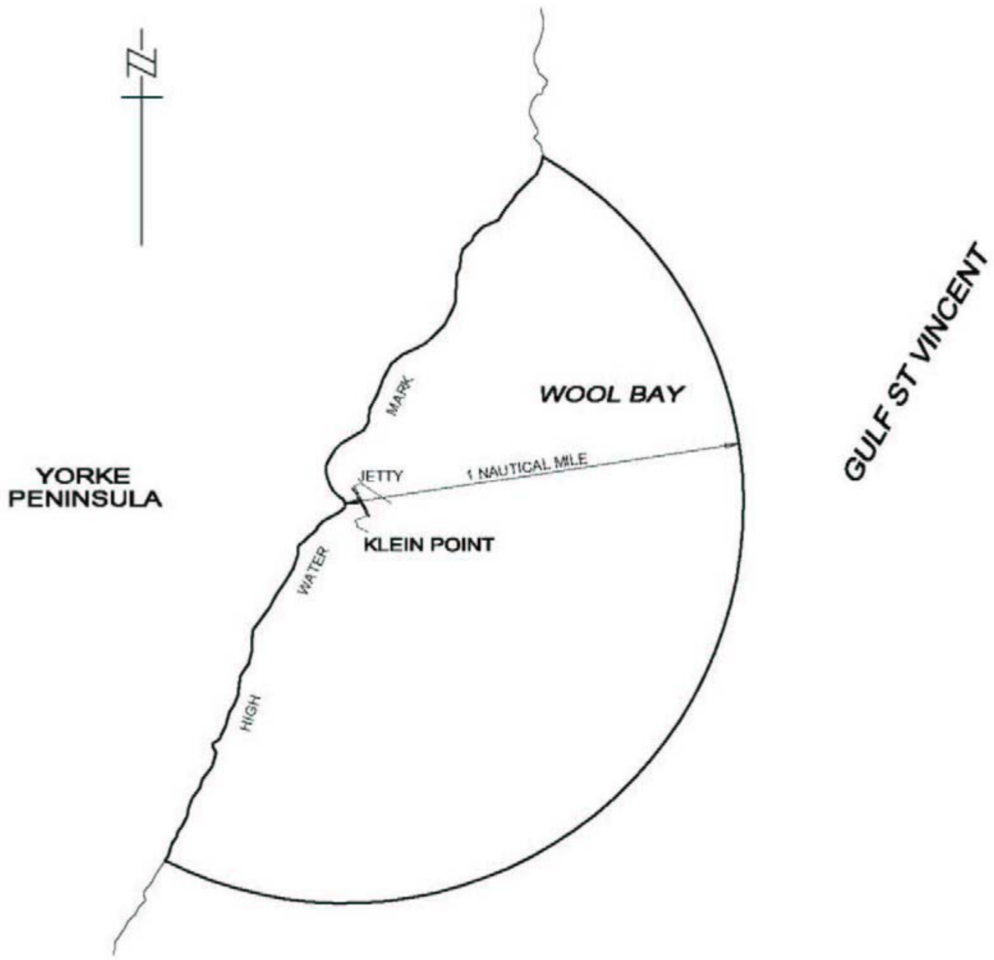
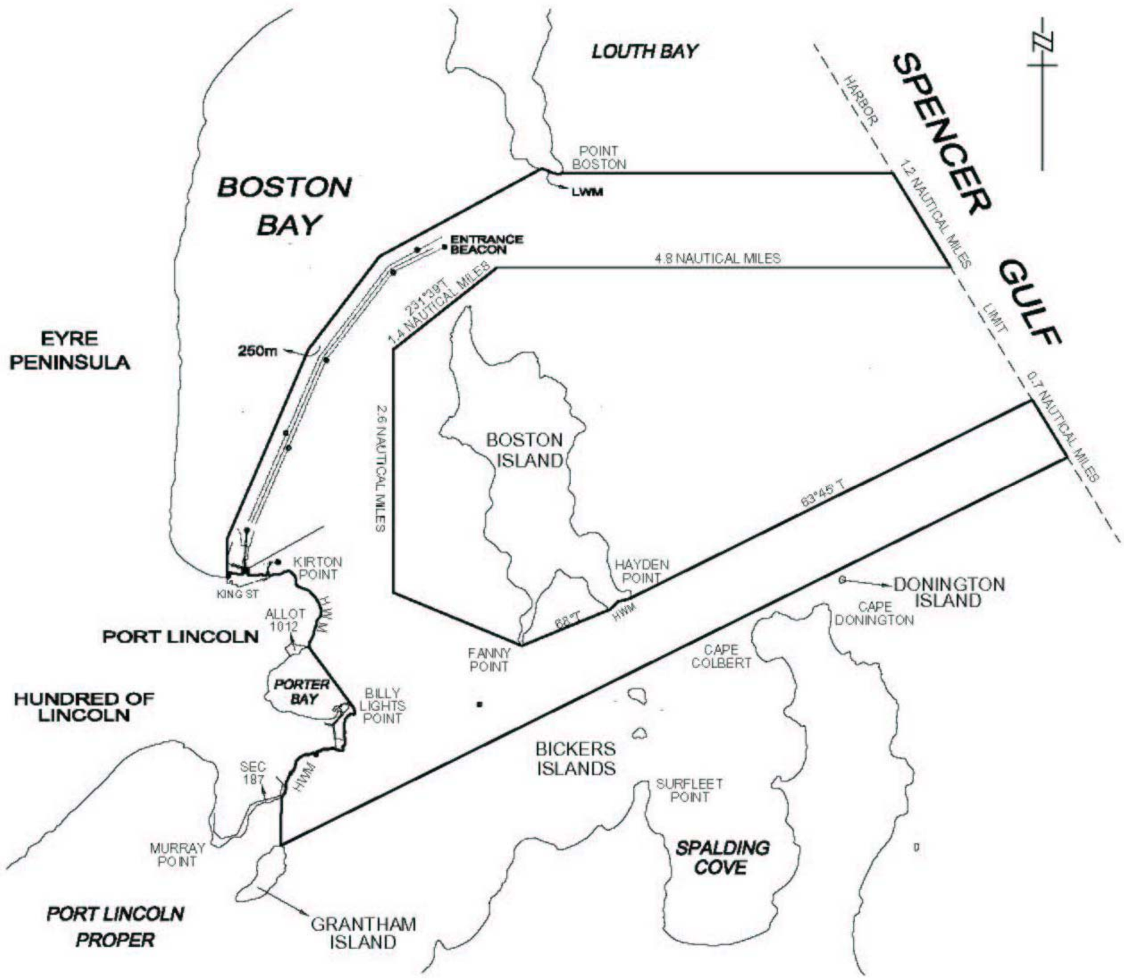
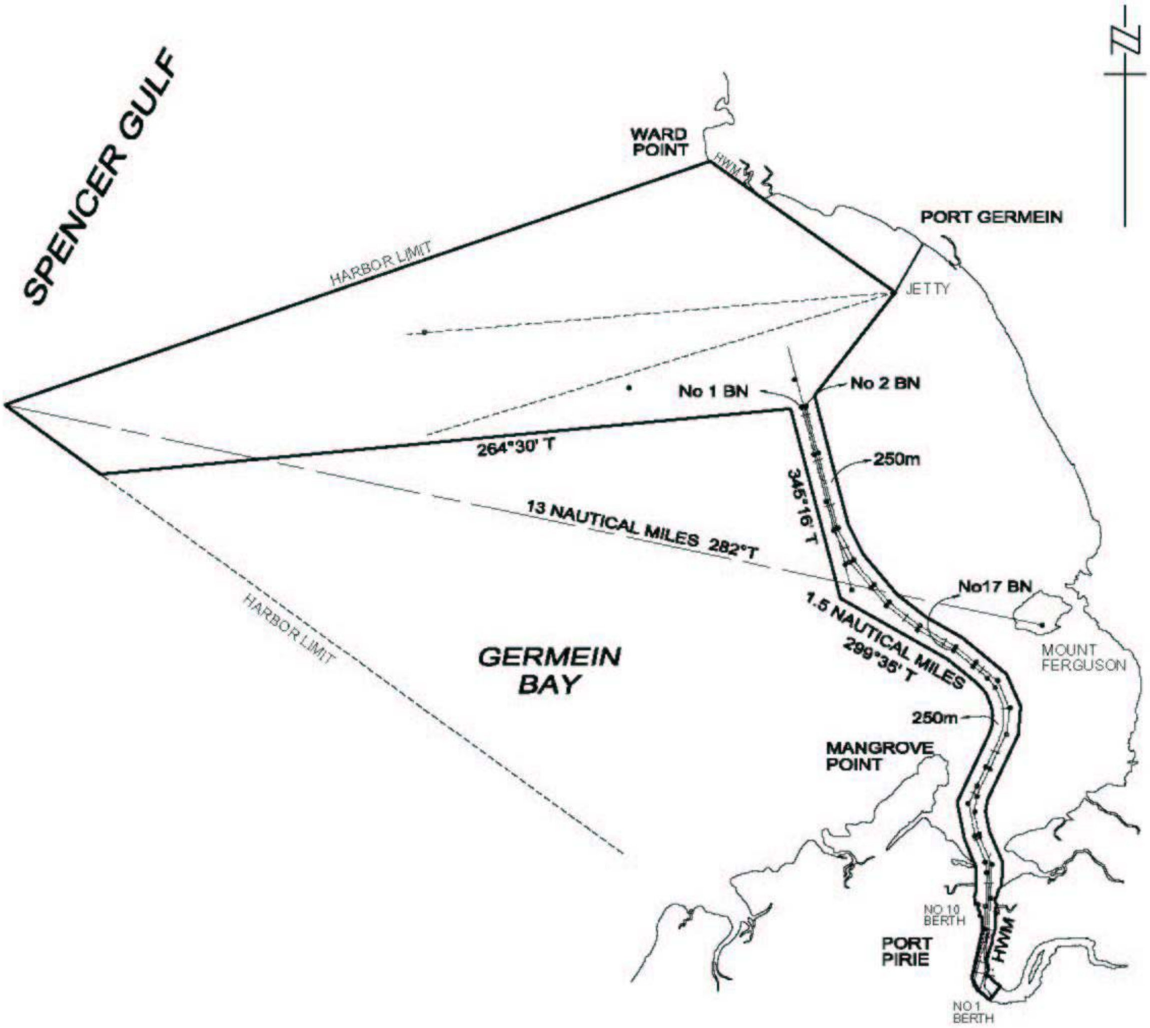


Figure 1.4 Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Port Lincoln



UNCONTROLLED COPY if printed

Figure 1.5 Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Port Pirie



UNCONTROLLED COPY if printed

Figure 1.6 Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Thevenard

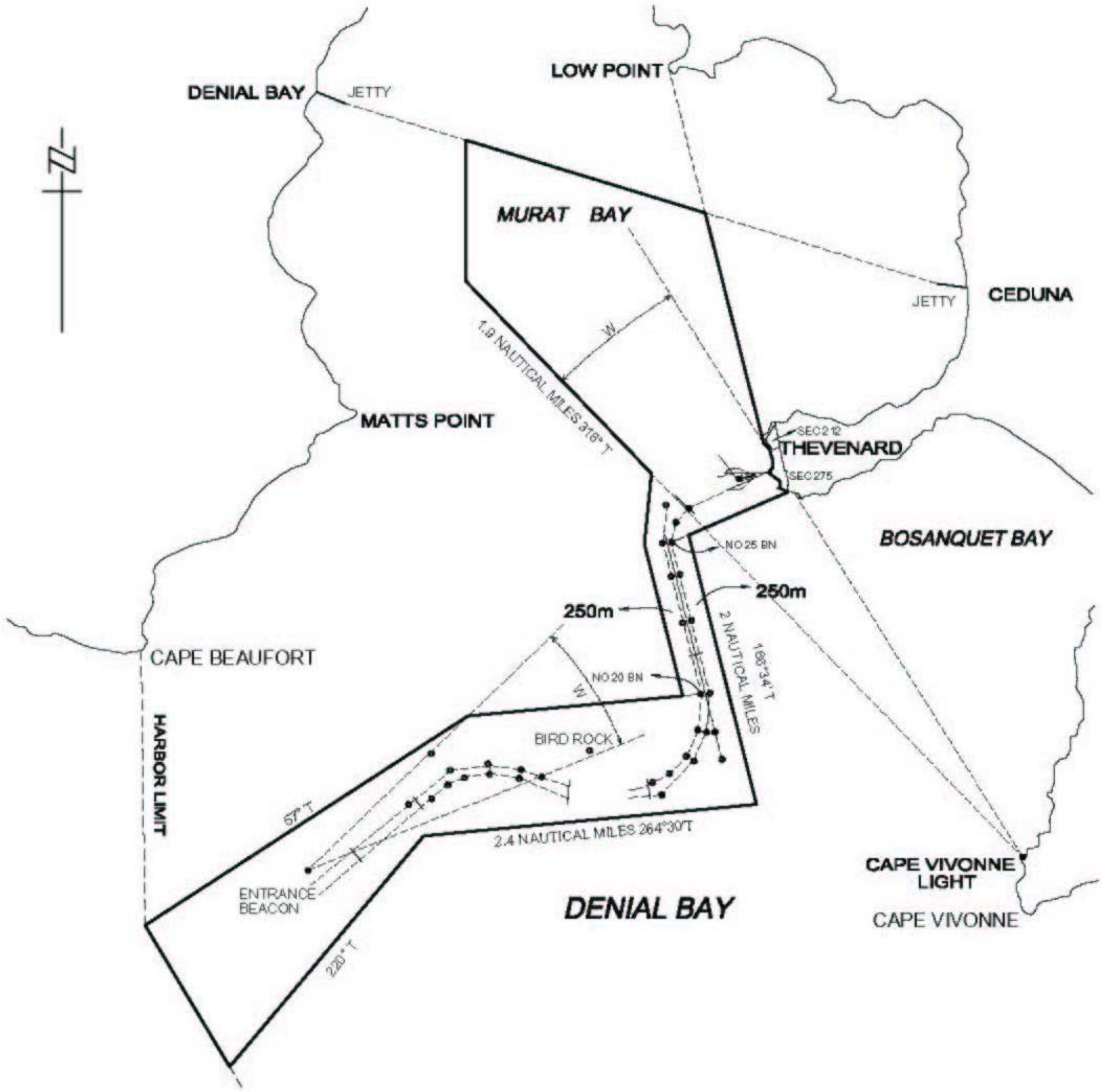


Figure 1.7 **Regional Ports Covered by the FPSA Oil Spill Contingency Plan – Wallaroo**

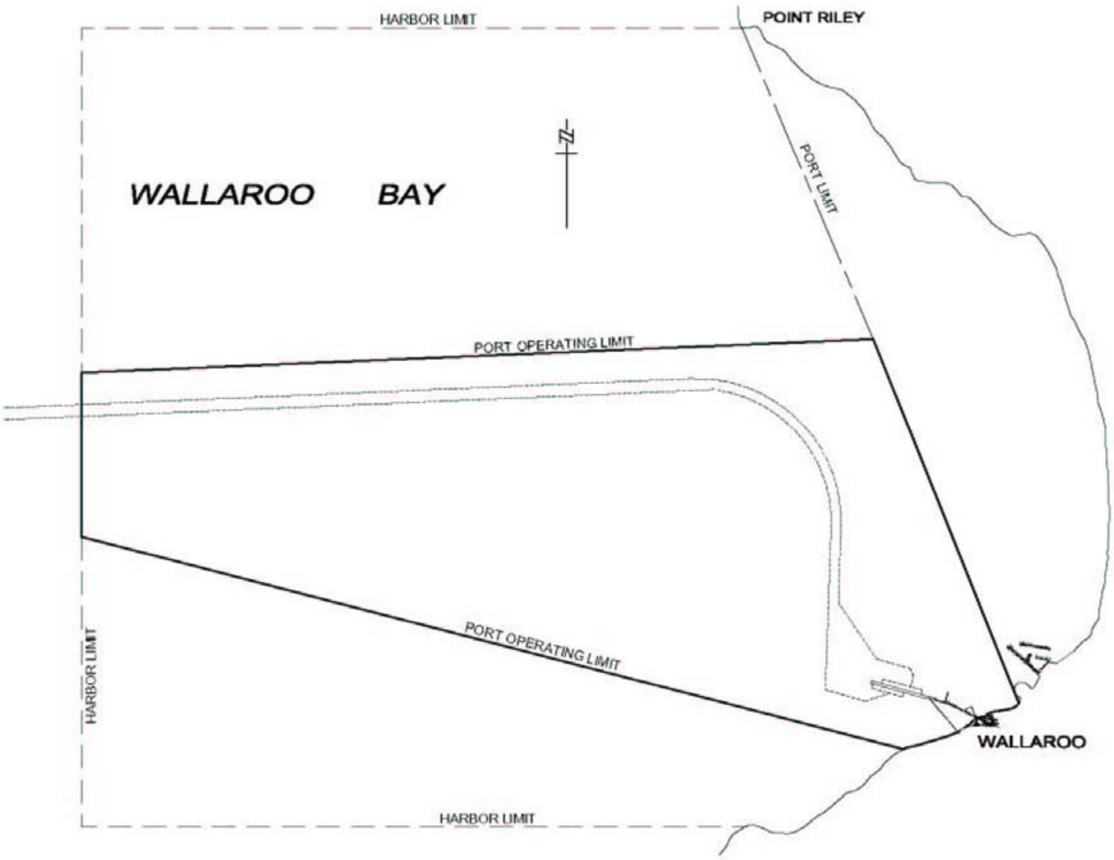


Table 1.1. Types of Oil Handled at FPSA Ports [(1)]

Oil Name		Specific Gravity (@15°C)	Flash Point (°C) [(2)]	Pour Point (°C) [(2)]	Viscosity (cST) [(2)] (@ 40°C)	Viscosity (cST) [(2)] (@30°C)	Oil Group [(3)]
Mogas		0.7-0.78+	<0+	n/a	1.1+	1.5+	I
Dual Purpose Kerosene (DPK)		0.78-0.82	38-40 (min)	•	4.5+	5.5+	II
Diesel	Domestic	0.82-0.88	66	15	1.6-5.8	2.5-7.5+	II
	Export	0.82-0.88	60	0	1.8-5.0	2.7-6.8+	II
Waxy Residue (LSWR)		0.88-0.93	74 (min)	>48	solid	solid	III P
Bunker C Fuel Oil		>0.98	-	2+	400-1000+	1000-2500+	IV P

(1) If other oils are to be imported or exported from the ports, then the OSCP should be revised.
(2) + Estimated * unreported but very low i.e. below operational constraints.
(3) Using the classification system of ITOPF and the US Coast Guard.
P= Persistent Oils.

Table 1.2 Government Agencies, which may be involved in Spill Response Operations

Agency	Function
Transport SA- Marine Department	Incident Controller for state-run spill responses. Area Coordinator and preparedness of equipment and personnel .
Local Authority	Transportation, equipment, personnel and disposal
Fisheries Department	Equipment and advice on marine life
Police	Air and sea reconnaissance, communications and security
Meteorological Department	Advice on meteorology
Fire Department	Service and rescue
Civil Aviation Department	Communications, equipment and Side Looking Airborne Radar (SLAR) service.
Department of Environment	Enforcement, Assessment of the oil spill Postfacto and Training.

2.1 STRUCTURE & REVIEW OF THE OIL SPILL CONTINGENCY PLAN (OSCP)

The sections of the OSCP can be generally grouped into three parts:

PART A: **Management. (Section 1-4)** consisting of a description of the Plan), its purpose and the organization of the Oil Spill Response Team at Flinders Ports South Australia.

PART B: **Action Plan (Section 5 to Section 12).** This part of the plan describes the **actions**, which need to be taken during a spill response. Each section is designed to be a complete 'module' and may be used as a detailed handbook for various aspects of spill response.

PART C: **Appendices.** These contain information that may be needed by support staff, reference materials, or blank assessment forms. This part of the OSCP includes a full list of available equipment, and a contact directory.

2.2 REVISIONS & UPDATE OF THE OSCP

The OSCP is to be reviewed after each spill incident and amended as necessary. This should include:

- Checking telephone and fax numbers
- Checking names of office holders
- Changes to response actions thought necessary on the basis of:
  - training;
  - spill response.
  -

The OSCP and any subsequent amendments are to be approved by the Minister of Transport, prior to promulgation.

2.3 DISTRIBUTION

The OSCP is available via the Flinders Ports website (www.flindersports.com.au). Any printed copies are classed as "Uncontrolled Copies" and should be checked regularly for any amendments. Upon request your details can be added to a distribution list where you will be advised of any amendments to the OSCP by email. The Distribution list will be held by Flinders Ports.

2.4 RESPONSIBILITY OF FPSA STAFF

All FPSA staff involved in the **Oil Spill Response Team (OSRT**) must:

- **Know** their role and **responsibilities** during a spill response;
- **Know** their immediate **supervisors** in the OSRT organization;
- **Be familiar** with the roles and responsibilities of all other members of the OSRT;
- **Maintain** a current copy of the OSCP (available from the Flinders Ports website); **and;**
- Keep their copy of the OSCP in a safe, **accessible** spot.

The **GMMO** and **Incident Controller (IC)** are responsible for maintaining a suitable level of training of all OSRT members and to conduct six monthly desktop exercises with an operational exercise annually, if possible. Where possible, exercises are to be held jointly with Transport SA. Staff will be trained to a level suitable to their responsibilities. Some of the courses offered nationally are outlined in Appendix III

3.1 VOLATILE LIQUID RESPONSE

Any oil spill within the boundaries of the Port, or adjoining areas that may impact on the Port must be immediately reported to the signal station. Using OSCP Spill & Assessment Form (OSCP FM01) the signal station operator will seek to gather the information required by the OSCP and notify the **Incident Controller (IC)**. The **IC** will activate the OSCP in accordance with Section 5. Any spill regardless of size must be reported to the **State Marine Pollution Controller (SMPC)**.

Upon receipt of a report of an oil spill the IC will initiate an immediate response (refer to Section 6) to determine the extent of the spill and to take action to prevent further pollution, safeguard the public, port customers and infrastructure, and to contain or limit the spread of oil during the early stages of the spill unless MoGas is involved.

In the event that MoGas is involved, an exclusion zone on the Port River, beaches and roads should be established by the State Police. The Metropolitan Fire Service/Country Fire Service (MFS/CFS) will be in attendance and will determine the boundaries of the exclusion zone. Vessel movements will be halted and ignition sources shut down. Depending on weather and tidal flow the MFS/CFS may use foam on the slick.

3.2 LEVELS OF RESPONSE: The Tiered Approach

Marine pollution response is based on a escalating scale whereby the amount of equipment, resources and personnel mobilised for a response, and the agency in control, will vary according to the incident characteristics.

The ic IS responsible for determining the Response Tier, in consultation with the **SMPC** (see Sections 4.2 and 6.3).

In order to determine the appropriate response tier it is necessary to first assess the oil spill. The procedures for assessing an oil spill are detailed in Section 6.3 of this OSCP.

3.2.1 Tier Definitions

These levels or response tiers are defined according to:

- the type and quantity of oil spilt
- the potential impact on the marine environment
- potential media and public interest in the incident
- the amount and source of resources deployed
- the levels of support and higher level management activated

The three tiers of response are described in Table 3.1.

3.3 TABLES

Table 3.1 Description of Response Tiers at FPSA

Tier	Description	Nominal [1] Volumes	Person in Overall Charge [2]
1	Spill response is within the capability of FPSA	Up to 70 barrels (10 tonnes)	Incident Controller
2	Beyond the capability of FPSA. SAMSCAP activated.	Between 10 tonnes and 1,000 tonnes	State Committee Chairman
3	Requiring SAMSCAP, National and possibly international assistance.	Above 1,000 tonnes	State Committee Chairman

4.1 THE FLINDERS PORTS SOUTH AUSTRALIA OIL SPILL RESPONSE TEAM

The Flinders Ports South Australia **Oil Spill Response Team (OSRT)** undertakes the responses to all Tier 1 oil spills at Flinders Ports South Australia.

The OSRT consists of four main sections:

- **FP Operations Section** consisting of both Marine Response Group and Shoreline Response Group and coordinated by the Incident Controller **(IC)**;
- **FP Logistic Section** under the control of Operations (Tier 1 or the SAMSCAP in a larger spill) which assists the Operations Section by providing materials and logistic support;
- **FP Incident Management Team (IMT)** headed by **the General Manager Marine Operations (GMMO)**;
- The Flinders Ports **Planning Section** which assists the **IC.**

The structure of the OSRT is shown in Tables 4.1 to 4.7 and Figure 4.2.

Figure 4.1 lists the personnel who are assigned to each of the key roles.

Detailed descriptions of each staff member's role in spill response are provided in Appendix I.

4.2 THE TIER 1 RESPONSE TEAM

The **Tier 1 Response** is under the direct control of the **IC.** The IC role is filled, initially, by the **Duty Pilot.** The role will transfer to the **GMMO** when in attendance.

The **IC** will take whatever action is necessary, in consultation with the **SMPC** to ensure the appropriateness of the response. If the spill is assessed to be greater than Tier 1 the **SMPC** will assume control of the response and activate the **SAMSCAP**. Should this occur FP personnel are to fully cooperate with the **SMPC**.

Where the **GMMO** is not in attendance the **IC** must also keep the person occupying this position informed at all times of the response and the action taken and proposed.

The **IC** is also assisted by the **Marine Operations Officer** and, if shorelines are oiled or threatened, by the **Shoreline Response Manager (SRM).**

If required the **IC** is supported by the **Planning Section**. The **Planning Section** provides technical assistance to the IC as required. The Operations Section comprises **Marine Operations Officer, Shoreline Operations Manager, Waste Disposal Coordinator, OH&S Manager, and Wildlife Operations Coordinator.** Other positions/personnel as described in Tables 4.1 to 4.7 could be called upon on an as needs basis. Appendix 1 describes the responsibilities of the personnel.

4.3 TIER 2 AND TIER 3 RESPONSE TEAMS

Tier 2 and Tier 3 Responses are under the direct control of the **SMPC.** The **SMPC** is the **Chair of the South Australian State Committee.** In the event that a Tier 2 or 3 spill is declared the FPOSCP will be suspended and the SAMSCAP activated.

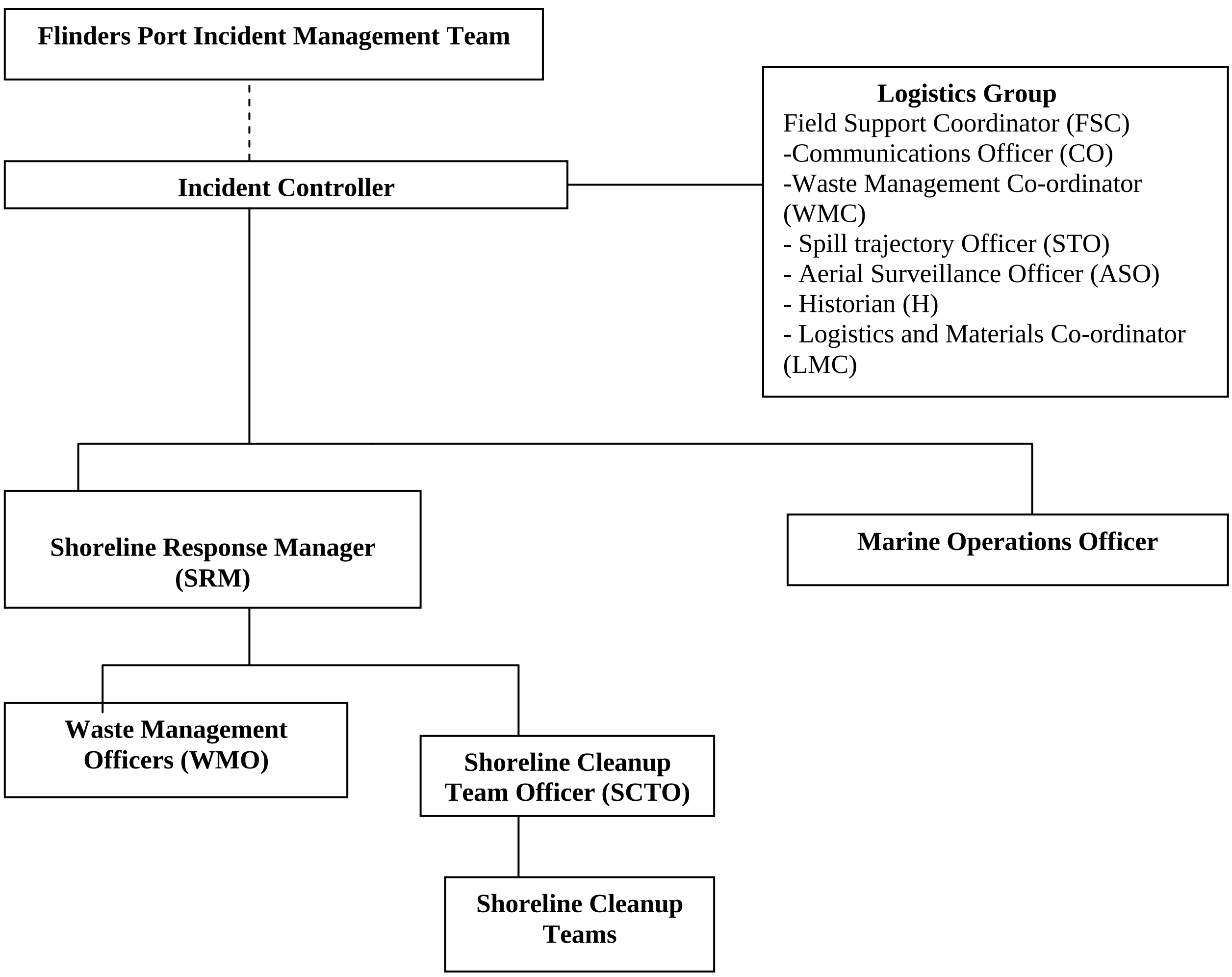
For a Tier 2 or 3 oil spill within the boundaries of a port the **IC** is to assist and be under the direction of the **SMPC.** The **IC** is located 'on scene' at the incident control centre and retains control of field operations (Flinders Ports South Australia staff and contractors).

The **Planning Section** may be expanded for a **Tier 2** or **Tier 3 Response** (Figure 4.2).

The **SMPC** is supported by the **Logistics Section.** This comprises a number of officers responsible for various tasks (see Figure 4.2).

4.4 FIGURES & TABLES

Figure 4.1 Tier 1 Response Organisation

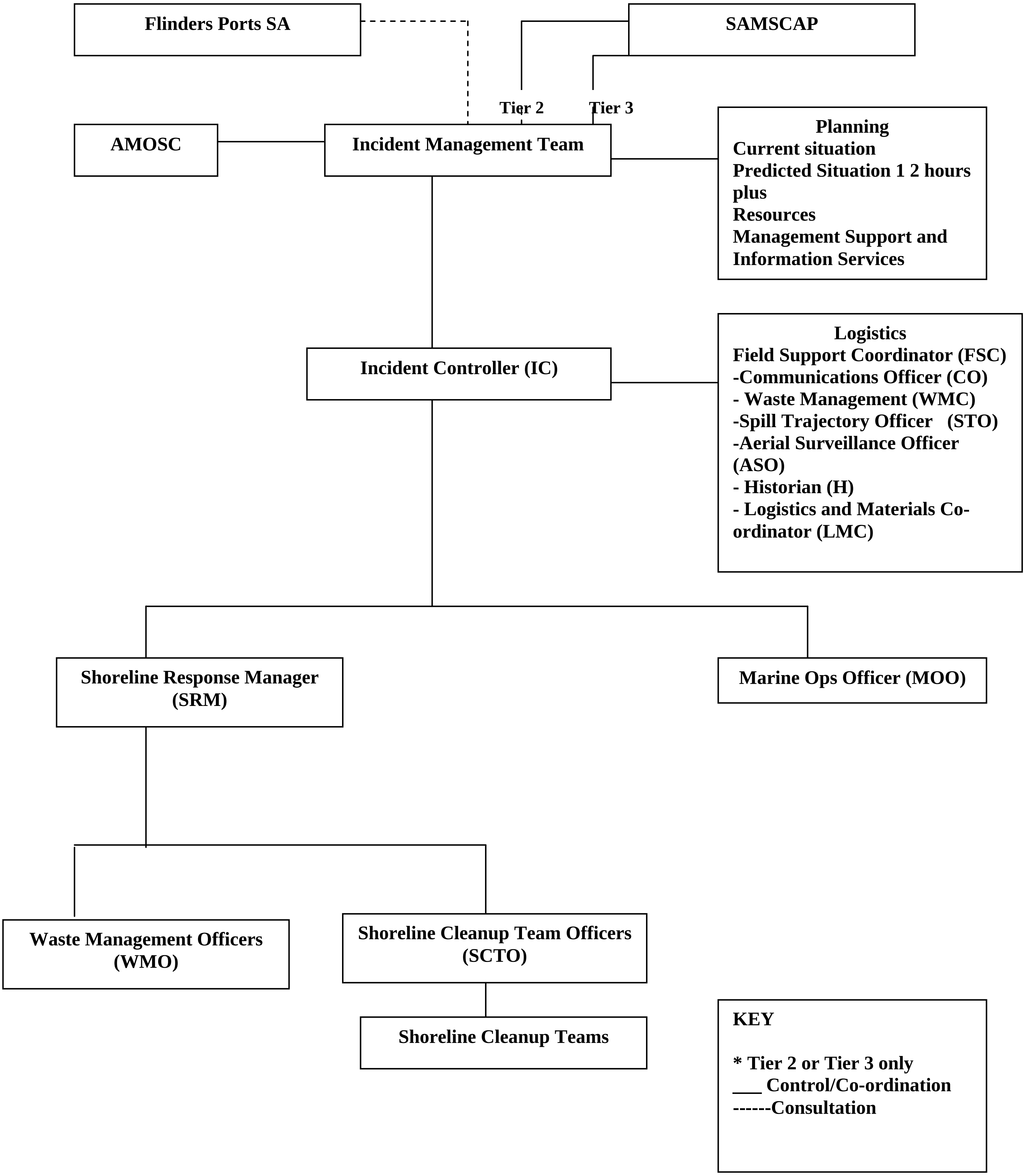


Key:

____ Control/Coordination

------- Consultation

Figure 4.2 Tier 2 and 3 Response Organisation (Table 3.1 SAMSCAP)



UNCONTROLLED COPY if printed

Table 4.1 Allocation of Key Oil Spill Response Team Roles- Port Adelaide

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		GMMO	Carl Kavina	A	S	S	
Incident Controller		IC	Martin Price	A	S	S	
Marine Coordinator		MC	Duty Pilots	A	S	S	
Shoreline Response Manager (1)		SRM	Terry Victory David Scheer Scott Marston	A	S	S	
Planning Coordinator		PC	Terry Victory	A	S	S	
Waste Materials Coordinator		WMC	David Scheer	A	S	S	
Logistics Coordinator		LC	Scott Marston	A	S	S	
Communications Officer		CO	Signal Station	A	S	S	
Media Liaison Officer		MLO	Vincent Tremaine	A	S	S	
Legal Officer`		LO	Mark Travers	A	S	S	
Historian	(Tier 1)	H	David Scheer	A	S	S	
	(Tier 2/3)	SH	David Scheer	A	S	S	
Shoreline Cleanup Team Officers (1)		SCTO	GS Team	A	S	S	
Waste Management Officers		WMO	GS Team	A	S	S	
Pilots		P	Pilots listed Port Adelaide Pilots	A	S	S	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.

(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

Table 4.2 Allocation of Key Oil Spill Response Team Roles- Wallaroo

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		GMMO	Carl Kavina	A	S	S	
Incident Controller		IC	Martin Price	A	S	S	
Marine Coordinator		MC	Duty Pilots	A	S	S	
Shoreline Response Manager (1)		SRM	Terry Victory David Scheer Scott Marston	A	S	S	
Planning Coordinator		PC	Terry Victory	A	S	S	
Waste Materials Coordinator		WMC	David Scheer	A	S	S	
Logistics Coordinator		LC	Scott Marston	A	S	S	
Communications Officer		CO	Signal Station	A	S	S	
Media Liaison Officer		MLO	Vincent Tremaine	A	S	S	
Legal Officer`		LO	Mark Travers	A	S	S	
Historian	(Tier 1)	H	David Scheer	A	S	S	
	(Tier 2/3)	SH	David Scheer	A	S	S	
Shoreline Cleanup Team Officers (1)		SCTO	GS Team	A	S	S	
Waste Management Officers		WMO	GS Team	A	S	S	
Pilots		P	Pilots listed Port Adelaide Pilots	A	S	S	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.
(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

UNCONTROLLED COPY if printed

Table 4.3 Allocation of Key Oil Spill Response Team Roles- Port Giles

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		**GMMO**	**Carl Kavina**	A	**S**	S	
Incident Controller		**IC**	**Martin Price**	A	**S**	**S**	
Marine Coordinator		**MC**	**Duty Pilots**	**A**	**S**	**S**	
Shoreline Response Manager (1)		**SRM**	**Terry Victory** **David Scheer** **Scott Marston**	A	S	S	
Planning Coordinator		**PC**	**Terry Victory**	A	**S**	**S**	
Waste Materials Coordinator		**WMC**	**David Scheer**	A	**S**	**S**	
Logistics Coordinator		**LC**	**Scott Marston**	A	**S**	**S**	
Communications Officer		**CO**	**Signal Station**	**A**	**S**	**S**	
Media Liaison Officer		**MLO**	**Vincent Tremaine**	A	**S**	**S**	
Legal Officer`		**LO**	**Mark Travers**	**A**	**S**	**S**	
Historian	(Tier 1)	**H**	**David Scheer**	**A**	**S**	**S**	
	(Tier 2/3)	**SH**	**David Scheer**	**A**	**S**	**S**	
Shoreline Cleanup Team Officers (1)		**SCTO**	**GS Team**	**A**	**S**	**S**	
Waste Management Officers		**WMO**	**GS Team**	**A**	**S**	**S**	
Pilots		**P**	**Pilots listed Port Adelaide Pilots**	**A**	**S**	**S**	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.

(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

Table 4.4 Allocation of Key Oil Spill Response Team Roles- Klein Point

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		**GMMO**	**Carl Kavina**	A	**S**	S	
Incident Controller		**IC**	**Martin Price**	A	**S**	**S**	
Marine Coordinator		**MC**	**Duty Pilots**	**A**	**S**	**S**	
Shoreline Response Manager (1)		**SRM**	**Terry Victory** **David Scheer** **Scott Marston**	A	S	S	
Planning Coordinator		**PC**	**Terry Victory**	A	**S**	**S**	
Waste Materials Coordinator		**WMC**	**David Scheer**	A	**S**	**S**	
Logistics Coordinator		**LC**	**Scott Marston**	A	**S**	**S**	
Communications Officer		**CO**	**Signal Station**	**A**	**S**	**S**	
Media Liaison Officer		**MLO**	**Vincent Tremaine**	A	**S**	**S**	
Legal Officer`		**LO**	**Mark Travers**	**A**	**S**	**S**	
Historian	(Tier 1)	**H**	**David Scheer**	**A**	**S**	**S**	
	(Tier 2/3)	**SH**	**David Scheer**	**A**	**S**	**S**	
Shoreline Cleanup Team Officers (1)		**SCTO**	**GS Team**	**A**	**S**	**S**	
Waste Management Officers		**WMO**	**GS Team**	**A**	**S**	**S**	
Pilots		**P**	**Pilots listed Port Adelaide Pilots**	**A**	**S**	**S**	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.

(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

Table 4.5 Allocation of Key Oil Spill Response Team Roles-Port Pirie

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		GMMO	Carl Kavina	A	S	S	
Incident Controller		IC	Ray Partingten M Amroliwala	A	S	S	
Marine Coordinator		MC	As above	A	S	S	
Shoreline Response Manager (1)		SRM	Bob Tasanen	A	S	S	
Planning Coordinator		PC	As above	A	S	S	
Waste Materials Coordinator		WMC		A	S	S	
Logistics Coordinator		LC		A	S	S	
Communications Officer		CO	Signal Station	A	S	s	
Media Liaison Officer		MLO	Vincent Tremaine	A	S	S	
Legal Officer`		LO	Mark Travers	A	S	S	
Historian	(Tier 1)	H	David Scheer	A	S	S	
	(Tier 2/3)	SH	David Scheer	A	S	S	
Shoreline Cleanup Team Officers (1)		SCTO	GS Team	A	S	S	
Waste Management Officers		WMO	GS Team	A	S	S	
Pilots		P	Ray Partington M Amroliwala	A	S	S	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.

(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

Table 4.6 Allocation of Key Oil Spill Response Team Roles-Port Lincoln

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		GMMO	**Carl Kavina**	A	**S**	S	
Incident Controller		IC	**P Anderson** **R Cobban** **D Montgomerie**	A	**S**	**S**	
Marine Coordinator		MC	**As above**	**A**	**S**	**S**	
Shoreline Response Manager (1)		SRM	**As above plus Bill Richter**	A	S	S	
Planning Coordinator		PC	**As above**	A	**S**	**S**	
Waste Materials Coordinator		WMC	**As above**	A	**S**	**S**	
Logistics Coordinator		LC	**As above**	A	**S**	**S**	
Communications Officer		CO	**SES Controller**	**A**	**S**	**S**	
Media Liaison Officer		MLO	**Vincent Tremaine**	A	**S**	**S**	
Legal Officer`		LO	**Mark Travers**	**A**	**S**	**S**	
Historian	(Tier 1)	H	**P. Anderson** **D Montgomerie**	**A**	**S**	**S**	
	(Tier 2/3)	SH	**P Anderson** **D Montgomerie**	**A**	**S**	**S**	
Shoreline Cleanup Team Officers (1)		SCTO	**P. Woodfield** **P Anderson** **Bill Richter** **Dean Palm**	**A**	**S**	**S**	
Waste Management Officers		WMO	**P. Woodfield**	**A**	**S**	**S**	
Pilots		P	**R. Cobban** **J Joubert**	**A**	**S**	**S**	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.

(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

UNCONTROLLED COPY if printed

Table 4.7 Allocation of Key Oil Spill Response Team Roles-Thevenard

Oil Spill Response Team (OSRT) Role		Abbrev.	Normal Operational Role (Staff Responsible)	Tiers 1	2	3	Active Station
General Manager Marine Operations		GMMO	Carl Kavina	A	S	S	
Incident Controller		IC	J Joubert D. Montgomery	A	S	S	
Marine Coordinator		MC	As above	A	S	S	
Shoreline Response Manager (1)		SRM	As above	A	S	S	
Planning Coordinator		PC	As above	A	S	S	
Waste Materials Coordinator		WMC	As above	A	S	S	
Logistics Coordinator		LC	As above	A	S	S	
Communications Officer		CO	P. Codrington (0427 69 161)	A	S	S	
Media Liaison Officer		MLO	Vincent Tremaine	A	S	S	
Legal Officer`		LO	Mark Travers	A	S	S	
Historian	(Tier 1)	H		A	S	S	
	(Tier 2/3)	SH		A	S	S	
Shoreline Cleanup Team Officers (1)		SCTO	G Drummond. (0407 612 356)	A	S	S	
Waste Management Officers		WMO	Chris Holland (0427 776 015)	A	S	S	
Pilots		P	R. Cobban J Joubert	A	S	S	

(1) Only activated if shorelines are impacted or likely to be impacted by oil.

(2) A: Active/Operational S: Standby N: Normal

MCC: Maritime Control Centre (Port General office ECC: Emergency Control Centre

5. STARTING THE OIL SPILL RESPONSE

UNCONTROLLED COPY if printed

5.1 INTRODUCTION

Initiation of the Oil Spill Response involves:

- Reporting of an oil spill (Section 5.2)
- Preliminary spill Assessment (Section 5.3)
- Notification of authorities (Section 5.4)
- Mobilisation (Section 5.5)

5.2 REPORTING OIL SPILLS

5.2.1 General: All Staff and Contractors

All Flinders Ports South Australia staff and contractors (including boat crews) **must** report **any** observation of oil or oil-like substance on the sea or shoreline.

All staff and contractors must:

- Contact Signal Station on 8248 3505 or, 8447 0696 who will then contact the Incident Controller (IC) and General Manager Marine Operations (GMMO).
- If oil is observed, determine;
  - the source of the spill
  - whether the spill is continuing
  - whether a risk exists to human health and safety.
- Take **immediate actions** to stop the cause of the spill if these can be done safely;

The reporting sequence is summarised in Figure 5.1. The responsibilities of key staff are outlined below.

5.2.2 Notification from the Public

The public will be encouraged through the Flinders Ports website and other information sources to contact the Signal Station to report an oil spill. The Signal Station will seek the information required by the Flinders Ports Oil Spill Contingency Plan and inform the **IC** as necessary.

It is important that:

- The reporting person is assured that their call is appreciated **and will be acted upon**;
- Details are obtained and recorded. In particular:
  - the time of observation'
  - the position of the oil or oil like substance;
  - description of the substance e.g. colour, area etc.

5.2.3 Incident Controller

Upon receiving a report of oil spillage, or oil on the sea, the Incident Controller will (using OSCP Form 005):

- Verify the report
- Inform **GMMO**
- Ensure that no risk to human health and safety exists and take appropriate actions if such a situation **does** exist.
- Determine and record:
  - the name of vessel and master reporting the spill;
  - position of the vessel at time of observation;
  - time of report.
- Determine the size and nature of the slick;
- Report all details to the **SMPC** in the **GMMO's** absence.
- Initiate the **Immediate Response** if necessary (Section 6)
- Ensure that appropriate steps have been taken to determine the source of the spill;
- Ensure that the fault, if any, is being rectified.

5.3 PRELIMINARY SPILL ASSESSMENT

The **Planning Co-ordinator (PC)** is responsible for providing the Incident Controller with enough detail to enable an initial spill assessment of the size and nature of any oil spill. This can be done by completing **OSCP Spill & Assessment Form (OSCP FM01)** and providing the information to the IC. This may be done initially by radio.

It is important that a spill report is <u>not</u> held up due to the lack of some details. Where information is not available this should be <u>clearly stated</u>. Spill size should <u>not</u> be underestimated on the basis of lack of information.

The **IC** in consultation with the **PO** determines the level (Tier) or spill response required (see Section 5.4). The **IC** will inform the **PO** and plan for a suitable response (Section 5.5).

5.4 NOTIFYING AUTHORITIES

It is the responsibility of the **IC** to ensure that **all** spills are reported to the **GMMO** who reports the spill to the **SMPC.**
The **IC** will also report Tier 1 spills to **MLO** and **OSRT**.

The **IC** is also responsible for notifying the relevant authorities.

5.5 MOBILISATION

5.5.1 Mobilisation Oil Spill Response Team (OSRT)

The **Immediate Response will be initiated by the Incident Controller (IC)** in consultation with the **SMPC.** (See Section 6).

The **IC** is also responsible for mobilising personnel and equipment in consultation with the **PO** for Tier 1 spills.

5.5.1.1 Incident Controller (IC)

If a Tier 2 or 3 response is required the **SMPC** will activate the SAMSCAP and may require the assistance of the Flinders Ports **IC**, logistics and other resources of the FPOSCP. The **GMMO** will assist the **SMPC** as necessary.

5.5.2 Flinders Ports South Australia Emergency Control Centre (ECC)

The ECC is situated on the first floor of the Flinders Ports building, St Vincent Street, Port Adelaide. It will be activated by the **IC** or **GMMO** for use during a response.

Upon being called to the ECC the **IC** will:

- ensure that any additional equipment is collected if required;
- confirm that the Flinders Port South Australia hand held portable VHF/FM Marine Band Units are operational;
- ensure that all telephone lines and facsimile lines in the ECC are connected and operational;
- take possession of additional portable radios and portable telephones and store in the Emergency Control Centre;
- note numbers and recipients of units distributed;
- ensure the distribution of equipment as required.

In the event of a Tier 2/3 spill being determined by the SMPC the SMPC may establish an ECC at another site.

5.5.3 Equipment, Materials, Labour and Logistic Support

5.5.3.1 Field Support Group

The **Logistics Officer (LO)** is responsible for ensuring that adequate Flinders Ports South Australia materials are mobilised for the spill response and distributed as required.

The **LO** will, upon request from the **IC** or **GMMO**, acquire materials or equipment from the sources in South Australia.

UNCONTROLLED COPY if printed

In a **Tier 2 or Tier 3 Response** the **LO** may be required to mobilise **regional national** or **international** stockpiles upon request from the **SMPC**.

5.5.3.2 Planning Section

In larger responses (Tier 2 or 3) the **Planning Officer (PO)** may be responsible for acquiring specialist contractors used in the spill response. This will be directed by the **SMPC**.

5.5.4 Finance and Accounting

In any spill response the **LO** may assign the **Finance & Accounting Officer (FAO)** to monitor and document equipment usage and expenditure (see Appendix 1).

5.6 FIGURES & TABLES

Figure 5.1 Sequence for Reporting Marine Oil Spills

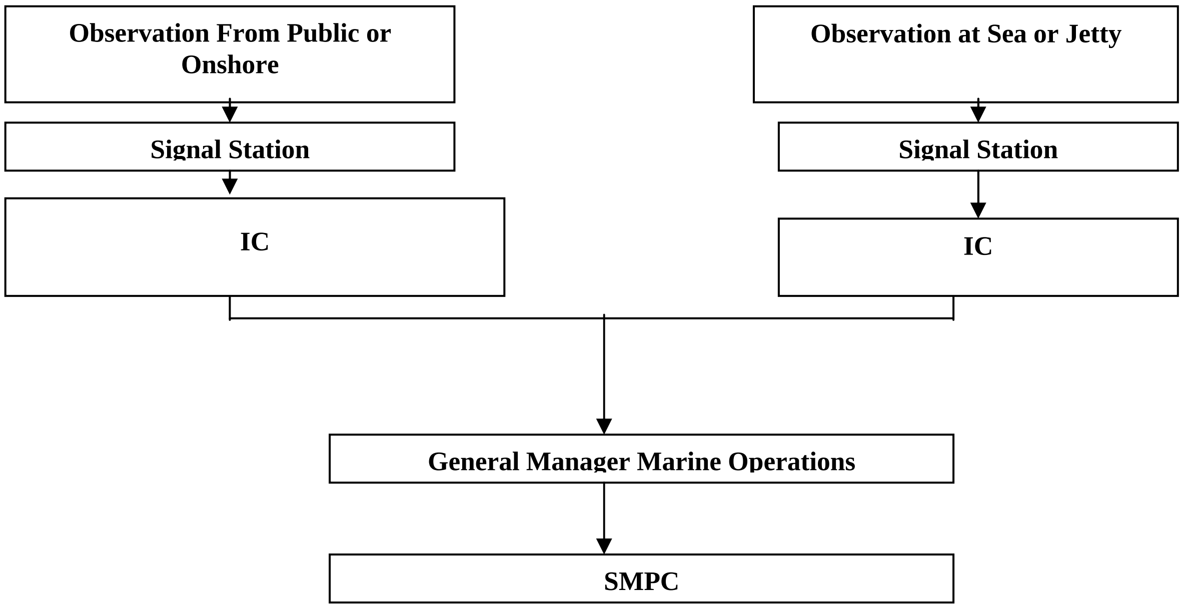


Table 5.1 Government and Other Authorities to be notified in Event of Oil Spill

Authority	Required for		
	Tier 1	**Tier 2**	**Tier 3**
Environment Protection Agency	+	+	+
Transport SA	+	+	+
AMSA Canberra		+	+

6. SPILL ASSESSMENT & MONITORING

UNCONTROLLED COPY if printed

6.1 GENERAL

An accurate estimation of spill volumes, and the type of oil spilt is essential if an appropriate level of response is to be mobilised and effective strategies and equipment used. A **preliminary** assessment is done by the **IC** but is unlikely to be entirely accurate. A **follow up assessment** of the spill is therefore required. However, the size of an oil slick and the nature of the oil are not constant. Weathering processes act to either increase or decrease slick volumes and, generally, the viscosity of oil will increase over time. This has implications for the effectiveness of spill response strategies. **Ongoing surveillance and assessment of the spill is required.**

6.2 PRELIMINARY SPILL ASSESSMENT

The preliminary assessment of an oil spill is to be undertaken by the **IC** or a trained nominee in consultation with the **SMPC**. The following parameters should be recorded.

6.2.1 Volume

Estimates of spill volumes can often be made on the basis of the cause of the spill and the duration of the spill event. It is also possible to estimate the volume of a slick on the basis of its appearance and area covered (Table 6.1 and Figure 6.2).

6.2.2. Oil Type

The type of oil spilt should be recorded. **It is important to differentiate between spills of crude oils, bunkers or refined product. Spillages of refined volatile product present distinct risks to human health and safety and the spill control**

methods outlines in this OSCP should not be used to respond to spills of these products. Spills of refined product have gas plumes associated with them and the lead agency for gaseous vapours will revert to the Metropolitan Fire Service/Country Fire Service (MFS/CFS).

6.2.2.1 Nature of the Incident

Information regarding the cause of the spill can be important in:

- Determining whether there is, or is likely to be, a threat to human health and safety;
- Calculating the volume, or potential volume, of a spill.

6.2.3 Weather Conditions

6.2.3.1 Wind Speed and Direction

Wind speed and direction at the time of a spill can assist in determining the initial trajectory of the slick. The Duty Pilot should obtain wind speed and direction from the anemometer at the Flinders Ports South Australia Jetty.

6.2.3.2 Tides

Tidal currents are the main influence on oil movement within port limits. The time of the spill should be noted, and current **tide tables** consulted in order to determine tidal direction and time of next change.

6.2.3.3 Sea State

Sea conditions influence not only the behaviour of spilt oil but also determine whether some spill management strategies are possible.

6.3 CONTINUING ASSESSMENT

For any spill requiring a **Response,** continuing surveillance of the slick is required. This can be assisted by the use of the **Oil Spill Trajectory Model** (See Appendix III).

Note: Computerised spill models should <u>not</u> be used as a substitute for field surveillance and assessment of an oil slick.

6.3.1 Vessels

Vessels can be used to monitor an oil slick. Vessels can be used to confirm shoreline impact of oil and to retrieve samples of the oil if required. Collection of samples should carries out under the direction of the EPA.

Any small boat can be used in this role. Boats with outboard motors should generally **not** be used to sample surface oil, due to their tendency to contaminate surface waters with films of light fuel oil.

6.4 SPILL PREDICTION

Predicting the movement and behaviour of an oil slick may be undertaken using the computerised Oil Spill Trajectory Model or, approximately, using manual calculations.

6.4.1 The Oil Spill Trajectory Model

An oil spill trajectory model is available to predict the movement of oil at sea. It is run by a nominated **Spill Trajectory Officer (STO)** assigned to the **Operations Section**.

The **IC** will commission the use of this model and be responsible for the provision of wind and other data to the STO.

6.4.2 Spill Prediction: Manual Estimates

6.4.2.1 Trajectory

Spill trajectory can be estimated by adding the vectors of current velocity to approximately 3% of the wind velocity. This is illustrated, and explained in Figure 6.1

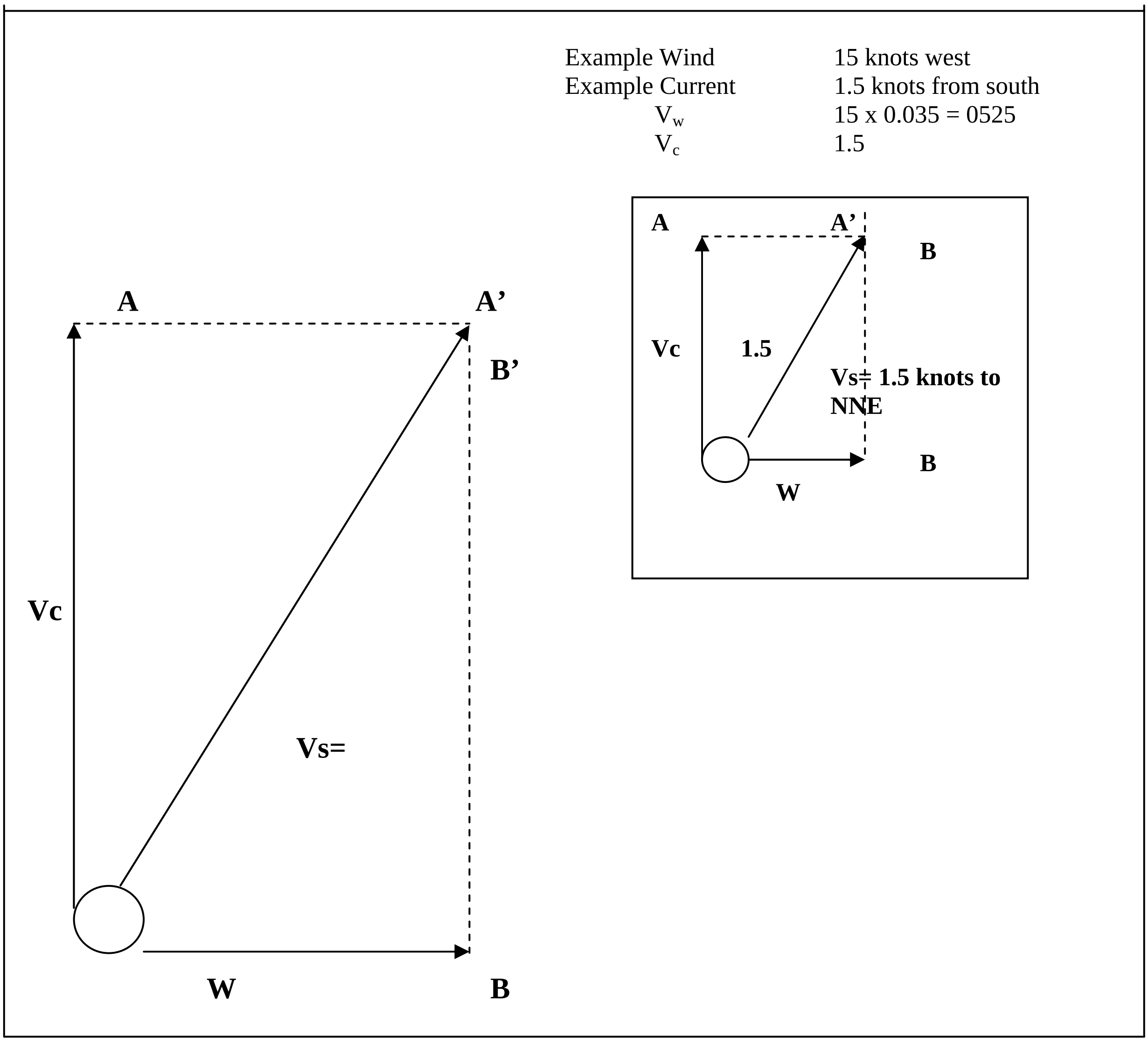
6.4.2.2 Oil Behaviour

The volume, and area of a slick, and the character of the oil will change in time. Figure 6.2 can be used to calculate approximate changes in viscosity for the diesel oils and bunkers used in Flinders Ports South Australia.

Changes in slick **volumes** can be very approximately estimated using Figure 6.3. Estimates of slick area are seldom accurately predicted. These are best estimated by observation.

6.5 FIGURES & TABLES

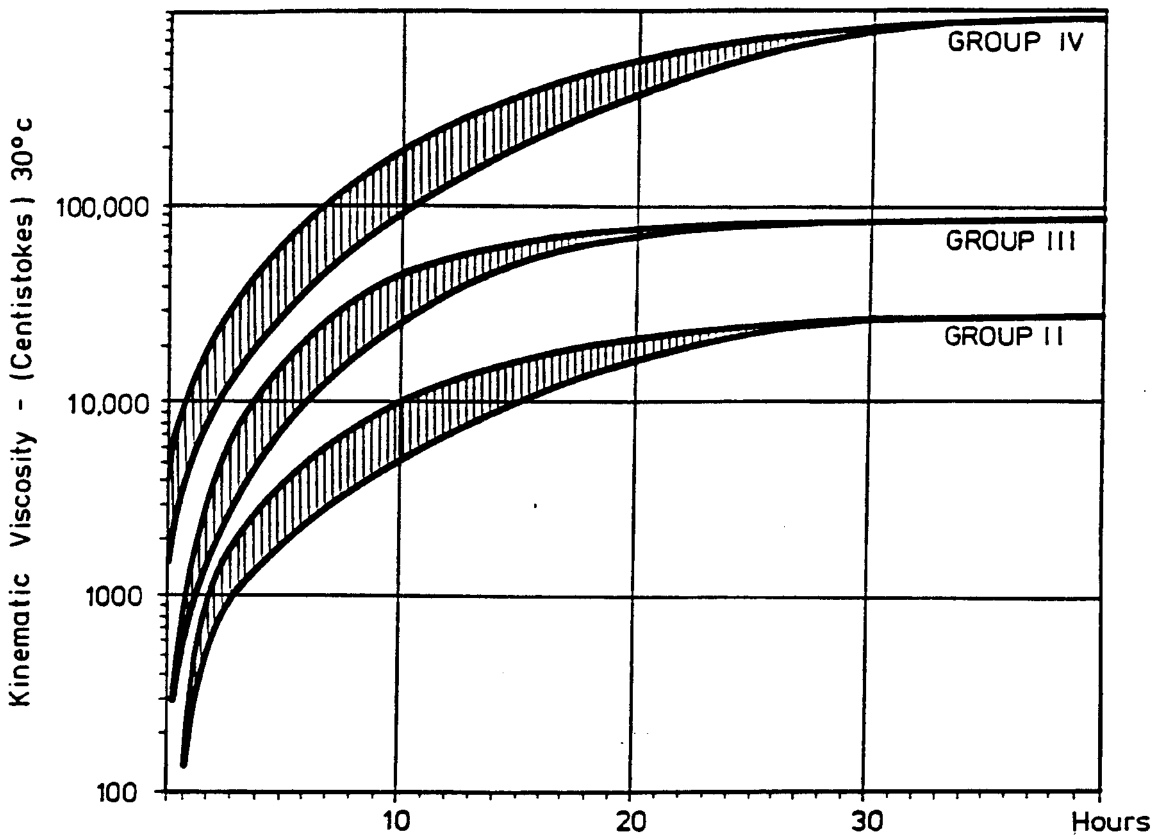
Figure 6.1



Calculation:

1. Plot location of spill at point O
2. Layout V_w and V_c from known headings, using the same length scale for both vectors.
3. Draw a line (A-A') parallel to V_w starting at the tip of V_c and a line (B-B') parallel to V_c starting at the tip of V_w.
4. Draw a line from O to A'B'. This is the Slick Vector V_s.
5. The length of V_s determines slick speed in knots and the direction is evident.

Figure 6.2 Change in Oil Viscosity over Time (Moderate to Rough Seas)



NOTE:

Group I	Naphtha, Mogas, Condensate
Group II	Tapis Blend Crude
Group III	Waxy Residue (LSWR)
Group IV	Bunker Fuel Oil

Critical Viscosities:

2000 cSt:	Dispersant efficiency reduced
4000-5000 cSt:	Dispersants not effective
2500 cSt:	Disc skimmer efficiency reduced
3000-4000 cSt:	Oleophilic mop skimmer efficiency reduced

Figure 6.3 Change in Slick Volume Over Time

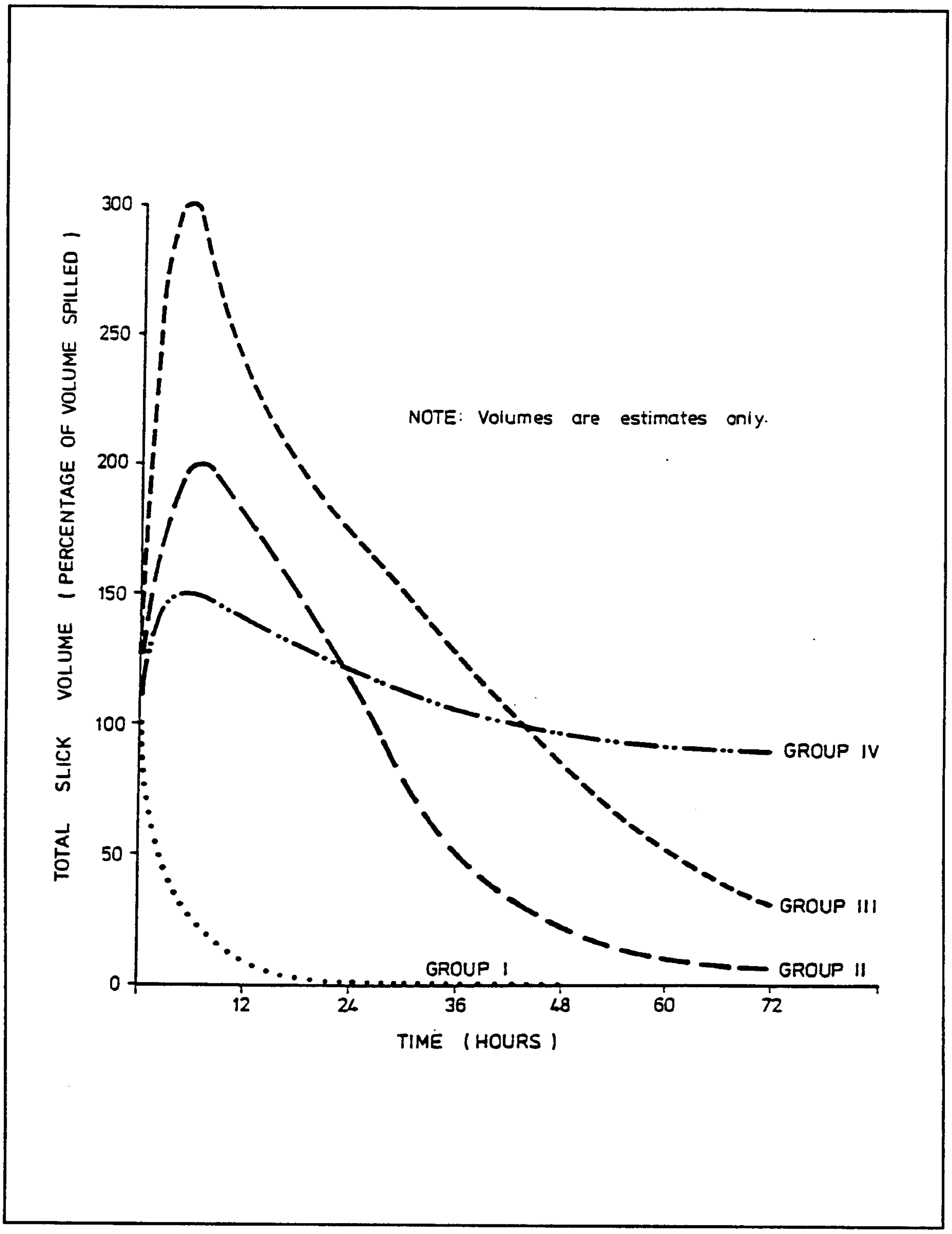


Table 6.1 Guidelines for Estimation of Spill Volume

Appearance of Film	Film Thickness ($x10^{-6}$m)	Volume of Oil per Km^2		
		m^2	Tonnes	Barrels
Barely Visible Except under some light conditions	0.05	0.05	0.04	0.31
Silvery Sheen	0.10	0.10	0.09	0.63
Rainbow – Iridescence Bright bands of colour	0.30	0.30	0.26	1.89
Dull Colours Colours still visible but are dull	1.00	1.00	0.85	6.29
Dark Black or brown or very dark colour	2.00	2.00	1.70	12.60

7.1 INTRODUCTION

The preferred response action, in all spills, is to contain and recover oil from the water surface. If containment and recovery is not possible then shoreline protection methods, deflection boom arrays or dispersant options must be considered. The **Incident Controller (IC)** will consult with the **Planning Officer (PO)** to determine the nature of any **Immediate Response** within Flinders Ports Port limits. Generally, containment and recovery strategies can be used only if:

- Oils are **not** light volatile products or condensates;
- Sea states are less than Force 5;
- Wind velocities are less than 20 knots;
- Tidal currents at the spill site are under 2.0 knots.

7.2 TIER 1 - SPILLS AT THE JETTIES AND IN PORT LIMITS

7.2.1 Containment and Recovery

Initiation of the Immediate Response to spills at the Flinders Ports South Australia Jetties is the responsibility of the IC. Upon receiving a spill report the **IC** will with the approval of the **SMPC:**

- Despatches the oil pollution emergency trailer and where appropriate activate either the Murex or Conch.

- Despatch a vessel to collect a reel of boom, power pack, towing bridles, etc., a skimming unit and to take a slop barge alongside. Assisted by one of the line boats, the vessel should proceed to the down current boom connector (tidal compensator) and attach one end of the boom. The vessel will then maintain a 'J' configuration (Figure 7.1 (a)) or take instructions from the **IC**.

- Once in position with the boom deployed, the vessel will deploy the recovery unit into the oil and commence recovery into slop barge (Figure 7.1 (a)).

- In high sea states or currents a second vessel may need to assist (Figure 7.1 (b)).

- If oil has travelled past the fixed boom point, the vessels should proceed to the leading edge of the slick, deploy the boom, retaining one end, and passing the other end to other available vessels. The vessels should then take up station such that the boat forms a 'J' configuration. The vessel on the short leg of the boom with the slop barge alongside will deploy the skimmer unit and recover oil into the slop barge (Figure 7.1 (c)).

In the event of a large or continuing spillage a second boom should be deployed with two vessels, one of which will have storage capacity and a recovery unit onboard. This second containment system will take up station astern of the first boom array. Any oil escaping from the first system will then be collected by the second (Figure 8.5, Section 8).

7.2.2 Secondary Boom Deployment

Should the IC consider protection of sensitive areas is required, deflection booming may be called for.

7.2.3 Use of Dispersants

Authorisation is required for the use of dispersants. Such authorisation must come from the **State Marine Pollution Controller (SMPC)** in conjunction with the **Environmental Protection Authority (EPA).** To obtain this, the following steps should be followed:

- If oil is not contained, or is unlikely to be contained, the IC must inform the **Planning Officer (PO)** who will seek approval from the **SMPC** for the use of dispersants.

- The **SMPC** may either:

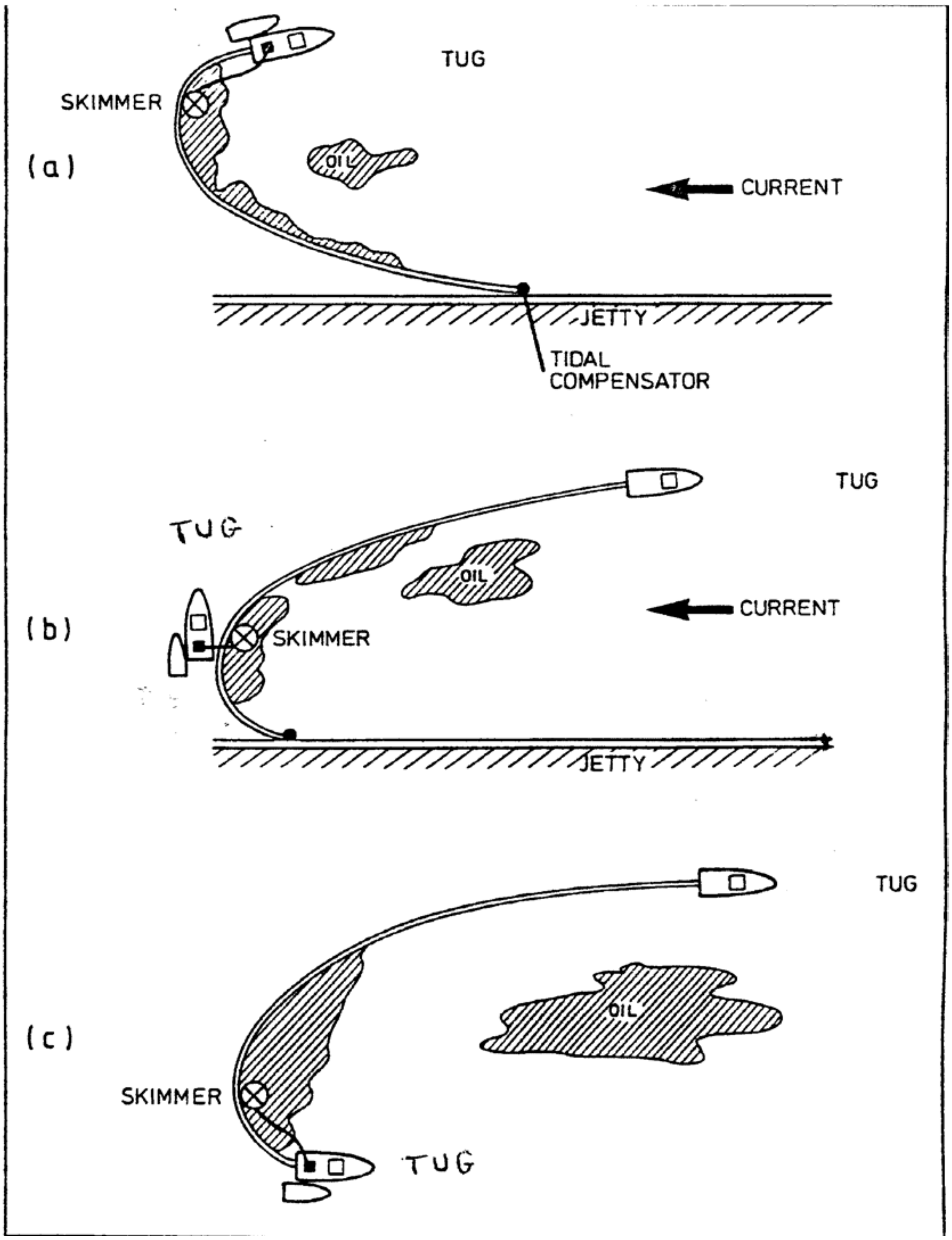
  - consult the **EPA** for advice;
  - give (or deny) permission for dispersant use.

- While permission is being sought one or two vessels should proceed to the leading edge of the slick, deploying dispersant spraying equipment during transit.

- Once on station, and **if permission is given**, vessels shall commence applying dispersant (refer to Section 8.3.5).

7.3 FIGURES & TABLES

Figure 7.1 Immediate Response Boom Configuration at Jetty (a) and (b) and at Sea (c)



8.1 INTRODUCTION

8.1.1 Objectives of the Marine Response

The objectives of the Marine Response Strategies are to:

- Protect the marine environment by containing spilt oil close to the spill site, and to recover it;
- Protect the shoreline and coastal resources by;
  - containing and recovering spilt oil on water;
  - deflecting oil away from sensitive shorelines;
  - dispersing oil, which is likely to impact sensitive shorelines.
- Monitor the movement and behaviour of oil on water.

8.1.2 Priorities

In any spill response, human health and safety are the first priorities. In particular the following must be considered:

Fire and explosion hazards
Small boat safety
Proximity to fixed and rotary wing aircraft safety

The priorities in the Marine Response are to:

- Contain and recover the oil as close to the source as possible;
- Protect any threatened resources based on predicted trajectory;
- Contain and recover any oil that has escaped the primary control operations;
- Recover any oil that has pooled along the coast in bays or coves;
- Safely dispose of recovered oils and debris.

8.1.3 Using the Marine Response Module

This module has been prepared to assist the **Incident Controller IC** and the **Planning Officer (PO)** at FPOSRT.

The module is organised according to the sequence of events to be considered in responding at sea to an oil spill. **It is not a textbook or a substitute for training, qualified technical advice, good judgement or common sense.**

Section 8.3 provides **general guidelines** on the **strategies** that can be used for containment, deflection, recovery and dispersion of oil.

Section 8.4 describes the **actions** to be taken by members of the Flinders Ports OSRT during a spill. This includes **temporary storage methods** and **waste handling practices** for recovered oil or oily debris.

Lists of key equipment available at Flinders Ports South Australia and the region are provided at the end of this section.

8.2 MARINE RESPONSE ORGANISATION

The IC is responsible for co-ordinating the Flinders Ports South Australia **Marine Response** and directing FP OSRT staff and contractors at sea (See Section 4 and Figures 4.1 and 4.2).

The IC is directly responsible to the **General Manager Marine Operations (GMMO)**. However, the State Marine Pollution Controller (SMPC) may assume overall control of any spill response. The responsibilities of the **IC, Tug Masters and Boat Masters** are detailed in Appendix I and outlined below.

8.2.1 Incident Controller (IC)

The IC's role is filled by the **Duty Pilot** at the port involved. The IC is responsible for the direction of all on water containment and other activities, and the deployment of necessary manpower and equipment required for these Tier 1 response operations.

Should a **Tier 2 or 3 Response** be initiated by the SMPC the IC will:

- Report immediately, as directed for a briefing by the **SMPC**;
- Direct the response team in containment, clean-up and disposal operations, including operational support;
- At the direction of the **SMPC**, deploy manpower and equipment for at sea containment and cleanup;
- Liaise with the **Logistics and Materials Co-ordinator (LMC)** to confirm availability and delivery of required personnel, equipment and supplies;
- Instruct the **Mooring Gangs** to establish the location of staging areas for the delivery and deployment of resources to vessels;
- Meet with the **SMPC** to review plans, as required;
- Assign manpower, equipment and supplies to specific operations at sea;
- Ensure that appropriate safety procedures are implemented;
- Liaise with the **SMPC** on the progress, future plans and resource requirements of operations at sea;
- Keep daily records of manpower, equipment and supplies used in operations at sea;
- Assist the **SMPC** in advising recreational or other vessels in the area;
- Direct the pumping of recovered oil from storage barges or vessels;
- Co-ordinate the transfer of recovered oil from at sea storage systems to shore facilities.

The IC is also primarily responsible for controlling the source of a spill if this is from the jetty or ship at berth.

8.2.2 Pilots

The Duty Pilot is **IC**. Other available **Pilots** will be responsible for the on site coordination of vessels involved in operations on water where more than one vessel is involved in a particular area. The **Pilots** main task is to coordinate the efforts of response vessels operating in a particular area. The role of the pilot will be at the discretion of the **IC**.

Pilots will:

- Attend IC briefings if required;
- Direct vessels under their control in the deployment of booms, skimmers and other equipment;
- Ensure that safe practices are used at all times, on all vessels.

8.2.3 Tug or Boat Masters

Tug or **Boat Masters** may still be staff of Flinders Ports South Australia or contractors. They are responsible for the deployment of booms or skimmers from vessels, and for applying dispersants from vessels.

If mobilised the **Tug** or **Boat Master** shall:

- Direct the activities of crews engaged in the containment and clean up operations;
- Arrange for assembly of dispersant spraying gear if required;
- Supervise the transfer of any recovered oil to the floating **temporary storage systems** at the Flinders Ports South Australia jetty or at sea;
- Maintain radio contact with the **Pilot** or IC;
- Maintain time sheets for the crew.

8.3 MARINE RESPONSE GUIDELINES

8.3.1 General

Oil on water at sea can be managed using a number of strategies:

- **Containment** using booms (Section 8.3.2);
- **Deflection** away from sensitive shorelines using booms (Section 8.3.2);
- **Recovery** using skimmers, sorbents or other methods (Section 8.3.3);
- **Dispersion,** either physical dispersion using ships' propellers to break up the slick, or using chemical dispersants (Section 8.3.4).

The efficiency of each is dependent on the speed of response, the speed and trajectory of the slick, and the use of methods and equipment, that are appropriate for the **oil type, weathering state** of the oil, and **sea conditions.**

In particular, the time between spillage and the impact of oil on shorelines may restrict the capability of mounting an effective marine response.

The influence of oil type, and weathering state of the oil on the efficiency of spill control methods are outlined in Section 8.3.3 and 8.3.5. Figure 8.1 illustrates the weathering processes and implications for spill volume and oil viscosity. Table 8.1 describes the various sea state terms used in the text.

It is also important that spill response is undertaken in a manner, and in conditions that are safe. **The health and safety of the public and response teams is the prime concern in any spill response.**

8.3.2 Containment and Deflection: The Use of Booms

Caution:	**Light volatile products such as LPG, Naphtha, Mogus, or fresh condensate should not be contained in booms. Booms may however, be used to deflect slicks of such products.**

The purpose of containment is to:

- Localise the spill and thus minimise pollution;
- Facilitate removal of the oil by causing it to concentrate in thicker layers on the surface.

Containment of an oil spill relies on the effective and efficient use of **booms** in suitable sea conditions.

8.3.2.1. Boom Selection

Booms may be classified according to their operating capability in various sea states. Table 8.2 shows the ranges of freeboard and draught corresponding to the expected maximum waves.

They may also be classified according to their construction. A **Boom Selection Matrix** has been developed to enable selection of the best boom for specific situations. The matrix shows:

- Generic types of boom that are most suitable in a given environment;
- Booms that have the required performance characteristics;
- Booms with the most easily handled i.e. “convenience characteristics”.

The **Boom Selection Matrix is provided in Table 8.3** and should be used by the IC in selecting from boom stockpiles at Flinders Ports South Australia and regional sources. The boom types held by Flinders Ports South Australia are illustrated schematically on the following pages (Figure 8.2) and listed in Table 8.8 at the end of this section.

8.3.2.2 Methods

The optimum deployment of a boom will depend on weather conditions, sea state and other factors. Ideally the static 'U' and 'J' configurations shown in Figure 8.3 are used to collect oil at the source. Oil may escape such arrays and so mobile or towed booms may also be required. **The Pilot or Boat Master will generally decide upon the configuration to be used.**

- **Encircling**

This method is employed primarily in calm or sheltered sea areas and should not be used to hold crude oil in close proximity to tankers, or to contain volatile oils.
This method may be employed in the early stage of spill control but **only** when the spill discharge rate is low and the effects of wind and current are not significant. (Figure 8.3).

The length of the boom in this application generally needs to be at least three times the length of the object, e.g. a ship, to be encircled.

- **Deflection**

Deflection arrays can be used on open water to deflect oil into, or away from the shoreline or other resources (e.g. fish farms). The angle of deflection required is dependent on current flow. Generally, at sea, a number of booms are required to do this effectively. Inshore use of deflection booms is outlined in Section 9 of the OSCP.

- **Towing Booms**

If wind speeds and current velocities are too high for the use of fixed boom arrays, or if the oil has spread over a wide area, mobile boom arrays can be used. Booms can be towed at low speed (i.e. less than 1 knot or 0.5m/s) through the water. 'U' and 'J' configurations can again be used.

- **Multiple Setting**

If currents are high, oil may escape beneath the boom (entrainment). If this occurs, multiple (double or triple) setting of booms may be necessary. If **multiple setting** of booms is necessary, adequate separation is needed between the booms. Generally, a separation of between 5-10 metres between the booms is required for the escaping oil to be held by the secondary or tertiary barriers.

8.3.3 Recovery

8.3.3.1 Selection of Skimmers

CAUTION:	**Skimmers should not be used on spills of Naphtha, Mogas, LPG, or unweathered condensate.**

Once oil has been contained by a boom, it is essential that recovery of the collected oil be undertaken as soon as possible. This is normally done through the use of **skimmers**. Skimmers can generally be grouped into a number of categories;

- **Oleophilic surface** (belts, disc, ropes and brushes, either acting independently, mounted on a vessel, or used in combination with a boom);
- **Weir** (simple, self-levelling, vortex assisted, auger assisted, vessel-mounted and weir/boom systems);
- **Vacuum units** (portable units and truck-mounted units);
- Other methods (including paddle belt, brush systems and net trawl).

A **Skimmer Selection Matrix** is presented in Table 8.4. This is used in selecting the best equipment for a particular oil type or sea. It lists a number of generic types of skimmer along with twelve performance criteria.

The skimmer selection matrix must be used with some judgement because the ratings (on some criteria) are dependent on the size of the skimmer.

For example, pickup rate and suitability for use in open seas, are **strongly size dependent.**

The IC should be aware that the nominal pickup rate is seldom, if ever, maintained due to the difficulty of keeping skimmers in the thickest oil.

A list of skimmers, and types, held by Flinders Ports South Australia (Transport SA) is provided at the end of this section. Figure 8.4 illustrate the types of skimmer available at Flinders Ports South Australia (Transport SA) or in the region.

8.3.3.2 Methods

Skimmers should be deployed in the apex of collection boom as indicated in Figure 8.3.

8.3.4 Temporary Storage

Temporary storage systems are required for oil, which is recovered by skimming devices from within containment booms. **Most vessels and recovery devices do not incorporate any significant storage capacity and at sea storage systems must be provided by a towed barge, floating storage tanks or collapsible tanks.**

As most floating storage systems are of limited capacity, it is also necessary to quickly transfer recovered oil or oily emulsions to fixed facilities on the shore. Recovered oil can then be stored whilst a decision is made as to its final disposition.

Table 8.12 at the end of this section, provides a list of available temporary storage containers.

8.3.5 Dispersants

Dispersants act to ‘break-up’ surface slicks and result in oil becoming mixed into the upper layers of water. They should be used with care and only when permission for their use has been granted by the **SMPC** through the **IC**.

8.3.5.1 Deciding on the Dispersant Option

The decision to use, or not use, chemical dispersants will be made in full consideration of the advantages and disadvantages of the option. These are summarised in Table 8.6. The decision will be based on whether there is a net benefit or net loss when the potential effects of effectively dispersed oil are measured against the potential effects of untreated oil.

Figure 8.5 provides a decision tree for dispersant use.

The IC should accurately record all considerations and facts used in deciding upon the request for permission to use dispersants. The use of dispersants may also be restricted by oil type or weathering, or by wind and sea conditions (Table 8.6).

8.3.5.2 Methods of Applying Dispersants

For oil spills at sea there are two types of dispersant application systems now in regular use. The first are systems designed for **vessels** and can apply undiluted Type 1 and Type 3 dispersants or Type 2 dispersants diluted with sea water (Table 8.7). The second type of system is designed for **aerial application** and uses Type 3 dispersants (‘concentrates’) applied in an undiluted form.

In both systems, the intention is to apply dispersant evenly over an oil slick at a concentration, which will effectively disperse the oil. In practice this is not easy to achieve. Generally, it is preferable to:

- To achieve the best results, dispersants should be applied as early as possible after oil has been spilled and preferably before significant weathering has taken place;
- Dispersants should be applied to the thickest patches of oil and **not** to sheens where dispersant is wasted because it breaks through the oil film.

- Where oil is threatening a vulnerable resource, the oil at the leading edge of the slick closest to the resource should be treated first;
- Wherever possible, an aerial observation system should be used to guide and monitor dispersant application vessels and aircraft;
- Regular checks on dispersability of oil should be made and when the oil becomes difficult to disperse the spraying operation should be terminated.

In practice these factors should be taken into account at the time a decision to apply dispersants is made and reviewed on a regular basis thereafter to reassess the strategy.

8.3.5.3 Vessel Application Equipment

Vessel application equipment can be divided into two distinct groups according to how the dispersant is applied, namely:

a) From nozzles attached to spray arms
b) By eductor units in combination with fire monitors

a) Spray Arm Systems

These are by far the most common systems for applying dispersants from vessels and have been developed from those originally designed by Warren Spring Laboratory (WSL). Although changes have been made over the years, all the units consist of the following components:

- Prime mover to power pumps
- Water pump/metering system (Type 2 dispersants only)
- Dispersant pump/metering system
- Spray booms with nozzles
- Interconnecting pipework
- Breaker boards (sometimes omitted, but facilitate mixing)

b) Eductor Units with Fire Monitors

Type 1 dispersants should not be applied in this way. In units of this type, water flowing through a venturi incorporates typically 10% to 15% of dispersant. This dispersant/water solution is directed onto the oil by fire monitor. The system is generally regarded as inadequate and wasteful of dispersant.

8.3.5.4 Aerial Application Equipment

Aerial application equipment comes in a greater variety of forms than vessel spray equipment. Because of the need to consider both helicopter and fixed wing aircraft and to utilise a wide size range of aircraft. Aerial application can only be accessed/initiated by the **SMPC**.

The structure of aerial spray equipment is similar to that of vessels except that, since the dispersant is applied undiluted, there is no requirement for dilution equipment.

a) Helicopter Spray Equipment

There are a number of makers of dispersant spray equipment for helicopters all of which make use of underslung buckets and consist of:

- Dispersant storage
- Spray arms/nozzles
- Control valves
- Power unit
- Dispersant pump
- Control box with control cord
- Lifting wires

b) Fixed Wing Aircraft Spray Equipment

These vary from crop spraying aeroplanes to portable (bolt-on) units designed for small twin-engined aeroplanes, and to larger units used in roll on/roll-off transporters or large four-engined aeroplanes (e.g. the EARL ADDS pack).

Like vessel spray equipment, the latter systems can be fitted permanently in the aeroplane or be fitted as and when needed. In contrast to vessel equipment, however, detachable equipment will usually only be suitable for one type of aeroplane. Consequently this type of equipment is rarely used. **Only crop dusting aircraft should be used in a dispersant spraying role in this OSCP.**

It is essential that all equipment designed for aircraft has full approval from the relevant authorities, as the systems require substantial power from the aircraft and can affect aircraft handling characteristics. **It will be necessary to wash aircraft with fresh water after a days spraying, and it may be necessary for a certification check to be made before the aircraft can be used for other duties.**

8.4 RESPONSE ACTIONS

8.4.1 Deployment of Containment Booms and Skimmers

Tier 1 Response

The Flinders Ports South Australia **Immediate Response** is initiated by the **IC**. Procedures are detailed in Section 7.

Tier 2 or 3 Response

Secondary Marine Response is undertaken by the Flinders Ports South Australia **staff** under the immediate control of the IC. The IC will report directly to the **SMPC**.

The IC will instruct **Tug** or **Boat Masters** and crews to deploy booms as required. Generally, deployment of booms is as follows:

- Deploy the vessels with on-board booms, which are **not** involved in the **Immediate Response**, to the leading edge of the slick;
- Each of the tugs deployed should be accompanied by an additional tug or workboat;
- Tugs **will** be equipped with on-board skimmers and storage. This must be confirmed and, if not correct, tugs should be sent to collect skimmers.
- A tug should be despatched to collect the storage barge. This should be deployed at sea or alongside a jetty.
- Vessel pairs should deploy in a 'J' configuration (or as directed by the **IC**) at the leading edge of the slick. Skimmers should be deployed when collected oil is suitable.

Transport SA and AMSA boom and skimmer resources are given in Tables 8.8 and 8.9. A request for the use of this equipment must be made to the **SMPC**.

8.4.2 Temporary Storage Systems for Recovered Oil

It is important that **Tug** or **Boat Masters** inform the IC of their needs regarding temporary storage and transport of recovered oil to onshore facilities.

It is the responsibility of all personnel to ensure that 'down time' due to unavailability of at sea storage is minimised.

8.4.3 Dispersant Use

If containment and recovery operations are not effective and the **IC** considers that dispersants might be required the **IC** will consult with the **SMPC**.

The **IC** will consult with the **SMPC** and, with reference to the Decision Tree (Figure 8.5), decide upon their use or non-use.

Dispersants and dispersant spraying equipment/capacity in South Australian Ports is detailed in Tables 8.11, 8.12, and 8.13.

Permission to use dispersants MUST be obtained from the SMPC prior to their use.

8.5 FIGURES & TABLES

Figure 8.1 Weathering processes in Crude Oil at Sea and Implications for Slick Volume and Viscosity.

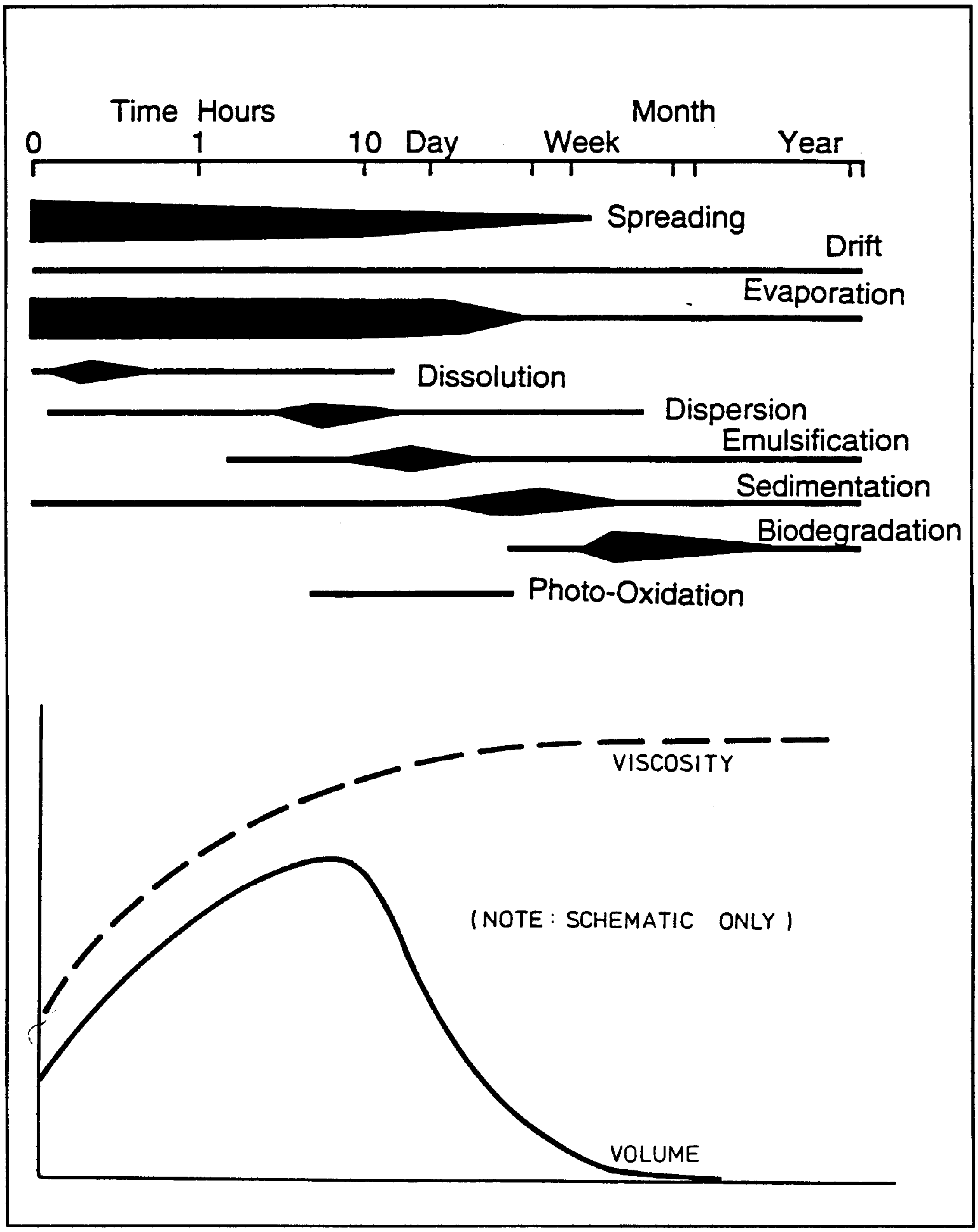
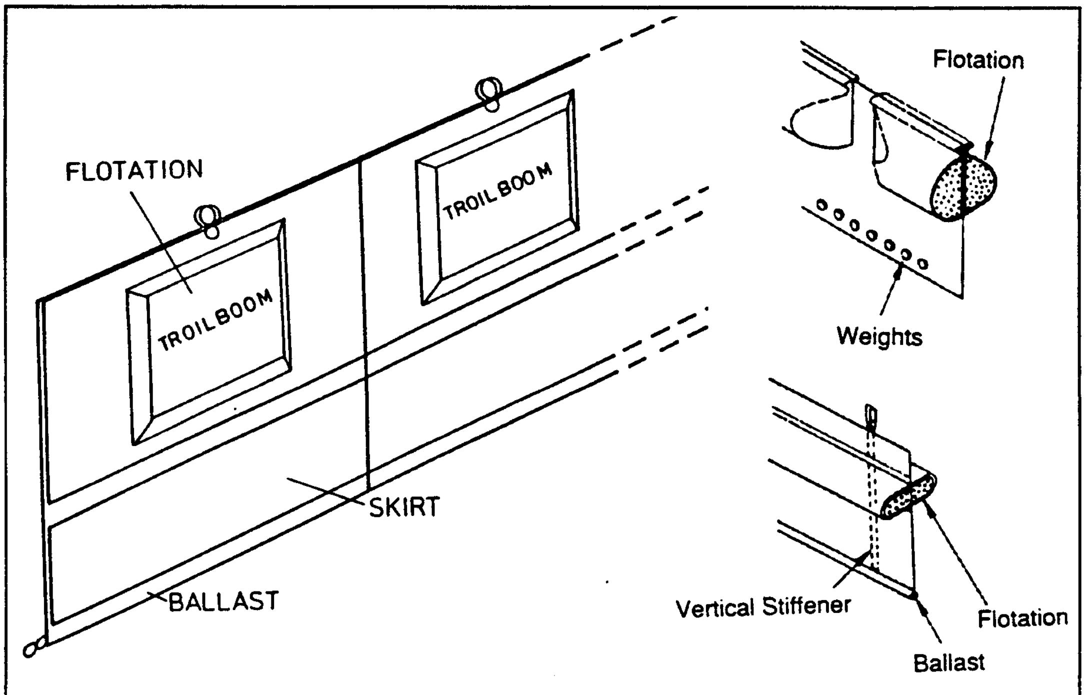
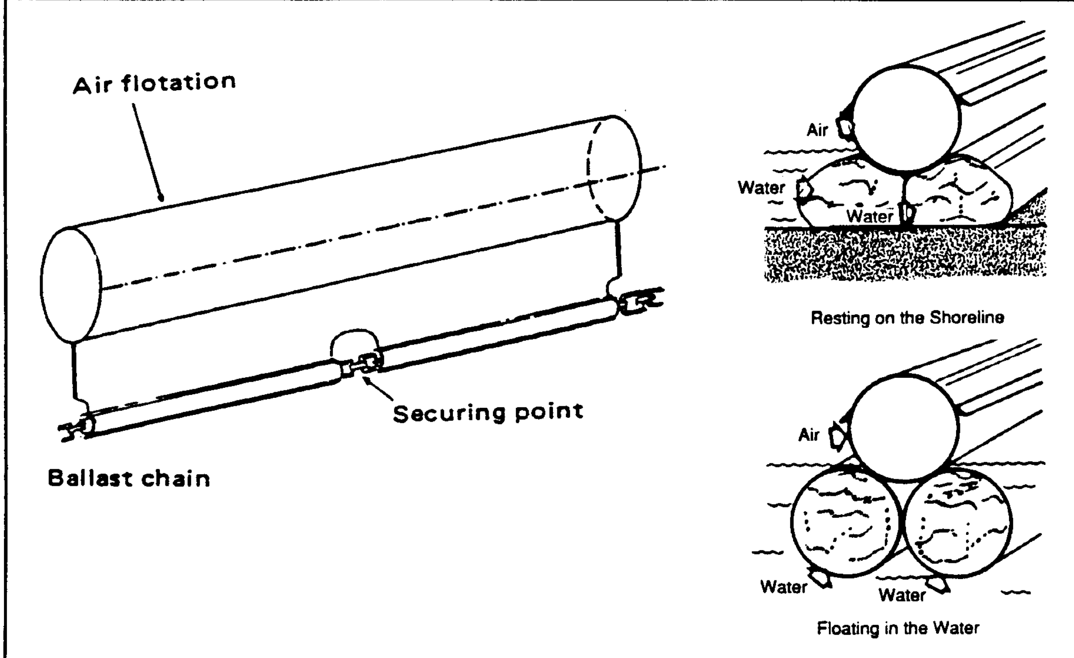


Figure 8.2 Types of Boom Stockpiled at Flinders Ports South Australia (Transport SA)



Solid Flotation Boom (E.g. Slickbar, Troil Boom)



Pressure Inflatable Boom (E.g. Sea Sentinel, Beach Guardian)

UNCONTROLLED COPY if printed

Figure 8.3 Phased Boom Array (Multiple Setting)

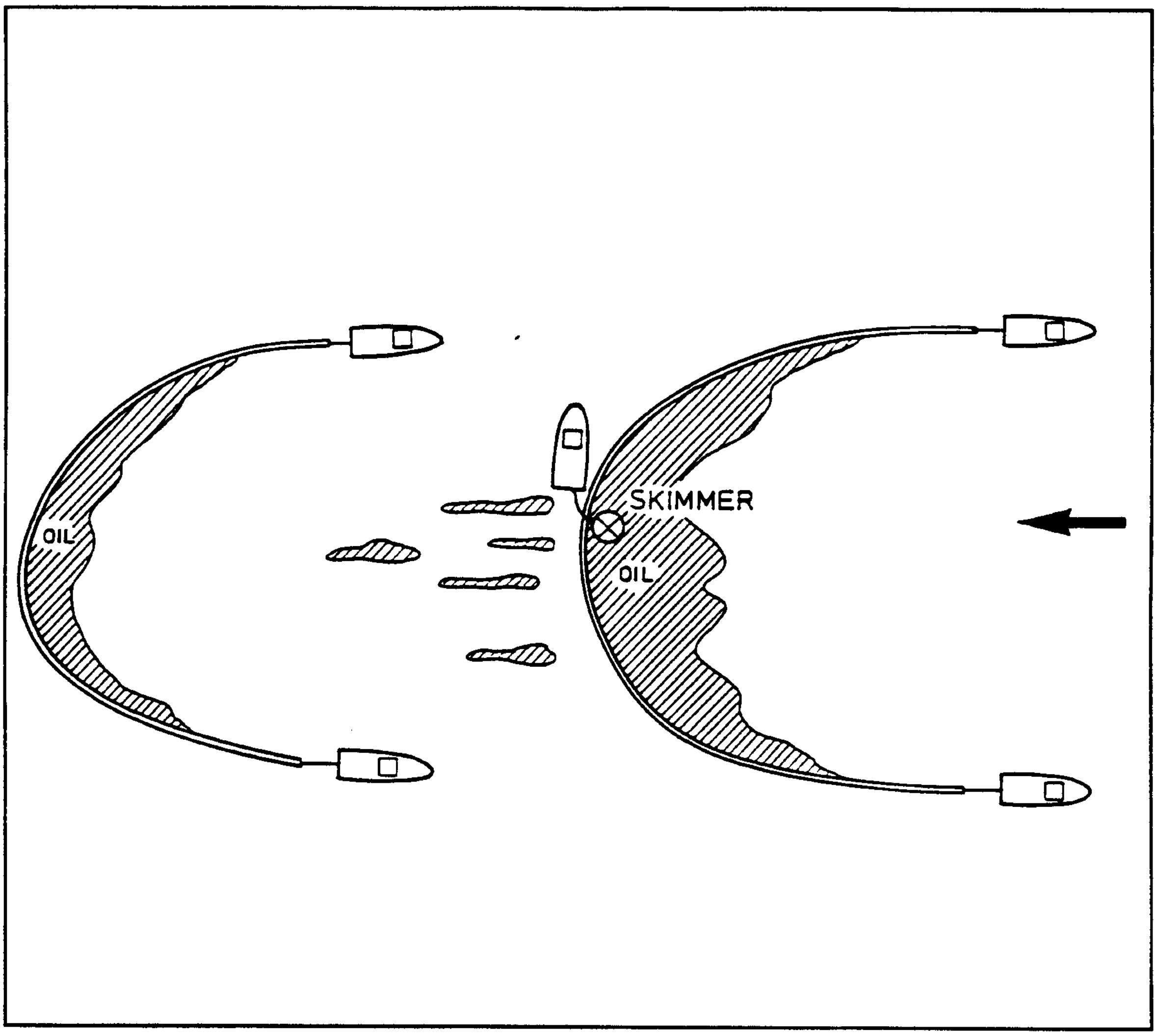


Figure 8.4 Type of Skimmer available at Flinders Ports South Australia and region

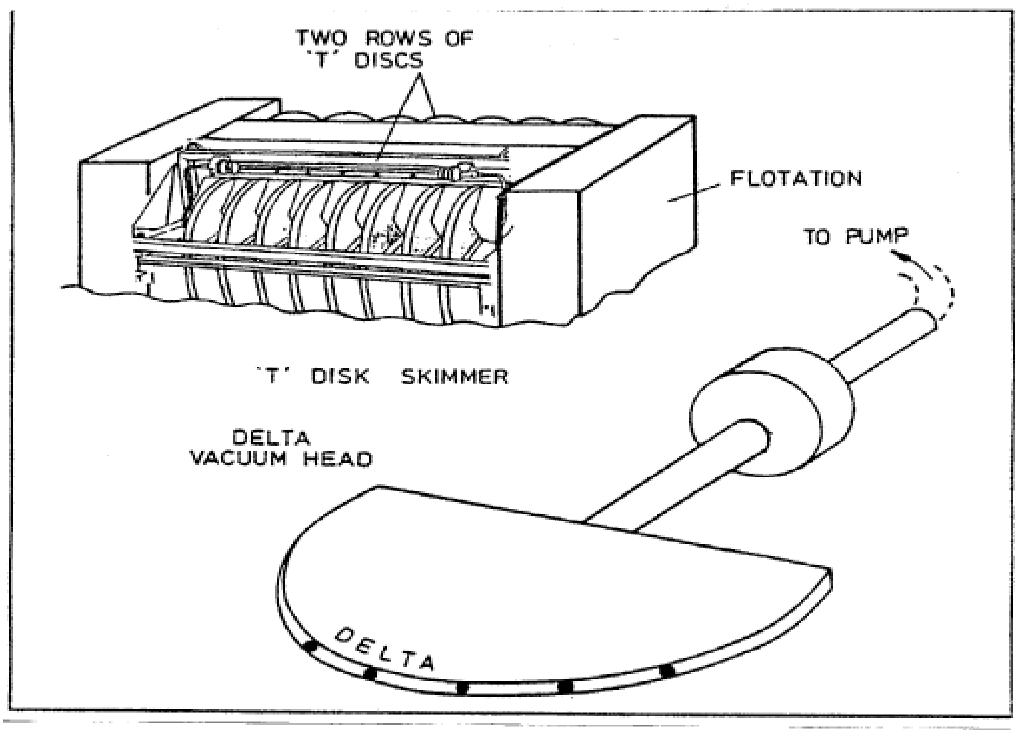
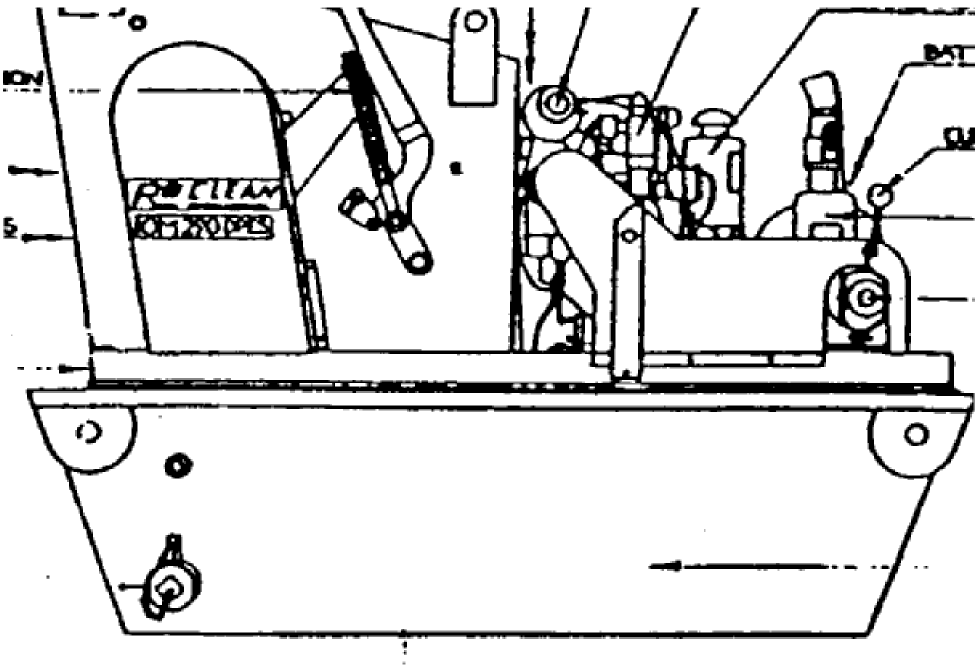


Figure 8.4a Oil Mop Oleaphilic Skimmer



UNCONTROLLED COPY if printed

Figure 8.4b VIKOVAN Vacuum System

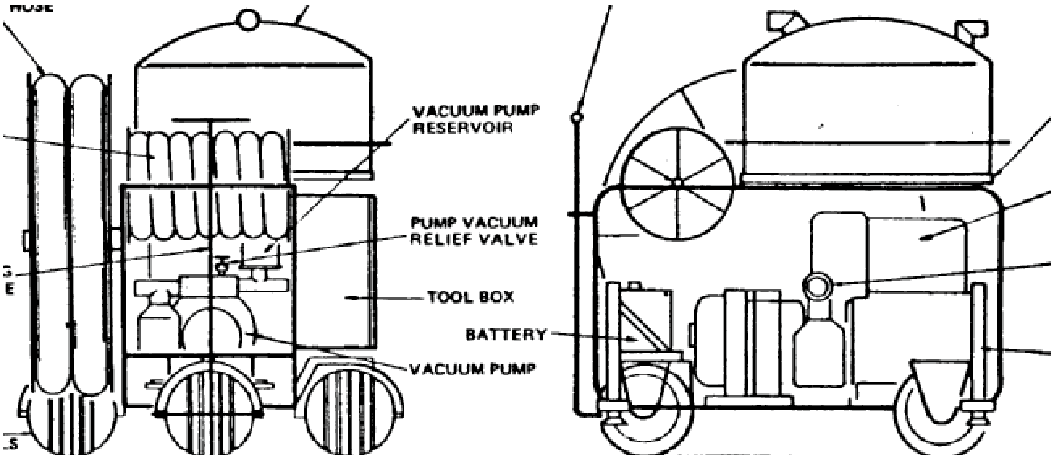


Figure 8.4c FOILEX Weir Skimmer

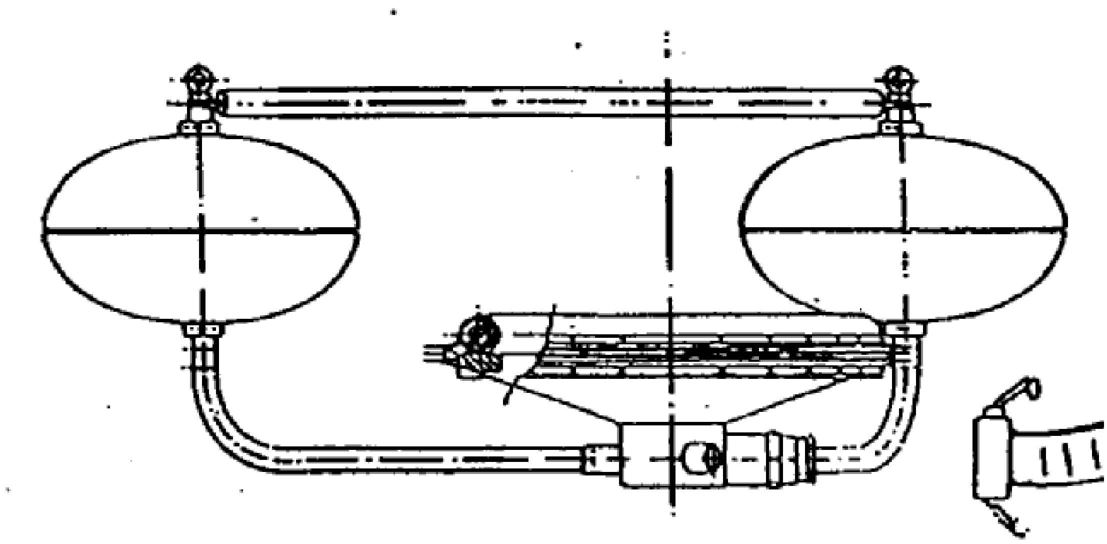


Figure 8.5 Decision Tree for Dispersant Use in the Open Sea

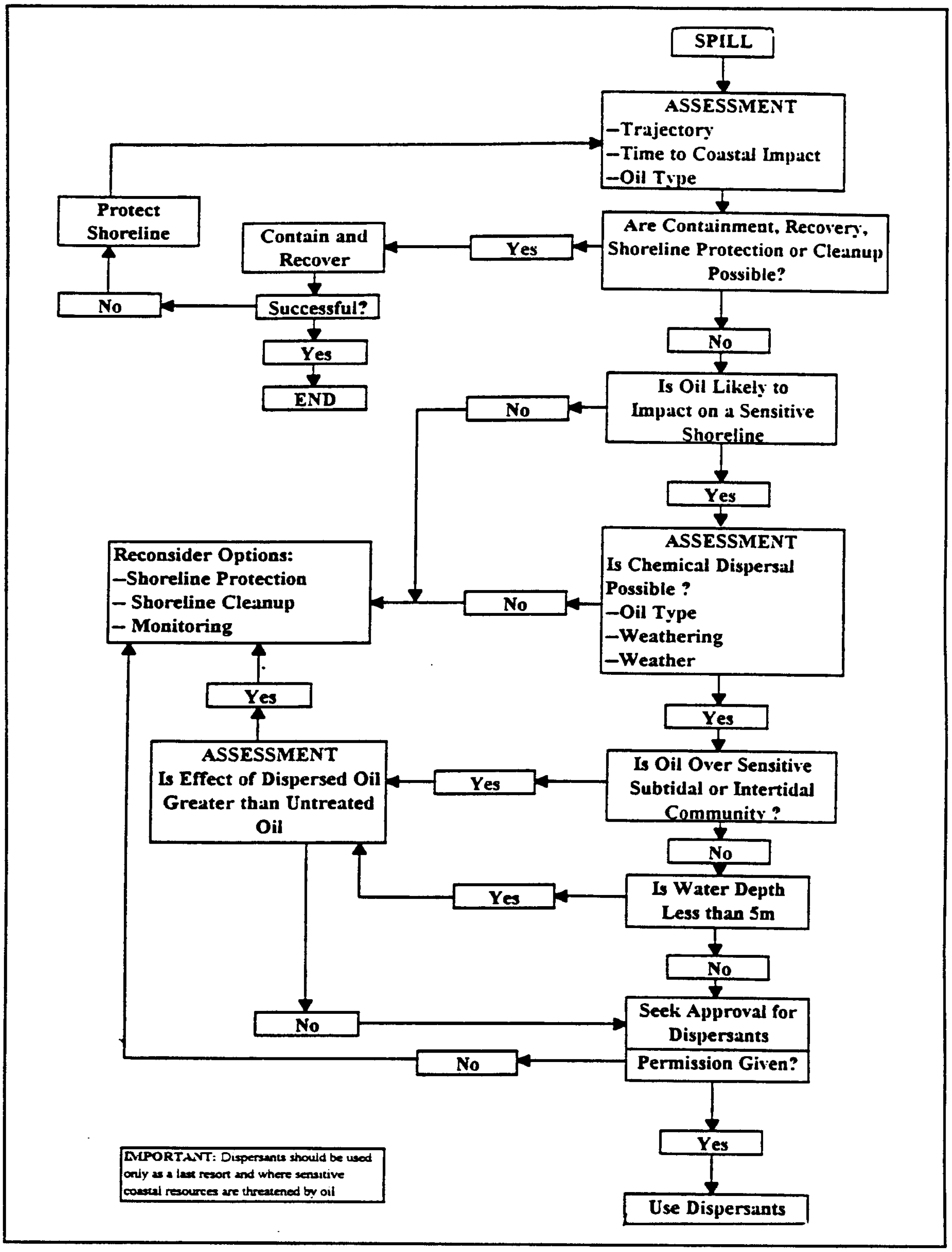


Table 8.1 Beaufort Scale of Sea Conditions

Wind Velocity, (knots)	4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 50, 60
Beaufort Wind Force & Description	1 Light Air; 2 Light Breeze; 3 Gentle Breeze; 4 Moderate Breeze; 5 Fresh Breeze; 6 Strong Breeze; 7 Moderate Gale; 8 Fresh Gale; 9 Strong Gale; 10 Whole Gale; 11 Stormy; 12 Hurricane
Sea State Number & Description	1 Smooth; 2 Slight; 3 Moderate; 4 Rough; 5 High; 6 Very Rough; 7 Very High; 8 Precipitous
Significant Wave Height Crest to Trough (feet)*	1, 3, 6, 9, 14, 18, 25, 35, 40, 50

* The average height of the highest 1/3 of the waves, assuming 1000 mile fetch, 25 hour duration, Bretschneider Spectrum

Table 8.2 Main Boom Requirements

Environment	HS Maximum (meters)(1)	Freeboard (cm) (2)	Draught (cm) (3)
Inshore or Calm Water	0.3	10-25	15-30
Harbour	0.9	25-46	30-61
Offshore	1.8	>46	>61

(1) Maximum operating significant wave height: The maximum wave height at which the boom is expected to operate efficiently.

(2) Freeboard is the height of boom above the water level, i.e. the portion of boom, which reduces ‘splash over’ of oil.

(3) Draught is the portion of boom below the surface. It consists of a ‘skirt’ and part of the flotation section (refer to Glossary).

Table 8.3 Boom Selection Matrix

Legend 1 - Good 2 - Fair 3 - Poor		Internal Foam Flotation	Self-Inflatable	Pressure-Inflatable	External Tension Member	Fence
		Type of Boom				
Environmental Conditions	Offshore Hs >1 m V < 1 knot	2	2	1	1	3
	Harbor Hs < 1 m V < 1 knot	1	1	1	2	2
	Calm Water Hs < 0.3 m V < 0.5 knot	1	1	1	2	1
	High Currents V > 1 knot	2*	3	2	1	3
	Shallow Water (Depth < 0.3 m)	1	2	2	3	3
Performance Characteristics	Operation in Debris	1	3	2	3	2
	Excess Buoyancy	2	1	1	2	3
	Wave Response	2	2	1	1	3
	Strength	2	3	1	1	1
Convenience Characteristics	Ease of Handling	2	1	2	3	2
	Ease of Cleaning	1	1	1	3	1
	Compactability	3	1	1	2	3

Notes:
1 knot = 0.5 metres per second or 1.8 km per hour approximately
Hs = Significant Wave Height
Hs = Significant Wave Height
V = Velocity of Surface Current
Ratings are indicative only for boom types. *Specially designed high-current models may be available (river boom)
To use the matrix correctly, follow these steps:
1. Identify the most probable environmental conditions in which the boom can be used. Note those types of booms with an acceptable rating (1 or 2)
2. Identify the most needed performance characteristics for the intended application. From the booms chosen above, select the ones that have an acceptable rating (1 or 2) in the most important performane characteristics.
3. Identify the most desirable convenience features. With booms from steps 1 and 2 above, select the boom with the best rating in the convenience features of interest

Table 8.4 Skimmer Selection Matrix

		Generic Type of Skimmer: Oleophilic Surfaces						Weir						Vacuum Units		Hydrodynamic Devices			Other Methods	
	Legend 1 - Good 2 - Fair 3 - Poor	Brush	Disc	Rope	Rope/Belt (Catamaran Mounted)	Sorbent Belt (Downward Moving)	Sorbent Belt (Upward Moving)	Advancing	Combination Weir/Boom	Saucer	Screw/Auger	Self-Levelling	Vortex	Vacuum System with Weir	Skimmer Head	Hydrocyclone	Submersion Plane	Water Jet	Combination Trawl/Boom	Paddle Belt
Operating Environment	Open Seas Hs >1 m V < 1 knot (0.5 m/sec)	2	.2	1	1	1	1	2	2	3	3	3	2	3		3	3	3	1	3
	Harbors and Bays Hs < 1 m V < 0.7 knot (0.35 m/sec)	1	1	1	1	1	1	1	1	2	3	3	1	2		3	2	2	1	3
	Protected In-shore Hs < 0.3 m V < 0.5 knot (0.25 m/sec)	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1
	High Currents V < 2 knot (1 m/sec)	2	3	2	1	1	2	1	2	3	2	3	2	3		2	2	2	2	2
	Shallow Water (< 0.3 m)	2	2	1	3	3	3	3	3	1	3	2	2	1		3	2	3	2	1
	Debris	1	3	1	1	2	1	2	3	3	2	3	3	3		3	3	2	3	2
Oil Viscosity	High Viscosity (> 1000 cSt)	1	2	2	2	2	1	2	2	2	1	3	2	2		3	2	1	1	1
	Medium Viscosity (100-1000 cSt)	1	1	1	1	1	1	1	1	1	1	1	1	1		3	1	1	2	1
	Low Viscosity (< 100 cSt)	1	2	2	2	1	3	1	1	1	2	1	1	1		3	1	1	2	2
Skimmer Characteristics	O/W Pickup Ratio	1	2	1	1	2	2	2	2	3	2	3	2	3		3	2	2	1	2
	Pickup Rate	2	2	3	2	2	2	2	1	2	3	3	2	3		2	2	3	2	2
	Ease of Deployment	1	1	2	1	1	1	2	3	1	2	1	2	1		2	3	2	3	2
Available as V.O.S.S. (Vessel of Opportunity Skimming System)		x	x	x			x		x	x	x	x	x						x	x
Available as an Advancing Skimmer		x			x	x	x	x	x							x	x		x	x
Available with Storage		x	x		x	x	x	x								x	x	x		x

Table 8.5 Advantages and Disadvantages of the Use of Chemical Dispersants

Advantages	Disadvantages
Oil is removed from the water surface and therefore poses a reduced risk to birds	Dispersed oil penetrates more deeply into the water column and may affect subsurface organisms.
Dispersed oil tends to adhere to surfaces less than undispersed oil	Dispersants are not effective against heavy or waxy oils, and emulsions
Biodegradation of dispersed oil appears to be more rapid than undispersed oil.	Dispersion reduces the potential for loss of volatile (light) hydrocarbons through evaporation.
Dispersed oil is less likely to movement due to wind; consequently coastal impacts may be avoided.	Dispersion may inhibit the photo-oxidation of oil. However, this is a relatively minor degradation pathway.
The formation of stable water-in-oil emulsions can be prevented.	Onshore use of chemical dispersant is likely to increase the penetration of oil into porous sediments. However, there is little to suggest that such oil is generally more persistent than undispersed oil.
Fire hazards are reduced through chemical dispersion	Dispersants are toxic to marine and coastal flora and fauna. Their direct impact on unoiled habitats is therefore to be avoided.

Table 8.6 Constraints to Dispersant Use and Efficiency

Oil Considerations	
Viscosity	Oils or emulsions with viscosities above 20,000 are not considered to be amenable to dispersants.
Weathering	Oils increase in viscosity as they weather and emulsify. Each oil has a 'window of opportunity' for effective chemical dispersion. This is dependent on sea state, wind and temperature.
Sea and Weather Considerations	
Calm Seas	Calm conditions may not provide enough mixing energy for dispersants to work effectively. 'Concentrates' are less susceptible to this constraint. Vessels can supply mixing energy in calm conditions.
Rough Seas	If winds exceed about Force 6 (above 25 knots) oil may be covered by breaking waves and the effective 'encounter rate' of the dispersant and oil is reduced.
Operational Constraints	
Encounter Rate	Vessel application rates will be slow, particularly where oil has had time to spread

Table 8.7 Types of Dispersant

Type	Description	Use	
1(1)	Hydrocarbon solvent based	Not to be diluted	From vessels only
2	'Water Miscible' solvent base (such as ethyl glycol)	Undiluted	Vessels or Aircraft
		Diluted (Between 1:3 and 1:9)	Vessels
3(2)	Concentrates	Undiluted	Vessel or Aircraft
		Diluted	Vessel

(2) Sometimes termed 'first generation' or 'second generation' dispersants.
(3) Sometimes referred to as 'third generation' dispersants.

Table 8.8 Booms Available in South Australia owned by Transport SA

Boom Name	Type	Length	Location
Self Buoyant Pacific	GP800	50 metres	Port Adelaide
Self Buoyant Pacific	GP500	200 metres	Port Adelaide
Self Inflating Versatech	Zoom 12/18	150 metres	Port Adelaide
Beach Structureflex	Land/sea	780 metres	Port Adelaide
Sweep	Nofi V 600/1000	100 metres	Port Adelaide
Beach Structureflex	Land/sea	40 metres	Port Lincoln
Self Buoyant Pacific	GP800	250 metres	Port Lincoln
Self Buoyant	American Marine Maximax	100 metres	Port Pirie
Beach	Skimmex Shoreline	340 metres	Port Pirie
Self Buoyant	Pacific GP 800	300 metres	Thevenard
Self Buoyant	Pacific GP 500	200 metres	Thevenard
Self Inflating	Versatech Zoom 12/18	150 metres	Wallaroo

Table 8.9 Skimmers Available in Region

Name	Type	Rates of Oil Retrieval (TPH) (1)	Location
Slickskim Manta Ray	Suction	1	Port Adelaide
Vikovac	Suction	1	Port Adelaide
Rope Mop OMI 260	Oleophilic	5	Port Adelaide
Oil Recovery Vessel	JBF DIP 1003	5	Port Adelaide
Slickskim Manta Ray	Suction	1	Port Lincoln
Disc Vikoma 9K	Oleophilic	5	Port Lincoln
Weir Foilex Mini	Weir	1	Thevenard
Weir Foilex Mini	Weir	1	Wallaroo

(1) TPH: Tonnes per hour

Table 8.10 Ancillary Equipment in South Australia (Transport SA)

Name	Type	Location
Radio Transceiver	UHF Motorola	Port Adelaide
Radio Repeater	UHF Motorola Flexar	Port Adelaide
Trailer Box	Single Axel	Port Adelaide
Trailer Boat	Tandem Axel	Port Adelaide
Trailer Box	Tandem Axel	Port Adelaide
Aluminium Punt	Kayfa 5.2 metres	Port Adelaide
Inflatable Dinghy	Avon 4 metre	Port Adelaide
Catamaran	GRP Murex 12 metres	Port Adelaide
Collapsible Tank	Transpack recovered oil	Port Adelaide
Collapsible Tank	Transpack recovered oil	Port Lincoln
Trailer box	Tandem Axel	Port Lincoln
Aluminium Catamaran	Conch 12 metre	Port Lincoln
Trailer Box	Tandem Axel	Port Pirie
Dinghy Inflatable	Avon 4 metre	Port Pirie
Trailer Box	Tandem Axel	Thevenard

Table 8.11 Dispersant Stockpiles Available in South Australia (Transport SA)

Name	Type	Quantity	Location
Ardrox 5120	3	3,600 litres	Port Adelaide
Slickgone LTSW	3	5,000 litres	Port Adelaide
BP AB	1	27,800 litres	DAS Store Adelaide
Ardrox 6120	3	5,000 litres	Calvin Grove, Adelaide
Corexit 9527	3	2,400 litres	Calvin Grove, Adelaide
Slickgone LTSW	3	15,000 litres	Calvin Grove, Adelaide
Corexit 7664	2	800 litres	Port Bonython
Corexit 9527	3	6,400 litres	Port Bonython

Table 8.12 Storage for recovered oil and Waste: Regional Resources (Transport SA)

Name	Type	Storage Volume	Location
Recovered Oil Tank	Flexidam	1000 litres	Port Adelaide
Recovered Oil Tank	Flexidam	1000 litres	Port Lincoln
Recovered Oil Tank	Flexidam	1000 litres	Port Pirie
Recovered Oil Tank	Flexidam	1000 litres	Thevenard
Recovered Oil Tank	Flexidam	1000 litres	Wallaroo

Table 8.13 Vessel Based Dispersant System owned by Transport SA

Vessel	Capacity	Spray System	Location
Tug	20 litres per minute	WSL	Port Adelaide
Tug	20 litres per minute	WSL	Port Lincoln
Tug	20 litres per minute	WSL	Port Pirie

9.1 INTRODUCTION

9.1.1 Aims of Shoreline Response

The objectives of the Shoreline Response Strategies are to:

- Protect sensitive shorelines from the impact of oil by the use of booms in order to:
  - minimise any immediate environmental effects from the oil.
  - Minimise any adverse effects from the cleanup efforts.
  - Facilitate the natural recovery of the shorelines.
  - Restore the shoreline as close as possible to its condition before oil impact.
- Rehabilitate oil affected biological communities if necessary.

9.1.2 Using the Shoreline Response Module

This section of the OSCP provides both general and site-specific guidelines for cleanup of oil-impacted shorelines.

Section 9.2 outlines the **Shoreline Response Team Organisation.**

Section 9.3 describes **general guidelines** for methods that can be used for protecting shorelines from oil.

Section 9.4 describes the methods available for **shoreline cleanup,** and the advantages and disadvantages of each method.

Section 9.5 outlines methods for handling **waste materials** and for the temporary, on site, storage of recovered oil and oily debris.

Section 9.6 consists of **coastal maps**, which indicate shoreline types, access and sensitive resources. These, together with the accompanying **data sheets,** provide **site-specific** guidance and instruction for shoreline cleanup. **These maps must be referred to during any shoreline response.**

9.1.3 Shoreline Classification

The shorelines within the response zone have been assessed and assigned values according to their **environmental sensitivity** and their **priority for cleanup.** These classifications are related but are **not** the same.

Environmental Sensitivity Index (ESI)

Coastal Areas have been assigned environmental sensitivity rankings for sensitivity to oil. These 'ESI' ratings are explained in Table 9.1 and also provided on the maps in Section 9.6.

Cleanup Priorities

These have also been assigned for each beach sector within the area and are defined in Table 9.2. These **cleanup priorities** indicate the order in which beaches should be cleaned, and reflect:

- Sensitivity to oil (ESI rating)
- Access for cleanup teams
- Sensitivity to cleanup methods
- Effectiveness of cleanup methods
- Potential for natural cleaning
- Future mobility of stranded oil
- Proximity of the oiled beach sector to sensitive resources.

Note: In consultation with the EPA cleanup priority rankings are <u>not</u> sensitivity rankings.

9.2 SHORELINE RESPONSE TEAM ORGANISATION

9.2.1 Flinders Ports South Australia

The **Shoreline Response Manager (SRM)** is responsible for co-ordinating the **Flinders Ports South Australia Shoreline Cleanup Teams.** The SRM is responsible to the **Incident Controller (IC)**.

Shoreline Cleanup Team Officers (SCTO) are responsible for supervising cleanup teams on shorelines, and teams working, inshore on shoreline cleanup. Cleanup teams may comprise personnel from either Flinders Ports South Australia or Terminal operations, or from other agencies.

9.2.2 Government Agencies

A number of government or non-government agencies may have authority over the shoreline. If confusion exists over who has authority over a sector of shoreline, staff should refer to either the SRM or the IC.

9.3 SHORELINE PROTECTION METHODS

9.3.1 General

Shorelines can be protected through either marine strategies (See Section 8) or by inshore or onshore protection methods. Options for inshore or shoreline response include:

- **Diversion booming** – to divert oil **away** from sensitive areas **(deflection)**, or to divert oil **onto** a low sensitivity beach for subsequent recovery **(collection)**;
- **Exclusion booming** – to prevent oil entering inlets or from impacting shorelines;
- **Beach treatment agents** – sorbents and other agents used to prevent the adhesion of oil onto sediments;
- **Inshore use of dispersants** – if coastal impact would be more damaging than the dispersant.

General methods of shoreline protection are outlined in Sections 9.3.2 to 9.3.6. However, the method or methods most appropriate are dependent on a number of factors including the amount of beach access, beach type etc.

The **SCTO** should consult the **Coastal Maps** and associated **Data Sheets** for site-specific guidance (Section 9.6).

Table 9.3 indicates generally suitable protection methods for shorelines, tidal inlets and other water channels.

9.3.2 Diversion Booms

Purpose: Used either to **deflect** oil **away** from sensitive areas or to **collec**t oil **onto** low sensitivity shorelines for cleanup.

When to use: Diversion Booms should be used when:

- Oil is moving **along** the shoreline.
- Surface flow rates are slow (preferably below 2 knots or 1 metre/second).
- Movement is not tidally influenced (i.e. is wind driven) or booms can be rapidly redeployed if the direction of spill movement is tidally influenced.
- Breaking waves are less than 0.5m high.

For Deflection:

- Shorelines are sensitive to oil, or are difficult to clean due to poor access etc.

For Collection

- The shoreline is of low sensitivity or relatively low sensitivity to oil and
- The shoreline impacted can be easily cleaned.

How to use: Diversion boom configurations are shown in Figures 9.1. The following must be considered:

- The boom or booms must be placed at a suitable angle.
- The angle required between beach and boom will depend on the flow rate of surface currents. **If the angle is too great the oil may be drawn under the boom.** If the angle is too small **then deflection will be less than optimal** (Figure 9.2).
- An effective seal must be maintained between the boom and the beach surface. The **Shore Guardian** boom is used to provide such a seal. If this is not available a seal can be improvised with sand (i.e. burying onshore boom sections). Or sorbents placed at the interface with the shore.
- The provision of an effective seal between the boom and beach is **essential**. This can be achieved using either specialised booms, (e.g. **Shore Guardian**) sorbents or sediment.
- Suitable **collection devices** (skimmers, vacuum systems etc.) access and **storage** facilities for oily waste must be avail

9.3.3 Exclusion Booming

Purpose: Boom is deployed so that oil cannot penetrate coastal inlets, marina entrances etc. or is prevented from impacting the intertidal zone.

When to use: Exclusion boom configurations should be used when:

- Oil is threatening tidal inlets and channels, marinas or streams with low flow rates. Particularly if inlets lead to sensitive resources such as sheltered marshes or lagoons.
- Tidal currents (or net inflow current) are low (less than 1 knot or 0.5 m per second) and where breaking waves have a height of less than 0.5m.
- The shoreline or inlet is of high sensitivity.

How to use: The following points should be considered:

- Boom must be deployed at a suitable angle (Figure 9.2).
- For artificial structures such as marina entrances an effective seal between boom ends and the wall or entrance sides is required. Figure 9.3 indicates an anchoring arrangement, which can provide this where channel sides are vertical. Such arrangements are not entirely effective where sides are sloping, particularly where constructed of large boulders. In these cases light backup booms can be used, in association with sorbents, to contain oil, which may pass through ineffective seals.

- Suitable collection devices (skimmers), storage and access must be available where oil is collected.
- Where the sides of channel entrances are gently sloping or where entrances are intertidal (e.g. protected by low sand banks), Shore Guardian Boom can be used. This allows an effective seal to be maintained between the boom and banks (Figure 9.4).

NOTE: **It is preferable to deploy boom at low tide so that adequate boom length is allowed for tidal ranges.**

9.3.4 Shoreline Barriers

Purpose: A number of other methods can be used to prevent oil from impacting shorelines or from entering tidal inlets or other waterways (Figure 9.5).

When to Use: Shoreline barriers are generally used when:

- Booms are not available and where inlets or small areas of beach require protection.
- Wave energies are very low.
- The tidal range is low (<2m).
- Access is available for mechanical equipment.

How to Use: Methods required are highly variable. Care must be taken to ensure that sensitive habitats or fauna are not disturbed.

9.3.5 Sorbents and Other Beach Treatment Agents

Purpose: To treat beach surfaces so that oil does not adhere to sediment or to treat oiled surfaces so that natural cleaning is enhanced.

When to Use: Beach treatments may be used when:

- Beach cleaning is not possible or is likely to be damaging.
- In cases where effective collection of any oil cleaned from beaches is not possible. Where collection of oily sorbent is **not** possible and where refloated sorbents are not likely to be more damaging than oil on the beach.
- The treatment agents are not damaging to shoreline communities.
- Refloated oil is likely to be rapidly naturally dispersed.
- Increased volumes of oily waste can be handled (i.e. oil with sorbents).

How to Use: A number of products are available which are designed to reduce the amount of oil adhering to a shoreline (Table 9.4).

Sorbents

- Powdered sorbents can be used on already oiled beaches **provided that they can be recovered.**
- Solid sorbents can be fixed to beaches prior to oil impact but generally this is a labour intensive process and requires large amounts of sorbent.

Other Agents

A number of chemical agents may be available for the pre-treatment of shorelines. The use of these products is not generally recommended at present.

9.4 SHORELINE CLEANUP

9.4.1 General Guidelines

A number of methods can be used to clean shorelines impacted by oil. The selection of method must be made with regard to:

- Beach type (e.g. rock, sand, mud etc.)
- Degree of exposure and wave energies
- Amount and type of access available
- Biological and other character of the beach (public use etc)
- Nature of the oil (viscosity etc.)
- Amount of oil present
- Distribution of oil on the beach, and in the sediments
- Available equipment and labour

It is important that oiled beaches are assessed in order to determine:

- Suitable cleanup method;
- Volumes of oily waste likely to be produced.

The assessment procedure is outlined in Section 9.4.2.

Section 9.4.3 outlines the methods, which can be used to clean various coastal types.
Section 9.4.4 outlines these methods.

Section 9.6 provides site-specific recommendations on the data sheets and **Coastal Maps.**

9.4.2 Shoreline Assessment

Shoreline assessment is undertaken in two stages:

- A preliminary assessment to determine whether cleaning is required and to quantify the amount of oil, and character of oil present. This assessment will allow the **Flinders Ports IC, (Tier 1 Response)** and **SAMSCAP IC** (for Tier 2/3 response) to conform **priorities** for cleaning.
- An assessment to determine the **type** of cleanup required.

9.4.2.1. Preliminary Assessment

The **Flinders Ports IC or SAMSCAP IC** for Tiers 2 or 3 will undertake a preliminary assessment of any oiled, or reportedly oiled beach that they are instructed to clean (or assess).

This assessment is to be done according to the procedures outlines in OSCP FM 01 for Tier 1 spills only.

The key information will be provided, via hand held radio, to the **IC.**

A completed assessment form (OSCP FM 01) must be provided to the **IC** as soon as possible.

9.4.2.2. Determining the Cleanup Methods to be Used

A number of shoreline types are found within the Flinders Ports South Australia OSCP area. Each of these is amenable in varying degrees to a variety of cleanup methods.

The shoreline types considered are:

- Rock Platform and Reefs
- Boulder and Cobble Beaches
- Sand Beaches
- Pebble/Gravel Beaches
- Intertidal Mudflats/Sandflats
- Mangroves

General guidelines for cleanup are provided in Table 9.5. However, these shorelines may also be associated with biological resources or human uses, which require special consideration during cleanup. Biological constraints to cleanup do occur and site-specific guides to these are provided in Section 9.6. These may include:

- Subtidal Habitats
  - Seagrass
  - Reef or Mud Communities
  - Corals

- Birds
  - Rookeries and Nesting Sites
  - Migratory Bird Concentration
  - Waders and Waterfowl Feeding Areas
- Fisheries
  - Inshore Netting Areas
  - Fish Breeding Areas
  - Fish Farming Areas

- Terrestrial Habitats
  - Sand Dunes
  - Native Vegetation

Table 9.7 and Figure 9.6 provide a decision guide for small sediment shorelines, (mud, sand to cobble).

Figure 9.7 provides a decision guide for rocky shores.

9.4.3 Coastal Type Considerations

9.4.3.1 Cliffs

Description Vertical or sloped escarpments, which restrict access to underlying shores.

Priority: Often cliffs do not require cleaning because:

- Oil has been held off the coast by wave reflection.
- Self cleaning is rapid due to exposure to high wave energies.
- Cleaning is difficult or impossible due to
  - absence of access
  - high sea states or
  - dangerous working conditions

Cleaning: Sheltered cliffs associated with platforms or sandy beaches do sometimes need cleaning. In these cases the following methods may be used:

- High pressure washing with seawater (Section 9.4.4.5).
- Low pressure washing with seawater (thick films only).

Notes: Cleaning of rocky cliffs with detergent or dilute dispersants is practiced in some parts of the world, as are the use of abrasives or hot water washing. While these methods are effective in cleaning the surface they tend to result in damage to biological communities. They are not generally recommended.

9.4.3.2 Rock Platforms and Rock Reefs

Description: Flat or gently sloping rock surfaces. Platforms may be 'broken' with associated crevices, rock pools or boulders or 'unbroken' smooth surfaces with or without rock pools.

Platforms may occur in association with other beach types.

Priority: Platforms, which lie in the lower intertidal zone, are generally afforded a low priority because oil tends not to adhere to the wet wave exposed surface and to be rapidly removed. Platforms in the mid to upper intertidal zone are also generally self cleaning and therefore oil does not persist.

If significant biological resources such as shellfish harvesting activities are present a high priority for cleanup and protection must be given to platforms.

Cleaning:

- Manual removal of oily debris (Section 9.4.4.3).
- Low pressure flushing and irrigation with seawater (Section 9.4.4.4).
- High-pressure washing using seawater (Section 9.4.4.5).
- Use of sorbents to facilitate collection of oil. Powdered sorbents in association with vacuum systems, sorbent pads etc. for use with manual collection (Section 9.4.4.6).
- Vacuum systems can be used to collect heavy (thick) or pooled deposits of oil where access is possible (Section 9.4.4.7).

Note: Oiled vegetation (seaweed etc.) may be removed by **cutting** (not pulling up of plants) if the extent of oiling is large. Otherwise leave to self-clean.

9.4.3.3 Boulder Beaches

Description: Boulder beaches are those consisting of large rocks (over 250mm in diameter).

In the Flinders Ports South Australia region, boulders are associated with sands and are often man-made structures.

Priority: Boulder beaches are cleanable but will generally self clean.

Cleaning:

- High volume low-pressure irrigation of associated beaches, in with high pressure washing of rock surfaces.
- Moderate to high pressure washing with seawater is recommended (Section 9.4.4.5).
- Hot water washing may be used but only where damage to biological communities on rocks or adjacent subtidal communities is unlikely or not important.

Notes: Effective deployment of booms to collect oily runoff is required.

9.4.3.4 Cobble-Pebble Beaches

Description: Small areas of cobble (diameter 6-25 cm) and pebble (diameter: up to 6 cm) beaches do occur in the Flinders Ports South Australia region; predominantly cobble.

Priority: Boulder beaches are cleanable but will generally self clean.

Cleaning:
- Low pressure flushing is preferred, particularly if mangroves are present.
- High to moderate pressure washing may be used where cobble is associated with platform and mangroves are absent.
- Pooled oil may be removed using vacuum systems.
- Manual removal of oily debris.
- Mechanical or manual reworking of stained cobble may be effective in those places where access is available.

Notes: If mangroves are associated with cobble-pebble care must be taken that oil washed from the cobbled areas does not impact unoiled mangrove fringes.

9.4.3.5 Sand Beaches

Description: Sand beaches may be either find grained or coarse grained. Fine sands are generally flat, wide and hard packed; and therefore can support vehicles. Coarse sands are usually steeper, narrower and may not support vehicles.

Priority: Sand beaches are generally cleanable, providing access is available, particularly if oil is viscous or emulsified. Recreational beaches or those adjoining sensitive shorelines are given a moderate priority for protection and a high priority for cleanup.

If significant biological resources or economic value is associated with these shores, a high priority for protection will be given.

Cleaning:
- Manual cleanup where access is restricted, if oiling is light, or if the beach cannot support vehicles (Section 9.4.4.3).
- Mechanical cleanup, provided beach can support heavy machinery (Section 9.4.4.2).
- Low-pressure irrigation of soft sediments may be advisable.
- Refloated oil must be collected using booms and skimmers (Section 9.4.4.4).
- Vacuum trucks or systems can be used on pooled oil or where oil is very thick (Section 9.4.4.7).
- Final 'polishing' of sediment can be achieved through 'tilling' of surface sands.
- Sediment can be reworked by 'harrowing' or 'discing' to facilitate removal of oil stained sediments.

Notes: Always confirm that the beach can support vehicles.

9.4.3.6 Intertidal Sand Flats

Description: Intertidal flats are comprised of mud or sand, or a mixture of both. Sediments are often water saturated and may be very soft. In the Flinders Ports South Australia region, most intertidal muds are unconsolidated or cannot support foot traffic.

Priority: Intertidal mudflats are afforded a moderate to high level of priority for protection, particularly where they are associated with other high priority shorelines such as mangroves. Some mudflats also support diverse biological communities. In the region the intertidal flats support a commercial fishery and are allocated a high priority for protection and cleaning.

Cleaning: If oiled, intertidal sand or mudflats tend to self-clean, despite being of low energy. This is due to the fact that oil is restricted to the surface by the sediment water, which prevents deep penetration of the sediment by oil. However, should cleaning be attempted the following methods are recommended:

- Use of sorbents on incoming tide to facilitate pickup of oil on high tide. This should be done using shallow draft boats (Section 9.4.4.6).
- Low pressure flushing of sandflats is possible in some areas. Care should be taken that erosion of sands is not caused.

Notes: Care is needed in working on or near intertidal sand or mudflats.

Generally, entering these areas on foot is not recommended. Use of vehicles is **not** to be attempted.

Waders and waterfowl may be excluded from small oil patches using balloons or other means.

9.4.3.7 Mangroves

Description: Landward ‘inner fringe’ mangroves are relatively dense, while outer fringes are generally less dense. Mangroves may be exposed to relatively high wave energies and tidal flows. Sediments are generally peaty-muds but may be sandy or rocky also.

Priority: Mangroves are given a high priority for protection but a low priority for cleanup due to:

- Generally poor access.
- Potential damage for cleanup activities.

However, mangroves in the southern sections of the bay are often backed by a sandy beach and constitute narrow fringes. As such they can be cleaned.

Cleaning: If cleaning is required the following methods should be used **under close supervision**:

- Heavy or pooled oil may be removed by low pressure flushing with seawater **provided** that:
  - -- suitable access is available.
  - - oil will not be washed into unaffected areas.
  - - **no** erosion of sediment is observed.
  - - a collection boom can be deployed.
- Oily debris should be manually removed provided that access is available.
- Sorbent materials may be used to collect oil from mangrove margins and channels provided that they can be effectively recovered (i.e. **no** use of loose sorbent granules or powders).
- If oiling is light to moderate the mangroves should be left to recover naturally.

Notes: All cleanup in or near mangroves should be under the supervision of an environmental officer.

9.4.4 Cleanup Methods

9.4.4.1 Environmental Considerations

It is necessary to consider the possible environmental effects of the cleanup methods used.

9.4.4.2 Mechanical Cleanup

Mechanical cleanup techniques may utilise a number of equipment types, and methods used will depend on the equipment that is available (see Figure 9.9).

Generally equipment is sources from local government and local contractors (Appendix I).

Figure 9.9 illustrates the preferred methods for mechanical beach cleaning. Indicative fuel requirements and anticipated cleanup rates are given in Table 9.8.

It is best to use equipment in the way for which it was designed.

Front End Loaders, Bulldozers and Elevating Scrapers can all be used to rework beach sediment (e.g. cobble, pebble, boulder) or to push such sediments into the shoreline for cleaning by waves.

Note: **Vehicles should not be allowed to pass over oiled sediment since this tends to result in the burial of oil into sediment.**

9.4.4.3 Manual Cleanup

Manual cleanup is the preferred option for cleaning inaccessible shorelines or those where mechanical cleanup is undesirable.

Manual cleanup is slower than mechanical cleanup but generally results in the removal of much less sediment. Hence disposal requirements are reduced.

Equipment is usually basic and consists of wheelbarrows, rakes, buckets, shovels, plastic bags (industrial strength) or other temporary storage.

The requirements for manual beach cleanup are highly variable but generally a 10 person team, plus 1 supervisor is required in order to clean 1 km of lightly oiled beach in 1 day. Table 9.10 provides indicative needs.

9.4.4.4 Low Pressure Flushing

Low pressure flushing can be used, **with care**, to remove surface oils from most beach type surfaces.

It is important that refloated oil is collected in booms or other containment devices and recovered using skimmers or sorbents. Generally low pressure flushing does not result in the emulsification of oils and so sorbents may be used. It is preferable to check the condition of refloated oil and choose a suitable skimming device and pump (Section 5).

It is important also that refloated oil does not pass over clean sediment.

Figure 9.10 illustrates a typical flushing array. Table 9.10 provides indicative material requirements.

9.4.4.5 High Pressure Washing

High-pressure washing is to be used only on rocky sediments or on artificial surfaces such as wharves, jetties etc.

This method tends to emulsify oil and consequently the use of sorbents to collect refloated oil is not recommended.

Oil, which is removed from surfaces, can be collected within light inshore booms or onshore using **Shore Guardian** or a similar boom.

Oil can be recovered using vacuum systems or skimmers.

Material and labour requirements are highly variable and will depend on the extent of oiling, the speed with which cleaning is expected to proceed, the type of substrate and the ease with which containment can be achieved. Table 9.11 provides an indication of equipment required per team.

9.4.4.6 Use of Sorbents

Two types of sorbent materials can be used:

- Loose, powdered or granular sorbents.
- Solid, pads, rolls or sheets.

Each of these may be either of synthetic or natural fibre.

As a general rule loose sorbent materials are not used because they are difficult to recover. However, there are occasions when this is not considered to be a problem, such as in high-energy areas where oily sorbent materials can be expected to be washed off of surfaces and dissipated to sea. Of course, oil too is likely to be washed off such shorelines, to dissipate.

Solid sorbents may be used in the form of sorbent booms to recover light oil films or as pads or rolls to absorb free oil from the surface of sediments in cases where vacuum systems cannot gain access or where oil is too fluid for manual recovery.

9.4.4.7 Vacuum Systems

Vacuum systems may be portable hand operated systems or vacuum trucks.

Vacuum systems tend to pick up large volumes of water with the oil and so it is preferable to use them on oil pooled on the sediment surface or to remove oil from containers or dams in which the water has been decanted.

One method to minimise the amount of water removed from the beach is to use light, portable vacuum systems to deposit oil-water into temporary storage containers on the beach, allow settling time and to decant the water (Figure 9.11). Large units can then be used to collect the oil from these containers and transport oil to storage sites.

Vacuum systems can also be used in association with deflection booms to recover oil from the sea surface. It is advisable in this case to fit the hose with a broad **Manta Ray** head.

9.4.4.8 Steam Cleaning and Sandblasting

Steam cleaning and sandblasting are **not** recommended cleanup methods for natural shorelines. They may be used for the removal of weathered residual oil from artificial structures such as sea walls.

Effort will vary according to distribution of the oil and the extent of weathering. Table 9.12 provides indicative requirements and cleaning rates.

9.4.4.9 Use of Chemical Agents

Chemical agents have been used on shorelines to either:

- Protect the shoreline from oil impact (i.e. prevent adhesion of oil).
- Remove oil already deposited on the shore (e.g. detergents).
- Convert the oil to a form more amenable to removal by washing etc. (a number of ‘gelling’ agents).

The use of chemicals for beach cleaning is not recommended, even though cleaning times can sometimes be greatly reduced.

9.5 WASTE HANDLING AND TEMPORARY ON SITE STORAGE

9.5.1 Safe Handling Practices

All shoreline response personnel must be supplied with equipment and gloves so that oil or oily materials need not be directly handled.

It is the responsibility of the **Shoreline Cleanup Team Officer** to ensure that all workers are suitably trained, equipped and that oil and oily debris is being handled properly.

In the case of larger cleanup programmes **Waste Management Officers** will be available to provide instruction and advice to field teams.

9.5.2 Temporary Storage

Table 9.11 lists the temporary storage containers, which are available for holding oily wastes. The **Shoreline Cleanup Team Officer** may request these from the **Shoreline Response Manager** as required.

If a delay is experienced the recovered waste should be handled as follows:

Oily sediment, no free oil:

- Stored above the high tide mark in pits no deeper than 1 m. the storage site should avoid vegetated areas and low lying areas.

Oily sediment or debris, some free oil:

- A shallow pit should be dug and lined with plastic. Edges should be elevated above sediment level. Depth of pit should not be such that intrusion of sediment water occurs.

- Plastic bags, no more than one third full, and stored above the high tide mark.

200 litre drums, if available. Again these should not be filled to the top; two thirds full is sufficient. Drums should be **covered** if possible to avoid the entry of rainwater with consequent overflow. Drums should have holes punched approximately 30 cm from top to facilitate handling and transport.

Free Oil, Oily Debris:

- Storage pits and drums as per oily sediment/some free oil, except that greater care is needed in the siting of temporary storage pits. Unless sediment water is encountered, pits should be deeper than above and left no more than two thirds full if possible. Storage pits should be covered.

- Fast Tanks or other temporary storage containers are available.

9.6 COASTAL MAPS AND DATA SHEETS

9.6.1 General

The following **Coastal Maps** have been prepared by the Transport SA. They are to be used in the field with the **Data Sheets.**

The maps provide information regarding:

- Beach type
- Access
- Sensitive resources

The accompanying **Data Sheets** provide supporting information regarding:

- Special cleanup instructions
- Standard of access
- How to deal with or avoid sensitive resources
- Sources of advice
- Relevant authorities
- Contact numbers

These require periodic updating. Should any of the information prove to be incorrect this should be brought to the attention of the **SMPC.**

9.7 FIGURES & TABLES

Figure 9.1 Protection of Shorelines, Marinas and Tidal Inlets Using Diversion (Deflection or Collection) Booms

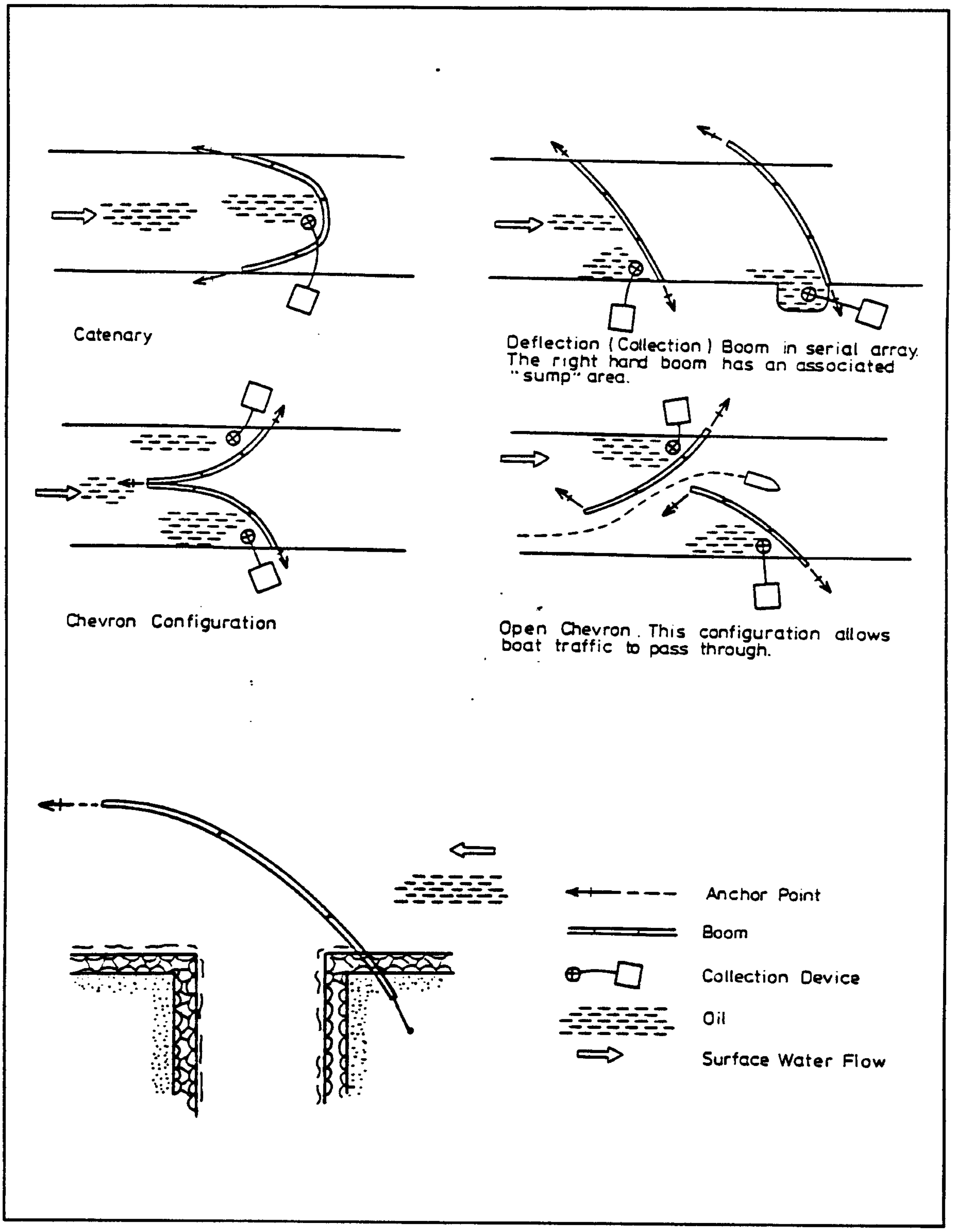
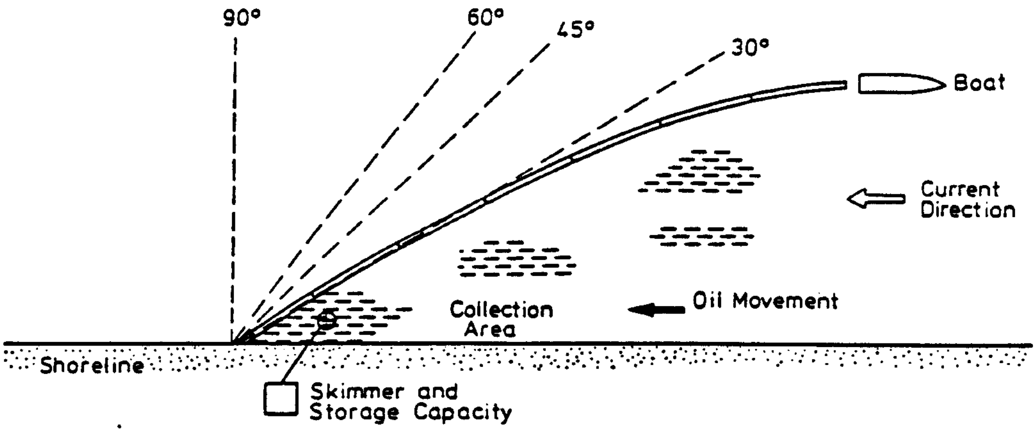


Figure 9.2 Position (Angle) Required for Effective Diversion Booming



Current Velocity knots	m per sec.	Maximum Boom Deployment Angle
	0.35	90
1.0	0.5	45
1.4	0.7	30
1.6	0.8	26
1.8	0.9	22
2.0	1.0	20
2.5	1.25	16
3.0	1.5	13

NOTE: Current direction and flow rates vary greatly within the bay. These should be monitored regularly at each deployment site. It should not be assumed that tidal conditions in the main channels are the same as those at each onshore location.

Figure 9.3 Anchoring Configuration for use of Booms on Artificial Structures

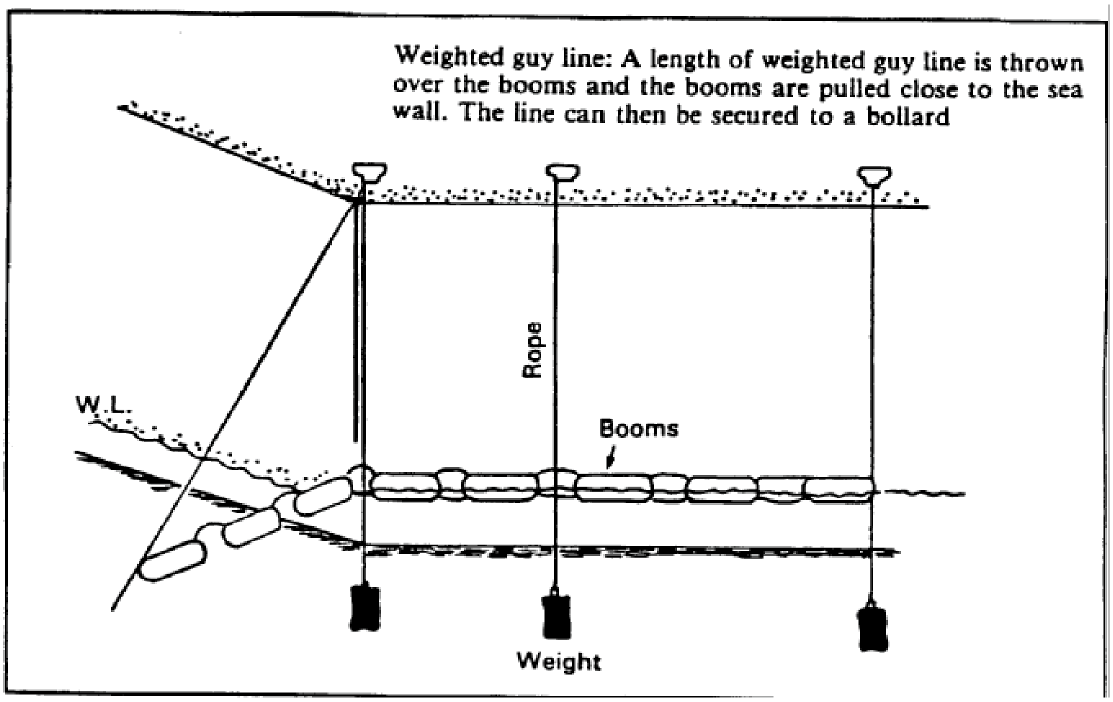


Figure 9.4 Use of Shore Guardian Boom to Exclude Oil from Tidal Channel

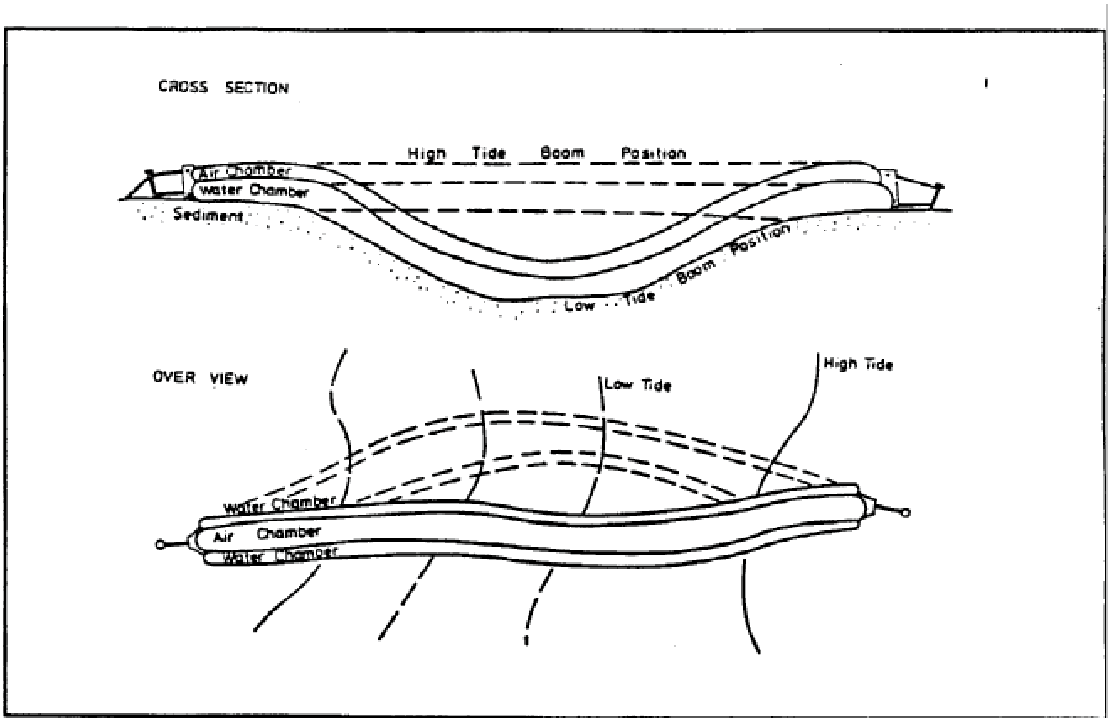
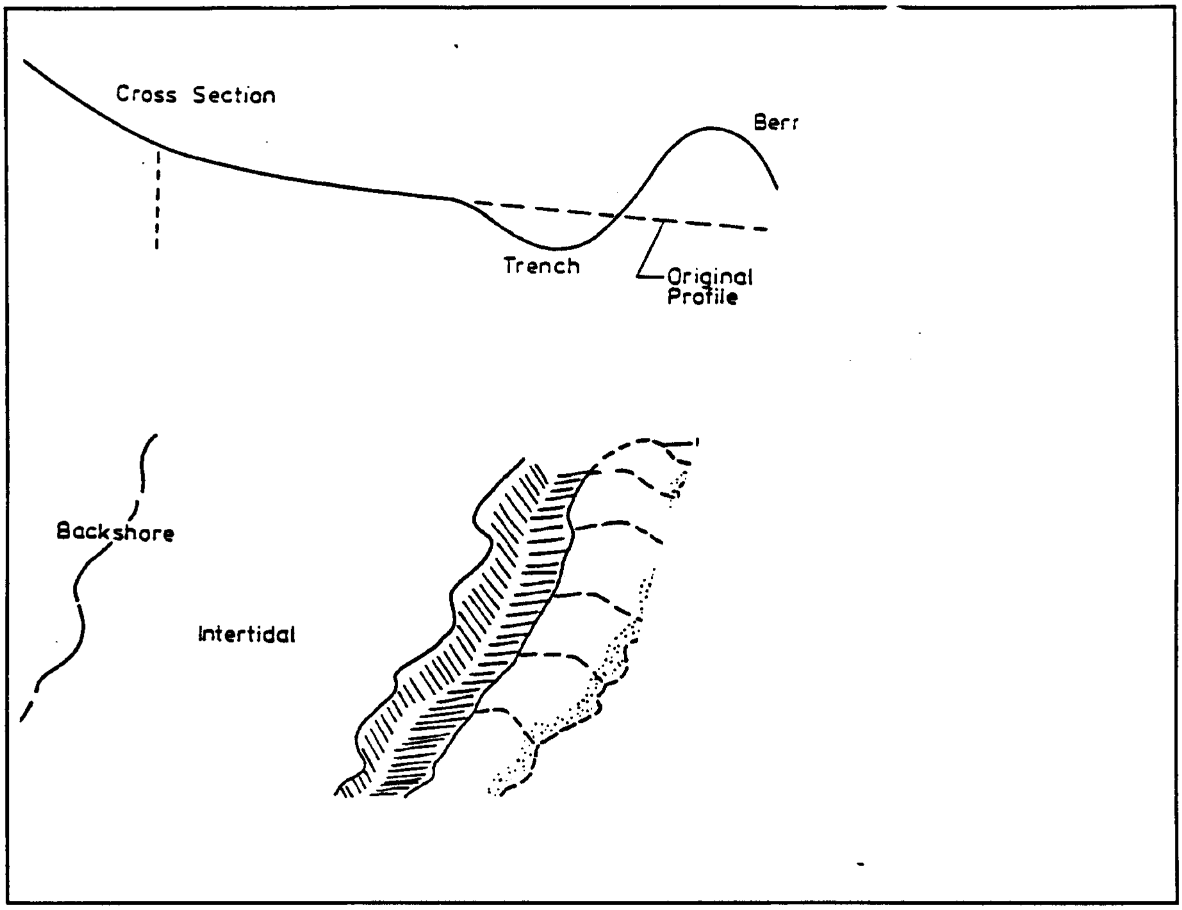


Figure 9.5 Use of Beach Berm for the Protection of Beaches, Inlets and Slow Flowing Streams



UNCONTROLLED COPY if printed

Figure 9.6 Decision Guide for Cleanup of Small Sediment Shorelines

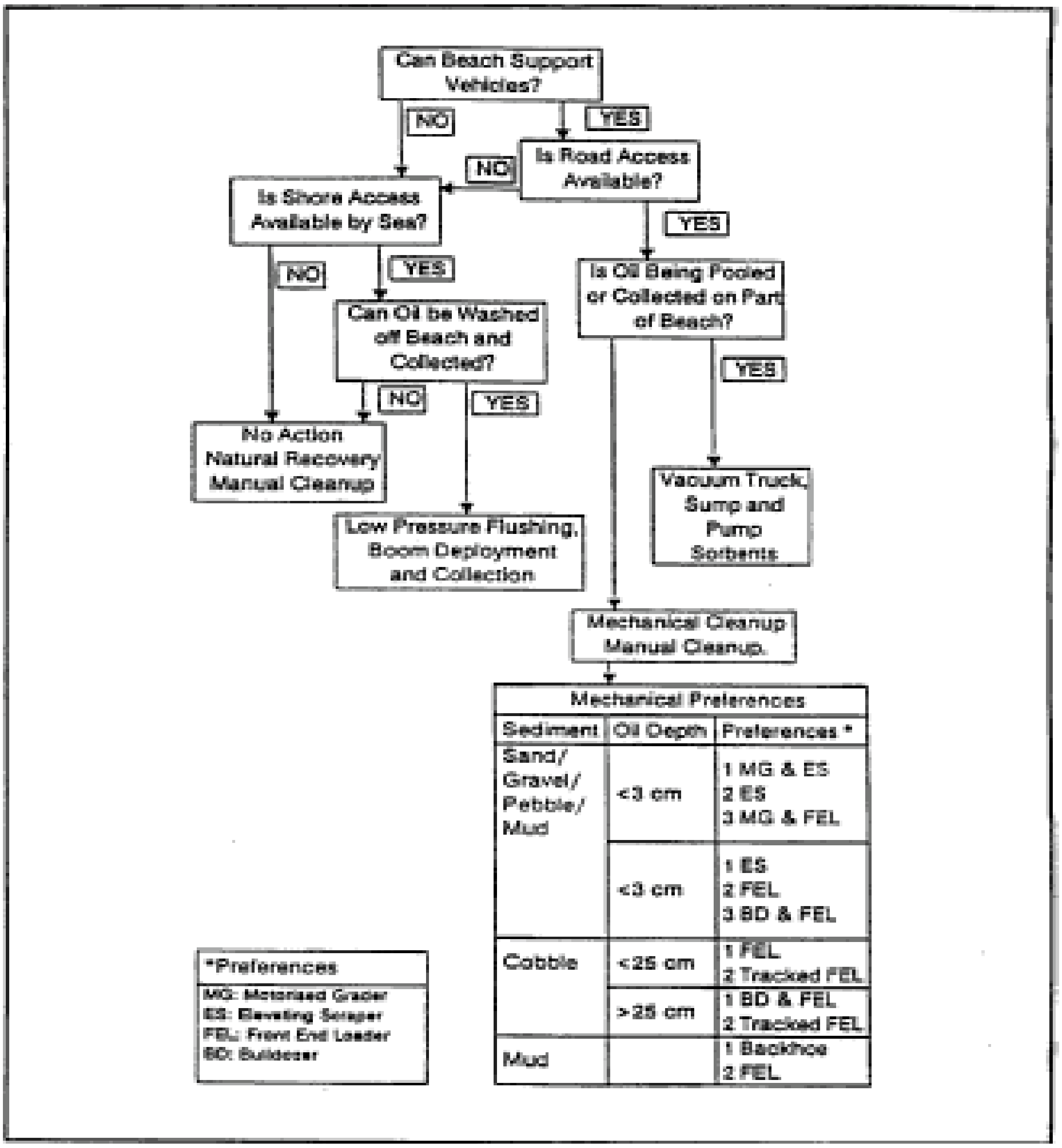


Figure 9.7 Decision Guide for Cleanup of Rocky Shorelines

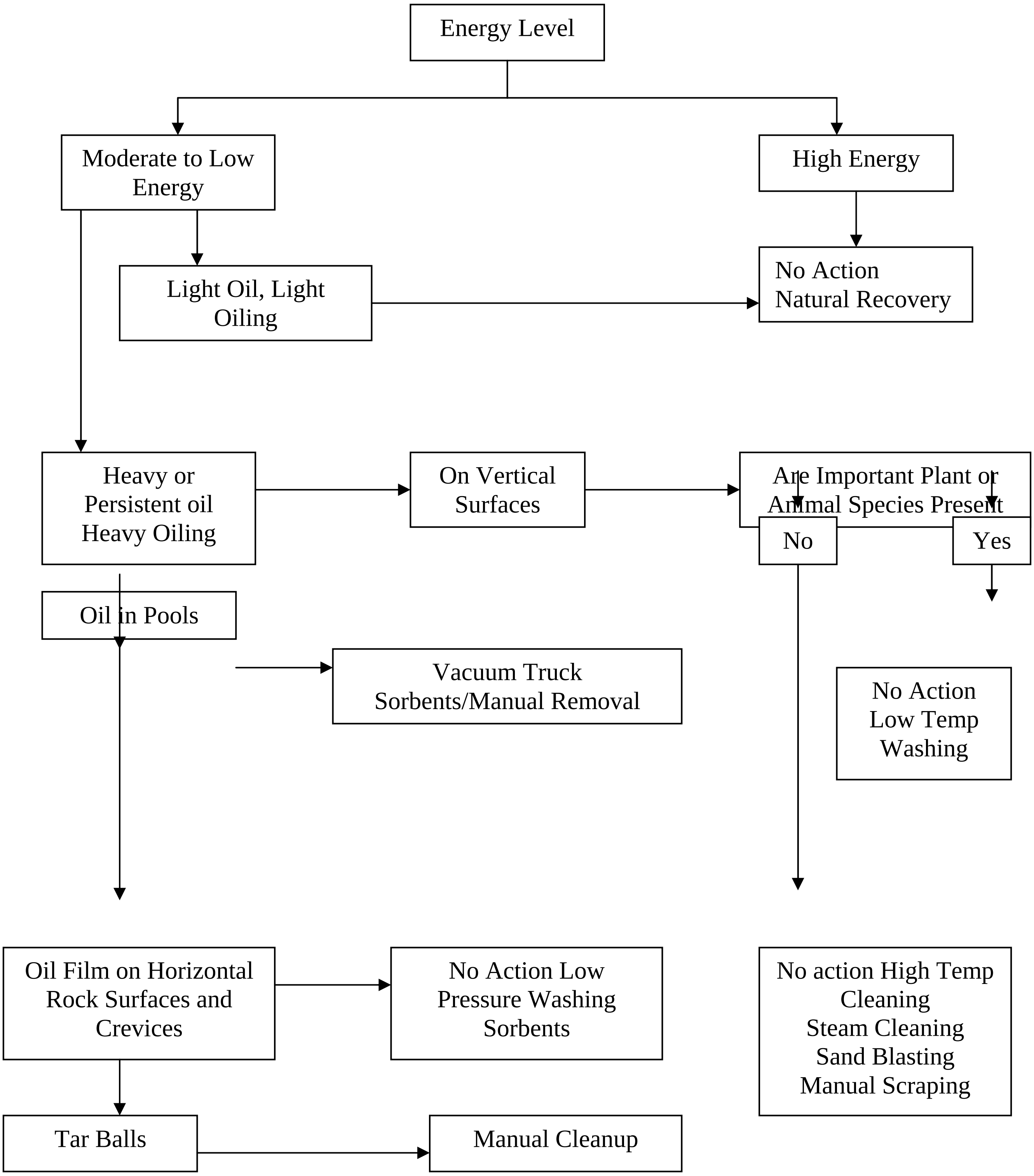


Figure 9.8 Methods for Mechanical Beach Cleaning (Adapted from Exxon 1993)

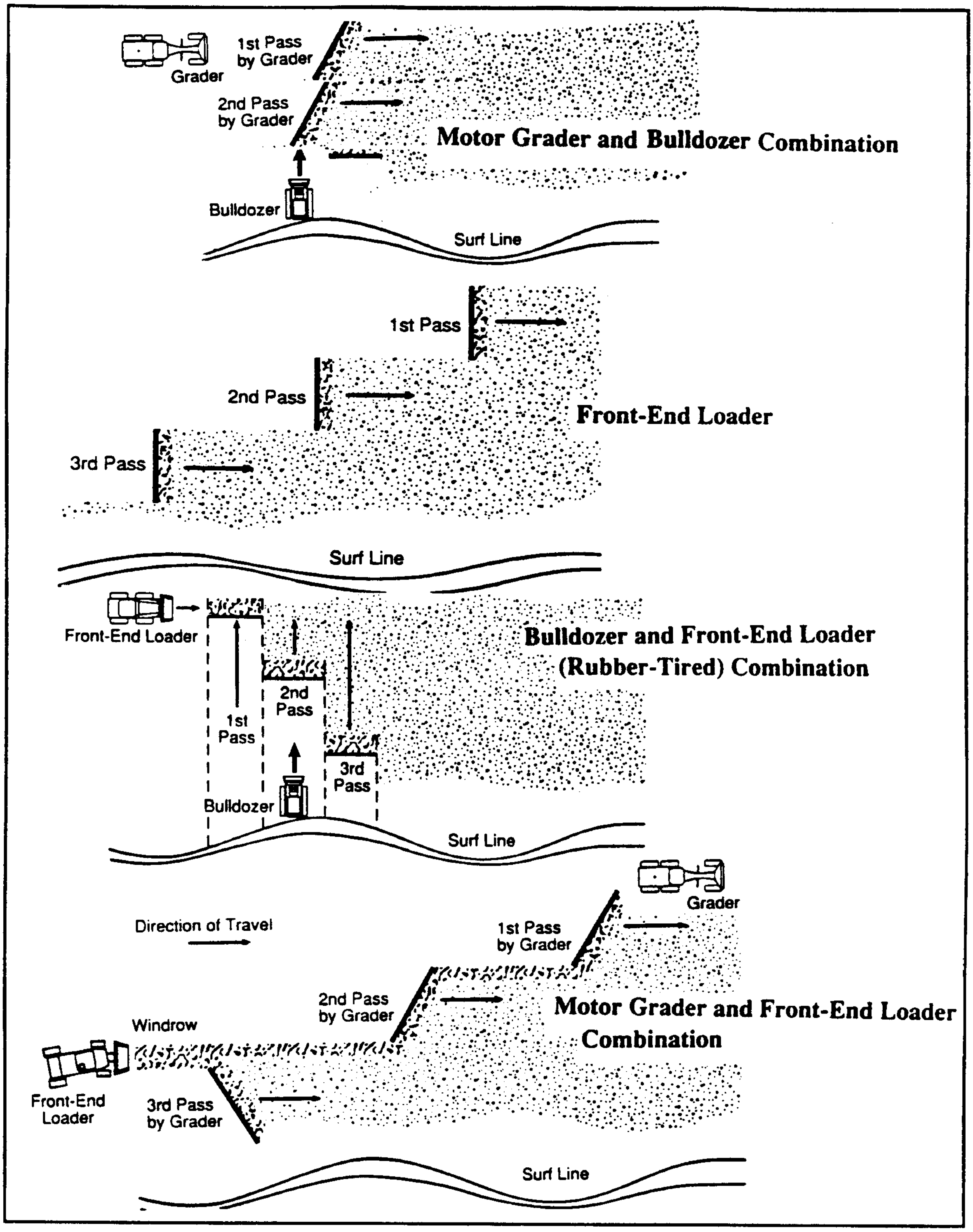
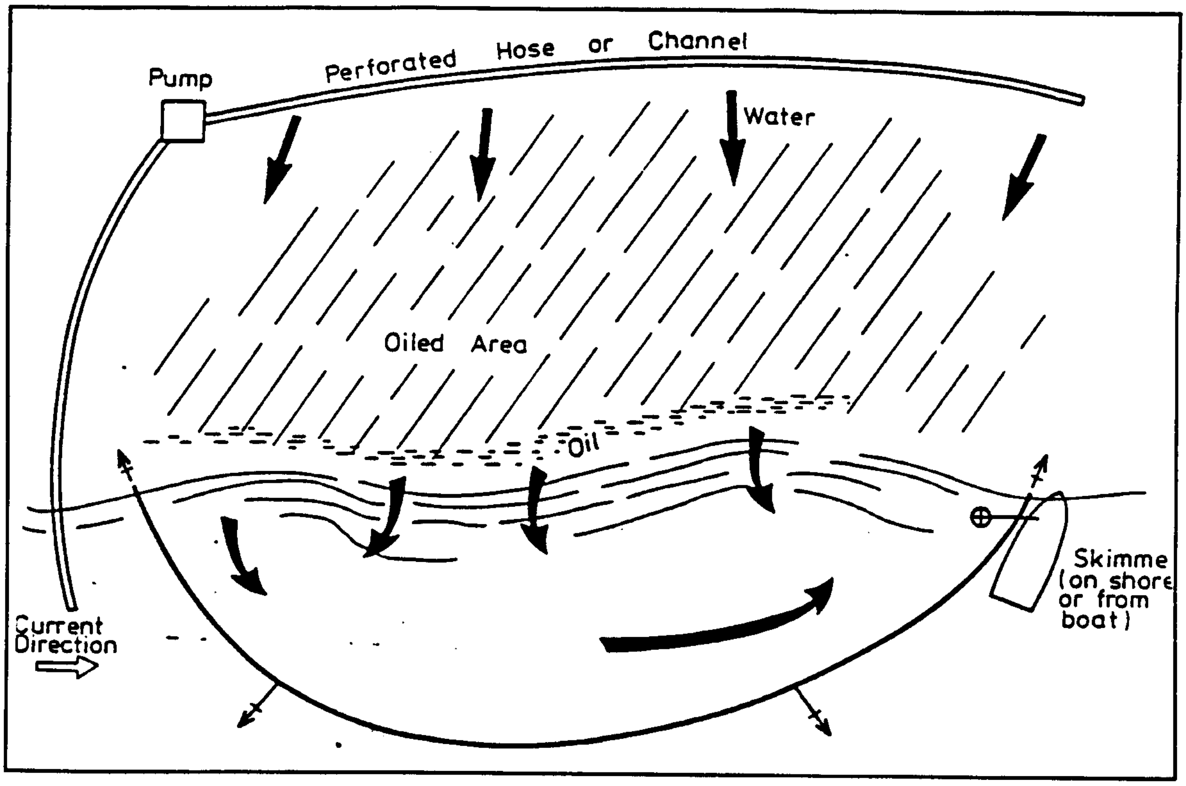
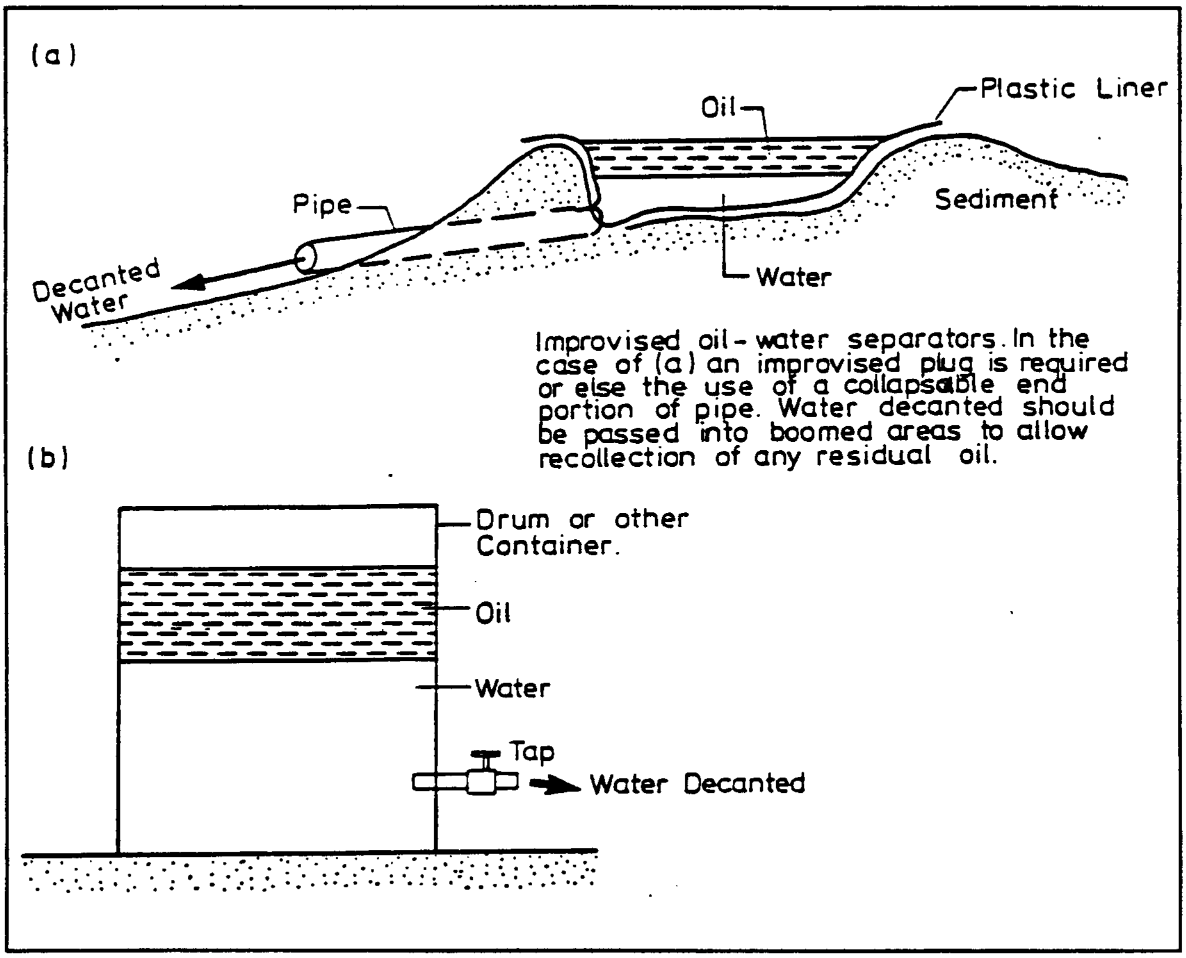


Figure 9.9 Typical Low Pressure Flushing Array



UNCONTROLLED COPY if printed

Figure 9.10 Temporary Storage Systems for Separation of Oil and Water



UNCONTROLLED COPY if printed

Table 9.1 Environmental Sensitivity Index (ESI) Ratings for Various Coastal Types

ESI Rating	Coastal Type (s)	Comment
1	Exposed rocky headlands Wave Cut Platforms Seawalls	Considered to be of low sensitivity. Oil not likely to be persistent.
2	Exposed fine grained sand beaches Sandy shoals	Low sensitivity. Little percolation of oil into sediment. Oil unlikely to persist.
3	Exposed medium-course grained sand beaches	Oil may percolate into sediment or be buried. Oil may persist. Low biological sensitivity.
4	Exposed mixed sand-gravel beaches Sand gravel fills	Oil unlikely to penetrate deeply due to sand. Low biological diversity.
5	Exposed gravel beaches Riprap	Oil likely to penetrate sediment Low biological diversity.
6	Exposed tidal flats	Oil not likely to penetrate sediments. Biologically may be diverse.
7	Sheltered rocky shores Sheltered sand beaches Pocket beaches Raised river banks	Oil may persist. Biologically may be moderate-diverse.
8	Sheltered tidal flats Coral flats	Oil may persist on surfaces. Biologically diverse.
9	Exposed mangroves	Oil may penetrate sediment but unlikely to persist on surface. Biologically diverse.
10	Sheltered mangroves	Oil may persist. Biologically diverse.

Key: 1 = low   10 = high

Table 9.2 Shoreline and Cleanup Response Priority Rankings

Ranking	Comment
1	First priority. Beach is cleanable, access available and sensitive resources will be protected through appropriate cleanup.
2	Second priority. Beach is cleanable and access is available but oil poses little or no further risk. Few sensitive resources present.
3	Beach is cleanable but difficult (access or other constraints). Generally the cleanup is not damaging, and the oil poses little or no threat to adjacent areas.
4	Beach is cleanable but difficult (access or other constraints). Beach likely to self-clean. Oil poses little or no further threat or this is outweighed by potential effects of cleanup.
5	No cleanup to be attempted. Area is self-cleaning and of low sensitivity or cleanup is likely to result in more damage than the oiling.
P	Priority for protection. Sensitive resource present. This classification is assigned independent of cleanup ranking.
C	Beach is suitable for **collection** i.e. oil should be directed towards beach for collection: Beach is of low sensitivity and very cleanable. (Generally assigned to beaches with '2' ranking and occasionally with an 'l' ranking).

Table 9.3 Inshore or Onshore Protection Methods for Various Coastal Types

Shoreline Type	**Method of Protection**				
	Booms		**Earth or other Barriers**	**Beach treatment Agents**	**Inshore Use of Dispersants(1)**
	Deflection	**Exclusion Barrier**			
Exposed Rock Cliff					V
Exposed Platform	V	V			V
Sheltered Platform	P	V		V	V
Boulder/Cobble	P	V	V	V	V
Sand Beaches	P	P	P	V	V
Intertidal Mud & Sand flats	P	P			V
Mangroves	P	V			V
Seagrass (emergent or intertidal)	P				V
Salt marshes	P				V
Natural Inlets/Channels	P	P	P		
Entrance to Marinas	P	P	V		V

P Preferred method in most cases

V Viable method in some cases.

(1) CAUTION: Highly dependent on considerations of potential effects on shallow sub tidal communities and likelihood of successful coastal protection. If dispersants are to be used it is preferable that they are used over deep water with good water exchange.

Table 9.4 Sorbent Materials and Oil Holding Capacities
(Note: Other sorbents may be available. In these cases characteristics should be approximated using this table.)

Material	Oil Sorbance Ratio Kg Oil/Kg Sorbent		Buoyancy After Prolonged Contact with Water
	High Viscosity Oil (1)	Low Viscosity Oil (2)	
Natural			
Peat Moss	4	7	Sinks
Straw/Rice Straw	6	2	Sinks
Cellulose Fibre (Paper or timber pulp)	12-18	6-10	Sinks
Peanut husks	5	2	Sinks
Artificial			
Polyurethane Foam	70	60	Floats
Urea-Formaldehyde Foam	60	50	Floats
Polyurethane Fibre	35	30	Floats
Polypropylene Fibre	20	7	Floats
Polystyrene Powder	20	20	Floats
Synthetic/Organic			
Perlite/Vermiculite	4	3	Sinks
Volcanic Ash	20	6	Floats
Glass Wool	4	3	Floats

(1) about 3,000 cSt

(1) about 5 cST

Table 9.5 General Guidelines for Shoreline Cleanup

Coastal Type	***Preferred Method***	***Options***	***Not to be used***
Rocky Cliff	No cleanup, natural recovery	High pressure flushing	Scouring Agents
Platform	No cleanup, natural recovery	High pressure flushing	Scouring Agents
Boulder	Low or high pressure flushing, normal removal of oily debris	Mechanical reworking of sediment to facilitate natural cleaning	
Cobble	Mechanical reworking of sediment and natural removal, manual cleanup/removal of oily debris, low pressure flushing	High pressure flushing, pushing oiled sediment into surf zone (High energy/exposed shorelines only)	Excessive removal of oiled sediment
Pebble/Gravel	Mechanical removal of sediment, pushing sediment into surf zone, manual removal of debris	Low pressure flushing, periodic reworking of sediment and natural cleaning	Dispersants, excessive removal of sediment
Sandy Beaches	Mechanical removal of oiled sediment. Manual cleanup of small spills	Low pressure washing of compacted, firm, sediment	Dispersants. (generally). Excessive removal of sediment
Saltmarsh/Mangrove	No cleanup, natural recovery, area should be protected from impact	Low pressure flushing	Dispersants, sediment removal, no intrusion into swamps by cleanup teams
Intertidal Seagrass	No cleanup, natural recovery, remove debris by boat at high tide if possible	Very low pressure flushing may be attempted	No personnel to enter these areas, dispersants not to be used on, over or near these communities
Shallow Subtidal Seagrass or Algaes (Kelp)	No cleanup, natural recovery	Booms and skimmers, preferably at high tide, sorbents, oiled fronds may be cut	Do not use dispersants over these, do not allow vessels to pass through surface oil in these areas
Other Shallow Subtidal Communities	No cleanup, natural recovery		Do not use dispersants over shallow communities

Table 9.6 Cleanup Methods for Small Sediment Shorelines

No	Vehicles	Methodology	Specific Requirements	Effect
1	Motor Grader and Elevating Scraper	Grader pushes oily sediment into windrows. Elevating Scraper picks these up	Good access for heavy vehicles, good load bearing capacity on beach	Surface 2-3 cm of sediment is removed
2	Elevating Scraper	Scraper picks up oily debris directly off beach	Good access for heavy vehicles, moderate to good load bearing capacity on beach	Removes 3-10 cm of beach surface
3	Motor Grader and Front End Loader	Grader forms windrows, FE Loader picks up oily sediment	Good access for heavy vehicles, good load bearing capacity on beach	Removes top 3cm of oily sediment, slower than 1 and 2
4	Front End Loader	FE Loader picks up oily material directly from beach	Good heavy vehicle access, if FE Loader has rubber tyres, moderate to good load bearing capacity on beach	Removes 10-25 cm of beach surface, substantial recontouring of beach, and possibly sediment replacement needed.
5	Bulldozer and Front End Loader	Bulldozer forms windrows of oily sediments, FE Loader picks these up	Good heavy vehicle access, if FE Loader has rubber tyres, moderate to good load bearing capacity on beach	Removes 15-50 cm of sediment surface, substantial recontouring of beach, and possibly sediment replacement needed.
6	Backhoe (also may use Dragline and Clamshell)	Operates from top of beach to remove oily material from steep slopes	Heavy equipment access, stable substrate at top of beach	Removes 25-50 cm of sediment surface, extensive beach damage, reprofiling and replacement of sediment required.
7	Manual Cleaning	Buckets, shovels etc to physically clean surface	Foot or light vehicle access or boat access	Removal of 0-3 cm of sediment, allows for selective removal of sediment, overall less damaging but labour and capital intensive.

Table 9.7 Environmental Considerations of Shoreline Cleanup Methods

Method of Cleaning	Considerations
Manual Cleanup	• Slower than mechanical but selective. • Personnel need to be made aware of their possible effects e.g. disturbance of fauna and vegetation (particularly dunes).
Mechanical Cleanup	• Requires access; may disrupt backing dunes etc. if road access lacking. • Noise: possible disturbance to fauna and humans. • Removal of sediment, if any, requires care. • Alteration of beach profile to be avoided. • Physical destruction of nesting areas, fauna or flora if insufficient care taken.
Low/High Pressure Flushing	• Possible removal of sediment. • Noise and other mechanical disturbance.
Vacuum Systems	• Noise and other mechanical disturbance. • Removal of sediment.
Sorbents	• Need to be collected and stored • Powdered or granular sorbents are difficult to distribute when windy.
Steam Cleaning and Sand Blasting	• Removes any surviving fauna and flora. • If excess may ‘ polish’ rock surface. • Emulsified oil or oily sand needs to be collected or it may impact adjacent areas.
Use of Chemical Agents	• Not normally recommended. • Remobilised oil is difficult to recover.

Table 9.8 Requirements for Beach Cleaning Equipment (Adapted from Exxon 1993).

Equipment Type	Fuel Requirement (Diesel)	Indicative Cleaning Rate (time to clean/ha)
Elevating Scraper	16-60 1/hr	3.0-3.5 hrs
Motor Grader	12-30 1/hr	3.0-3.5 hrs
Front End Loader tracked	6-40	11.0-11.5 hrs
Front End Loader (tyres)	6-40	8-8.5 hrs
Bulldozer	24-50 1/hr	12.5 hrs

Table 9.9 Indicative Requirements for Manual Cleaning of 1 km of Sandy Beach

Resource	Light-Moderate Oiling	Heavily Oiled Beach
Personnel	10 (1 team)	30-50 (3-5 teams)
Supervisor	1	3-5
Shovels/Rakes etc.	10 of each	20-40 of each
Wheelbarrows	3-5	10-15
Storage Capacity/bags/plastic	As required	As required

Table 9.10 Requirements for Low Pressure Flushing of Beach. Figures are Personnel Required per Team of 10

Equipment	Type/Comment	No. Per Team
Pump	10-20 psi (0.7-1.4 kg/cm^2) pressure at 200-400 litres/min	1
Hoses Perforated	100m, 7-10 cm diameter	1 length
Hoses (Water)	100-150m, 7-10 cm diameter	1 length
Skimmer	12K Light Skimmer (disc preferred)	1
Inshore Boom	50m length, Zoom Boom or other	2
Storage	Capacity dependent on skimmer type, degree of oiling etc.	-
Note: Requirements are highly variable and will depend on the degree and extent of oiling.		

Table 9.11 Requirements for High Pressure Washing

Equipment	Comment/Description	Personnel
Washing Unit	Self Contained but with 40 litres/min @4000 psi (280 kg/cm $^{(2)}$ pump	1
Operators	As required	2 per unit
Boom Deployment Team	As required	As required
Collection Skimmer/Pump	As required	1
Collection Boom/Storage	As required	As required

Table 9.12 Indicative Requirements and Cleaning Rates for Steam Cleaning and Sandblasting

	Sandblasting	Steam Cleaning
Size of Unit	280 psi (20 kg/cm^2) 100 C	-
Cleaning Rate (m^2/hr)	10-15	14
Workers per unit	2-3	2-4
Consumption/hr	450 kg sand	900-1000 litres fresh water

10. WASTE HANDLING, STORAGE & DISPOSAL

UNCONTROLLED COPY if printed

10.1 GENERAL

The **Waste Materials Coordinator** is responsible for developing and implementing a **Waste Management Strategy** for each spill.

Once recovered from the sea surface or from shorelines, oil and debris will be either:

- Pumped directly ashore for storage in holding tanks (if liquid);
- Placed in temporary holding tanks, drums or lined pits;
- Held in temporary, bunded, piles, (if solid).

It is important that waste materials are recovered, as quickly as possible, **particularly shoreline materials which are held in temporary storage containers or pits at the recovery site.**

It is also important to note that the volumes of oily waste recovered may be significantly greater than the volume of oil spilled.

If large areas of shoreline are impacted, and cleanup is proceeding, the **Waste Materials Coordinator** may appoint **Waste Management Officers** to advise shoreline response teams on waste handling and storage, and to facilitate collection of waste.

10.1.1. Priorities

The **Waste Management Strategy** should ensure that:

- Oil and oily debris is adequately treated and stored at the point of collection;
- Oil and oily debris is rapidly collected and taken to designated sites for storage, treatment or disposal;
- Treatment or disposal practices ensure that the waste poses no future threat to the environment.

A number of options are available. The preferred options are (in order of preference):

- Recovery and recycling of materials;
- Treatment (biodegradation etc.);
- Direct disposal (land filling).

10.2 WASTE MANAGEMENT ORGANISATION

10.2.1. Waste Materials Coordinator

The **Waste Materials Coordinator** will be mobilised by the **Incident Controller.** The **Incident Controller** will advise the **Waste Materials Coordinator** as to:

- The size of the oil spill;
- The likelihood of effective marine containment and recovery;
- The potential for coastal impact; and
- The likely location of coastal impact.

The **Waste Materials Coordinator** will:

- Determine the type of coast likely to be impacted and to make preliminary estimates of possible volumes of debris generated;
- Await notification from the **Incident Coordinator** or nominee, that oil has been recovered, or that shoreline cleanup is commencing;
- Notify assistants as required and place on standby;
- If oil is recovered and pumped ashore at a Flinders Ports South Australia jetty the **Waste Materials Coordinator** will determine the need for further treatment of recovered oil and advise the **Incident Controller**;
- Notify and mobilise industry resources or contractors to transport oil or debris to suitable storage treatment, or disposal sites;
- Notify and mobilise waste storage, treatment or disposal facility managers.

10.2.2. Waste Management Officers

Waste Management Officers will:

- Advise the **Shoreline Cleanup Team Leader** on safe handling procedures, and temporary waste storage;
- Advise the **Waste Material Coordinator** of the volumes, and type of waste, generated;
- Ensure that Flinders Ports South Australia staff and waste transport contractors follow safe practices;
- Keep an accurate record of waste collected i.e. volumes, contractor times etc.

Note For small shoreline cleanups this role will be filled by the **Shoreline Cleanup Team Leader.**

10.3 ASSESSMENT OF RECOVERED WASTE

The **Waste Management Officer** will, upon arrival at the scene of a shoreline cleanup, evaluate the nature and likely volume of the waste and advise the **Waste Management Coordinator.**

Wherever possible wastes will be segregated in accordance with the preferred segregation shown in Table 10.1. However, for small spills or those where it is not possible to effectively segregate wastes, broader 'field' segregations can be used.

It may be required to separate oil from associated water, sediment and debris, in order to minimise volumes. It is preferable that this is not attempted on site. If this is necessary a number of methods may be used (Table 10.2). These will only be attempted under the supervision of the **Waste Management Officer.**

10.4 TRANSPORT

The **Waste Management Coordinator** is responsible for the mobilisation of transport vehicles.

Waste transport and disposal will be undertaken by **local councils with agreement at that time. . Care should be taken that all vehicles, vessels, or containers used for the transport of oil wastes are effectively sealed and leak proof.**

10.5 STORAGE

Liquid oil or oily water can be temporarily stored at Flinders Ports South Australia in available tanks.

10.6 FIGURES & TABLES

Table 10.1 Segregation of Wastes

Field Segregation		Preferred Segregation
Liquid	Oils	Non Emulsified oils
		Emulsified Oils
	Wastewater	Water from temporary storage
		Water from heat or gravity separation of emulsions
		Water from chemically demulsified oil
Solid	Oils	High pour point oils
		High viscosity emulsions
		Tar balls
	Oily Debris	Oil mixed with cobble or sand
		Oil mixed with wood, vegetation, plastics or sorbents

Table 10.2 Separation of Waste Materials

Waste Type	Separation Method
Non emulsified oils	n/a
Emulsified oils	Heat treatment; Gravity separation (1) Demulsifiers (2)
Water from temporary storage areas	n/a (3)
Water from heat or gravity separation	n/a(3)
Water from chemically demulsified emulsion	n/a
High pour point oils	n/a
High viscosity emulsions	n/a
Tar balls	Sieve to remove sand (1)
Oil and sediment	Collect oil leaching from storage pits or piles (1)
	Wash with water or solvent
Oil mixed with wood or other debris	Collect oil leaching from storage pits or piles (1)
	Wash with water

(1) May be undertaken at the point of collection (shoreline).
(2) May be undertaken at the point of collection but is not preferred.
(3) Should not be undertaken on site.

11.1 GENERAL

The **Communications Officer (CO)** is responsible for maintaining effective communication between the various response groups operating during an oil spill response.

11.2 FLINDERS PORTS SOUTH AUSTRALIA COMMUNICATIONS

11.2.1 Ship to Shore

The Flinders Ports South Australia has VHF base stations at the signal station, jetty and in the control room with multi channel capability. There will also be numerous hand-held portable VHF units for use by jetty staff.

Tugs and workboats all have VHF and along with all other vessels will have a listening watch on **CH.16**. In addition, all ships will be instructed to broadcast Emergency on either **CH.17** handheld VHF or on **CH.5** on ships' radio.

11.2.2 Ground to Ground

In the event that shoreline clean up is necessary, good communications are essential. A number of handheld VHF units are held by Flinders Ports South Australia in the Port Radio Control and Marine Terminal Operation and would be for use by **Shoreline Cleanup Team Officers.**

OUTSIDE COMMUNICATIONS

At least one telephone and one facsimile should be a silent, unlisted number to ensure that the personnel conducting the operation have access to outside authorities.

A log should be kept of all calls and fax messages. To assist in this task consideration should be given to the installation of a recorder during emergencies.

11.3 SUPPLEMENTARY EQUIPMENT

11.3.1 Transport SA

- 1-VHF/AM Aero Band Base Station
- 1-UHF Base Station (National Oil Spill Frequency)
- 6-UHF Portables (National Oil Spill Frequency)

11.3.2 AMOSC Resources

AMOSC equipment is also available and is listed in Table 11.1 stored at Geelong and consists of 1 ‘master’ and 5 ‘slave unit’ walkie-talkies.

11.4 FIGURES & TABLES

Table 11.1 Regional Communication Resources

Equipment	Location
1 ‘master’ and 5 ‘slave’ walkie talkies	AMOSC Geelong
5 walkie-talkies	

12. RESPONSE TERMINATION

UNCONTROLLED COPY if printed

12.1 RESPONSIBILITY FOR TERMINATING THE RESPONSE

The **Incident Controller** is responsible for terminating a **Tier 1 Response.** However, permission to stand down must be obtained from the **General Manager Marine Operations (GMMO).**

Termination of **Tier 2 Response** is the responsibility of the **SMPC.**

Verbal notification must be followed by a written notification via fax showing date and time of instruction.

A **Tier 3 Response** can only be terminated by the **SMPC.**

12.1.1 Marine Response Operations

Marine Response Operations should be terminated when:

- All oil has been recovered; or
- The surface oil slick has broken up; or
- The oil slick has gone out to sea and is beyond the range of response options, and is unlikely to return; or
- Oil has impacted shorelines and is no longer on the water.

In the last case **marine response** resources must remain on standby and equipment maintained at the ready until **shoreline response** operations have been completed.

12.1.2 Shoreline Response Operations

Shoreline cleanup operations may be terminated **only** upon the instruction of the **SMPC.**

12.2 STAND DOWN PROCEDURES

12.2.1 General

Response personnel may be located in a number of areas. It is essential that all appropriate co-ordinators, managers and officers are informed that the response activities are being terminated and that all personnel are informed as quickly as possible.

12.2.2 Marine Response Teams

Upon receipt of response termination instructions **Incident Controller (IC)** will ensure that:

- All equipment is recovered from the water;
- All vessels return to their respective berths;
- All personnel are accounted for;
- Equipment is safely offloaded and transported to a site for cleaning or repair;

- All equipment returned is logged;
- All equipment, once cleaned, is returned to the correct owner and location.

12.2.3 Shoreline Response Teams

Upon receipt of response termination instructions each **Shoreline Cleanup Team Officer** will ensure that:

- All equipment is retrieved and stowed away in trailers etc;
- All equipment is retrieved and returned to Flinders Ports South Australia Terminal for cleaning and redistribution;
- Any equipment not collected is secured;
- All cleanup team members are transported back to Flinders Ports South Australia Terminal for demobilisation;
- All shorelines are left free of litter or other refuse;
- Preliminary Shoreline Oiling Assessment form is complete (OSCP FM 02)

At Flinders Ports South Australia the **Shoreline Response Manager,** or nominee will:

- Undertake a roll call;
- Log all equipment returned and note whereabouts of outstanding equipment;
- Ensure that returning personnel are provided with washing facilities;
- Arrange transport for staff if required.

12.3 ASSESSMENT OF SPILL RESPONSE ACTIVITIES

It is the responsibility of the **(IC)** to ensure that all field reports are completed and submitted to the **General Manager Marine Operations (GMMO)** who will provided that information to the **SMPC**.

The **IC** is responsible for ensuring that all reports, logs etc., are compiled and for the preparation of a Summary Report to the **SMPC.**

Such a report should address:

- Spill causes;
- Spill response;
  - speed
  - operation
  - effectiveness
- Equipment suitability;
- Familiarity of spill response team members with roles and responsibilities;
- Integration of plan and procedures with other response agencies.

Where appropriate the report will make recommendations for improving performance or revising the OSCP.

It is the responsibility of the **SMPC** to ensure that an adequate debriefing of all Flinders Ports South Australia staff and contractors is undertaken after a **Tier 2** or **Tier 3 Response**. The **IC** will do this after a **Tier 1 Response.**

12.4 POST SPILL MONITORING

The Preliminary Shoreline Oiling Assessment Form (OSCP FM 02) can be used to document surface and subsurface oiling and to monitor the effectiveness of cleanup efforts or self-cleaning of shorelines.

Flinders Ports South Australia will, where required, initiate a monitoring program to document the effects of oil or cleanup effects on the shoreline, and to document recovery.

The design of such monitoring programs should be undertaken with, and approved by, the relevant government, or other authorities.

TITLE	**GENERAL MANAGER MARINE OPERATIONS**		
ABBREVIATION	**GMMO**	**EMERGENCY STATION**	**TIER 1: Normal Station** **TIER 2 & 3 Emergency Control Centre**
ROLE DESCRIPTION:	**The GMMO is responsible for the overall management of all emergency situations, including oil spills. The GMMO is the officer with responsibility for liaising with non Flinders Ports South Australia personnel and authorities.**		
SPILL ACTION CHECKLIST:			
Report of Spill:	• Upon receipt of oil spill report; obtain relevant data from the **Incident Controller**. Refer to OSCP Form 01, Section 5 of the OSCP.		
Spill Assessment:	• Confirm with the **Incident Controller** the Tier of Response (sess Section 6 of the OSCP).		
Mobilization:	• For a Tier 2 or Tier 3 Response instruct the **Incident Controller** to mobilise the Strategic Support Group as required.		
Notification:	• Confirm with the **Incident Controller** that an Immediate Response has been initiated and **verify** that this response is suitable for the oil type spilt (Section 7 of the OSCP). • Authorize, or not, the use of dispersants if requested. This should be assessed in consultation with the Decision Tree (Figure 8.7 of the OSCP) and the Department of the Environment.		
Spill Response	• Monitor progress of spill response through the **Incident Controller**. Reassess situation periodically. • Liaise with government agencies, Transport SA as required. • In Tier 2 and 3 Responses, liaise with other spill response agencies and government agencies; and • Direct the **Incident Controller** in coordinating efforts with other response agencies, as required.		

TITLE	GENERAL MANAGER MARINE OPERATIONS
SPILL ACTION CHECKLIST: (Contd)	
Waste Handling:	• Verify with the **Incident Controller** that adequate provision has been made for the transport storage and disposal of wastes.
Response Termination:	• Authorise response downscaling or termination as required. Note: Verbal notification of stand down should be confirmed in writing to the **Incident Controller.**
Post Spill Assessment & Reporting:	• Request originals of all response forms used, and copies of all logs etc. These are to be compiled by the **Incident Controller** and **Shoreline Manager** and other officers. This should be coordinated through the **Incident Controller** and other officers. This should be coordinated through the **IC** for Tier 1 spills, and the **SM** for Tier 2 and 3 spills. • Request a written report, to accompany logs, form etc., from the **IC.**
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:	
OSCP	• Be familiar with **all** aspects of the OSCP. • Monitor the procedures for updating the OSCP and ensure that updates are made (Section 2). • Ensure that all copies of the OSCP and handbooks are current.
Training:	• Ensure that regular training and practical exercises are undertaken and \that all OSRT members are adequately trained (Appendix IV of the OSCP).

TITLE	INCIDENT CONTROLLER		
ABBREVIATION	**IC**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The IC is in charge of all field operations undertaken in respect of a marine oil spill by Flinders Ports South Australia. The IC will determine strategies and equipment to be used and may direct all Flinders Ports South Australia staff and contractors involved in field operations. The IC is answerable to the SMPC.**		
SPILL ACTION CHECKLIST: Report of Spill:	• Obtain information from spill reporter, **IC** or **SRM** as per Section 5.2 of the OSCP (OSCP Form 01). • Inform the **SMPC** of any spill and actions being taken. • Confirm with the **IC** or **SRM** the size of the spill i.e. Preliminary Spill Assessment (Section 5.3 of the OSCP). • Provide additional information to **SMPC** as required. • Determine source of spill if not known.		
Mobilization:	• Confirm with the **IC** that an **Immediate Response** has been initiated and **verify** that this is appropriate Section 7 of the OSCP). • Determine the size (tier) of response required. • Mobilise **Field Support Group** members as required. • Confirm (reassess) the size of the spill (Section 6 of the OSCP). • Convene a briefing of the **Incident Control Team.**		
Spill Response:	• Direct **ICT** in response priorities and strategies in accordance with OSCP or other considerations. • Periodically reassess spill response strategies and resource allocations. • Keep the **SMPC** informed of all operations		

TITLE	INCIDENT CONTROLLER
SPILL ACTION CHECKLIST: (Contd)	
Spill Response (contd)	• Carry out any instructions, from the **SPMC.** • Ensure that all field operations and **Field Support Group** is adequately staff and that relief crews are available. • Ensure that a complete and accurate log is kept of all instructions given, reports received, and other events (Through the **Historian** or **Senior Historian**).
Response Termination	• In consultation with the SMPC, downscale or terminate spill responses. • Ensure that all field reports are completed and logged. • Ensure that operations and other staff are debriefed. • Ensure that all field crews are demobilized and provided with suitable decontamination facilities, and transport.
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:	
OSCP	• Be familiar with **all** aspects of the OSCP. • Ensure that relevant Sections of the OSCP, and Appendix III are revised as required.
Training:	• Monitor the spill preparedness of all field staff through regular exercises. • Liaise with **Transport SA** and **SMPC** for the provision of training courses.

TITLE	**PLANNING OFFICER**		
ABBREVIATION	**PO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**Responsible for Managing the Planning Section of the ICC. Planning Section is responsible for the preparation of an Incident/Action Plan on behalf of the Incident Controller. It is also responsible for the collation and interpretation of required data.**		
SPILL ACTION CHECKLIST: Mobilization:	• Upon mobilization report to Incident Controller. • Start personal log. • Attend initial briefing. • Obtain available data on weather tides, currents, topography and shoreline character, environmental sensitivity data, spill trajectory oil data, community issues, action taken to date. • In consultation with the IC determine level of response and staffing requirements.		
Spill Response:	• Distribute draft incident action plan to Section Officers, MLO and advisors. • Obtain and collate subplans. 1. Communications subplan from Communications Coordinator 2. Health and Safety subplan from OH&S Coordinator 3. Operations subplans • Present Incident Action plan to IC for approval and distribute as directed. • Advise IC of need of planning meeting.		
Response Termination:	• Inform all Planning Section staff of planning determination.		

TITLE	PLANNING OFFICER
SPILL ACTION CHECK LIST: (Contd)	• Debrief Planning Unit Coordinators. • Attend IC debrief. Ensure that all records are given to Finance and Administration Officer.

TITLE	**OPERATIONS OFFICER**		
ABBREVIATION	**OO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**Responsible for ensuring that the objectives and strategies outlined in the Incident Action Plan are carried out effectively. The OO is responsible for determining how resources are distributed among the teams in the section and for coordinating joint activities.**		
SPILL ACTION CHECKLIST: Mobilization: Spill Response:	• Upon mobilization report to Incident Controller. • Start personal log. • Attend initial briefing. • Obtain available data on weather tides, currents, topography and shoreline character, environmental sensitivity data, spill trajectory oil data, community issues, action taken to date. • In consultation with the IC determine level of response and staffing requirements. • Determine need for advanced operations centre with Incident Controller and Logistics Officer. • Call in required staff. • Notify the Planning Section of the names and locations of section personnel. • Attend initial planning meetings with IC and other Section Officers, and record incident response aim (policies), priorities, objectives, and strategies. • Develop and collate operations subplan, encompassing marine response subplan, aviation subplan, shoreline response subplan, waste management subplan, wildlife plan. • Supply operations subplans to Planning Officer as developed and amended.		

TITLE	OPERATIONS OFFICER
SPILL ACTION CHECK LIST: (Contd)	• Obtain regular (daily) data on location of slick, condition of the oil sea state and weather. • Prepare work orders for Marine Response Teams. • Ensure that Marine Response Teams receive required information re: briefings/inductions/weather, personal protective equipment and supplies. • Inform Waste Management Coordinator of anticipated waste volumes and types. • Develop and update a shoreline subplan. • Calculate shoreline response equipment/labour/transport requirements. • Ensure that all OH&S subplan procedures are followed. • Coordinate the transport of oil and oil debris to central storage or permanent disposal sites.
Response Termination:	• Inform all Operations Section Unit Coordinators of response termination. • Debrief Operations Unit Coordinators. • Attend IC debrief • Ensure that all Field Teams return safely. • Ensure that all equipment is returned to Logistics Section. • Ensure that all records are given to Finance and Administration Officer.

TITLE	SHORELINE RESPONSE MANAGER		
ABBREVIATION	**SRM**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The SRM is responsible for directing shoreline cleanup teams, in the protection of threatened shorelines and cleaning of oil impacted shores.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Upon notification of an oil impact on shorelines, or imminent impact on shorelines, the **SRM** will proceed to the Marine Control Centre. • Notify **SCTL's** as required and assemble Shoreline Response Teams. • Attend the briefing meetings with **IC** or **SMPC** as required.		
Spill Response:	• Verify that all **SCTL's** are equipped with working handheld radios piror to deployment. • Deploy Shoreline Cleanup Teams **(SCT's)** as determined in consultation with the **IC**. • Determine the size (tier) of response required. • Ensure that adequate materials are provided for protection and cleanup of beach sectors. • Liaise with **WMC** to ensure that adequate waste storage materials are distributed to field teams. • Monitor the work practices and progress of **SCT's** to verify that safe and efficient procedures are being maintained. • Keep the **IC** informed of the status and progress of shoreline cleanup efforts		

TITLE	SHORELINE RESPONSE MANAGER
SPILL ACTION CHECKLIST: (Contd) Response Termination	• Upon being informed by the **IC** of a response termination, instruct all **SCTL's** to cease operations and to return to Flinders Ports South Australia. • Monitor roll calls to ensure that **SCTL's** have accounted for all staff and equipment at Flinders Ports South Australia. • Arrange for the cleaning, repair and storage of equipment • Ensure that all **SCT** members are provided with washing facilities, clean clothes or overalls, and transport as required. • Collect all documents from **SCTL's** and compile into a report for the **IC.** • Require additional reports from **SCTL's** as necessary (See Appendix V) e.g. - accident reports or other incident reports - equipment logs/records - waste management inventory.
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS: OSCP	• Revise Section 9 of the OSCP as required. • Be familiar with the environmental constraints and character of the shorelines within the OSCP area.
Training:	• Monitor the training status of all personnel involved in shoreline cleanup teams.

TITLE	**WASTE MATERIALS COORDINATOR**		
ABBREVIATION	**WMC**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The WMC will coordinate the storage, transport and disposal of recovered waste during, and after, a spill response. The WMC will ensure also that safe waste handling practices are maintained in field operations.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Upon mobilization, proceed to the **ICC**.		
Spill Response:	• Consult with **IC** and **SRM** and assess the volumes of waste materials likely to be generated. • Notify **WMO** and advise of likely transport and storage needs. • Appoint **WMO's** as appropriate, to monitor and supervise waste handling on site. • Ensure that safe waste management and handling practices are being exercised in the field. • Operate Oil Spill Trajectory Model and provide prediction to **IC** or **SMPC.**		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:			
OSCP:	• Check and revise Section 10 of the OSCP as required and supply revisions to the OSC.		
Training:	• Ensure that **WMO's** are suitably trained and participate in spill exercises as required.		

TITLE	**LOGISTICS OFFICER**		
ABBREVIATION	**LO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The LO will assist the IC by coordinating the efforts of the Logistics Team as required. The LO will ensure that adequate staffing levels are maintained in the Logistics Team and will appoint additional staff as directed by the IC or as required.**		
SPILL ACTION CHECKLIST: Mobilization:	• Upon mobilization, proceed to the **IC;** proceed to the **ICC** and establish communications with all **Logistics Team** members. • Attend briefings held by the **IC** and **SMPC** as directed by the **IC**.		
Spill Response:	• Monitor the activities of the **Logistics Team** and assist as required. • Appoint additional assistant staff as required. In Tier 2 and Tier 3 Responses the **Logistics Team** should liaise with the **IC** and **SMPC** in this regard. • Liaise with the **IC** to monitor and anticipate field support needs.		
Response Termination:	• Ensure that the **Planning Officer (PO)** has provided adequate staff for cleaning, repair and storage of equipment. • Collect logs, report forms etc. from **Logistics Team**. • Compile logs and provide to **IC.**		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:			
OSCP:	• Maintain an up-to-date and complete copy of the OSCP.		
Training:	• Ensure that all **Logistic Team** members are familiar with their roles and are adequately trained. Advise the **IC** of their training status.		

TITLE	**COMMUNICATIONS OFFICER**		
ABBREVIATION	**CO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The CO is responsible for maintaining communications links between the IC and field teams..**		
SPILL ACTION CHECKLIST: Mobilization:	• Ensure that communication equipment is available and in sufficient numbers. • Verify that field crews are using emergency channels. • Verify that communications are established between **ICC** field crews.		
Spill Response:	• Assist the **IC,** as required; to communicate with field response groups and the **ICC**. • Maintain a log of activities.		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS: OSCP:	• Revise Section 11 of the OSCP as required and advise the **IC** of needed revisions (Table 21. of OSCP).		

TITLE	SPILL TRAJECTORY OFFICER		
ABBREVIATION	**STO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The STO is responsible for running the Oil Spill trajectory Model and providing spill predictions to the IC and SMPC. Note: This role is generally held by the WMC.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Obtain details of spill size, location, oil type, wind and sea conditions from the **IC** (OSCP Form 01). • Make an initial estimate of spill trajectory, using the model and advise the **IC** of anticipated spill location in 2 hours, 4 hours and 6 hours after mobilization.		
Spill Response:	• Use model as requested by the **IC** or **SMPC,** to predict trajectory and slick condition. • Maintain a complete log of trajectories run, i.e. - time and date required - by whom requested - results obtained (log printout) - time and date, and to whom, results supplied.		
Response Termination:	• Compile the completed log for the **IC** or **SMPC**		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:			
OSCP:	• Ensure that the Spill Trajectory Model Manual (Appendix II of the OSCP) is regularly revised as required. • Continue to reappraise spill model in response to training exercises and spill events, and advise to **IC** of model status.		

TITLE	**GENERAL LIAISON OFFICER**		
ABBREVIATION	**GLO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The GLO will issue press and public statements, as authorised by the SMPC, and receive all communications and requests from the media, public and government agencies. The GLO is also responsible for identifying and mobilising external sources of manpower for any prolonged or major spill.**		
SPILL ACTION CHECKLIST: Mobilization:	• Upon mobilization by either the **SMPC** or **IC**, the **GLO** will obtain relevant spill details (Forms OSCP 005 and OSCP 006) and prepare an initial press release for approval by the **SMPC**. • Obtain authorisation from the SMPC or IC to contact relevant authorities (see Section 1.3 of the OSCP). • Establish contact with authorities if required, and log the names and contact numbers of individuals dealt with.		
Spill Response:	• Keep informed on spill response developments. • Prepare press releases and public bulletins as required by **SMPC** and **IC.** • **All** press statements must be authorised by the **SMPC** prior to release. • Guide media, public or government representatives to visitor lounge (Administration Building) or other location as required. • Advise **SMPC** of all Government requests and requirements. • Advise Government authorities of spill status, as required by **SMPC.** • Maintain a complete log of activities. • Identify the manpower needs of the **IC.**		

TITLE	GENERAL LIAISON OFFICER
SPILL ACTION CHECKLIST: (Contd)	
	• Request provision of required contracts, etc from the **LO**.
	• Keep a log of all external resources contracted.
Response Termination	• Complete log and provide report to **IC.**
	• Identify and advise the **SMPC** or **IC** of any Government reporting requirements.
	• Supply log of contracted or hired resources to the Finance Officer.
	• Receive work logs from contractors, etc., and compile into a record.
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:	
OSCP	• Regularly review Section 1.3 of the OSCP and advise the **SMPC** of any required changes.
	• Identify and regularly update local suppliers of manpower and equipment.
Training:	• Be familiar with the OSCP and participate in exercises and training workshops as required.
	• Assist **IC** in revision and update of Appendix III.

TITLE	LOGISTICS AND MATERIALS COORDINATOR		
ABBREVIATION	**LMC**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The LMC is responsible for mobilizing equipment required for non-Immediate Response equipment during a spill response and for locating and providing transport for materials, equipment and staff as required. The LMC may be required to identify and mobilize additional staff for field response teams during prolonged spill response activities.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Proceed to the Incident Control Centre and report to the **IC** (Tier 1) or **Planning Officer** (Tier 2- Tier 3). • Attend briefings by the **IC** or **SMPC** as required.		
Spill Response:	• Verify that listed equipment is functional and available. • Commission and arrange transport for equipment as required by field teams, and as requested by **IC** or **Planning Officer**. • Maintain a log of all equipment distributed.. • Ensure that staff are assigned to the task of cleaning, maintaining and storing returned materials.		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:			
OSCP	• Maintain an up to date and complete copy of the OSCP. In particular ensure that Equipment Lists (Section 8) and Team Roles, Section 4 are complete and current.		

TITLE	**FINANCE OFFICER**		
ABBREVIATION	**FO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The FO may be appointed to the Strategic Support Group and will monitor and document expenditure incurred during any prolonged response or a Tier 2 or 3 Response. The FO is responsible to the SMPC.**		
SPILL ACTION CHECKLIST: Spill Response:	• Maintain a log of all contracts issued by the **GLO or LO** during a response. • Maintain an accurate log of all incidental purchases or hires during a spill response (liaise with **GLO**, **LO.** • Monitor expenditure and keep the **SMPC** informed of this.		
Response Termination:	• Compile a full report on expenditure. Include copies of all contracts etc. (File originals).		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS: OSCP	• Produce standard contracts if required and provide to the **Historian** for inclusion into Appendix V of the OSCP.		

TITLE	LEGAL OFFICER		
ABBREVIATION	**LO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The LO will compile contracts, as required, for provision of equipment or labour from non- Flinders Ports South Australia sources. The LO is also responsible for receiving claims for compensation or other claims resulting from an oil spill or response.**		
SPILL ACTION CHECKLIST: Spill Response:	• Receive and assess any claims for compensation, or other claims, made as a result of the oil spill or spill response. • Provide contracts to **SMPC** of **IC** for provision of external services. • Review contracts provided by external contractors and advice **IC** and **SMPC**. • Maintain a complete log of contracts received or provided. • Maintain a complete log of compensation claims made and enquiries made with regard to claims.		
Response Termination:	• Compile records and logs for **SMPC.** • Advise **SMPC** of expected or potential liabilities and claims.		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS: OSCP	• Review Appendix V and advise **IC** and **SMPC** of any required additions or revisions to documentation.		

TITLE	**MEDICAL OFFICER**		
ABBREVIATION	**MO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The MO is responsible for the provision of medical support to field and other teams during a spill response.**		
SPILL ACTION CHECKLIST: Mobilization: Spill Response:	• Confirm with the **IC** or **SMPC** that the medical centre is prepared and advise them **immediately** of any anticipated needs. • Provide health services to field and other personnel as required. • In the event of any accidents, keep the **IC** and **SMPC** appraised of patient's condition. • Provide advice on the handling of chemical compounds as required.		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS: OSCP	• Maintain a complete record of the Materials Safety Data Sheets (MSDS0 for all chemicals used, or possibly used in a spill response • Revise, and advise the **IC** on the status.		

TITLE	HISTORIAN		
ABBREVIATION	**H**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The Historian is responsible for maintaining a complete record of operation in the ICC during Tier 1, Tier 2 and Tier 3 Responses, and to assist the IC in compiling post spill response reports.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Proceed to **ICC** and report to **IC**.		
Spill Response:	• Maintain a log of decisions made, and events in the **ICC** (time, person, decision). • Obtain a copy of all fax messages (sent or received and file each.		
Response Termination:	• Compile a completed log for the **IC**. • Assist the **IC** in compiling logs and reports from other officers. • Attend all briefings and meetings with the **IC**.		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:			
OSCP	• Revise Appendix V of the OSCP as required in association with the **Senior Historian (SH).**		

TITLE	**SENIOR HISTORIAN**		
ABBREVIATION	**SH**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The SH is responsible for maintaining a complete record of operation in the ICC during a Tier 1, Tier 2 and Tier 3 Response. The SH will assist the SMPC in compiling records and reports following each spill event.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Proceed to **ICC** and report to **IC or SMPC**.		
Spill Response:	• Maintain a log of decisions made, and events in the **ICC** (time, person, decision). • Obtain a copy of all fax messages (sent or received and file each.		
Response Termination:	• Compile a completed log for the **IC** or **SMPC.** • Assist the **IC** or **SMPC** in compiling logs and reports from other officers. • Attend all briefings and meetings with the **IC** or **SMPC** unless directed otherwise.		
MAINTENANCE OF SPILL RESPONSE PREPAREDNESS:			
OSCP	• Revise Appendix V of the OSCP as required in association with the **Historian (H).**		

TITLE	**WASTE MANAGEMENT OFFICERS**		
ABBREVIATION	**WMO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The WMO's will provide on site advice and assistance to SCTO's in the handling and storage of recovered wastes.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Report to the **WMC** (Location: **ICC**) unless directed to **ICC** for a briefing and assigning of beach sectors.		
Spill Response:	• Advise **SCTO's** on handling and storage of recovered wastes. • Assist contractors using the guidelines of the OSCP (Section 6) and instructions of the **SRM.** • Keep a log of waste recovered and removed from the site (i.e. date, location, type of waste, time collected). • Provide incident reports to **WMC** on any unsafe work practices observed.		
Response Termination:	• Ensure that all waste materials are removed from the site. • Advise the **WMC** if any waste is left overnight and if so request security. • **Do not leave waste unattended.** • Complete logs and provide to **WMC.**		

TITLE	**SHORELINE CLEANUP TEAM OFFICERS**		
ABBREVIATION	**SCTO**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**The SCTO's are responsible for directing the activities of shoreline cleanup teams on site. SCTO's are responsible for the maintenance of safe working practices on site.**		
SPILL ACTION CHECKLIST: Mobilization:	• Assemble at the Fire Station or, if instructed, the ICC and receive a briefing from the **SRM**. • Assemble cleanup teams and brief them on the site location, character, and cleanup method (see Section 6 of the OSCP).		
Spill Response:	• Assess each beach sector before cleaning to verify accuracy of supplied information and to assess oil condition (complete OSCP Form 01). • Clean beaches in accordance with the guidelines of the OSCP (Section 6) and instructions of the **SRM**. • Reassess beach at the end of each day and beginning of each day (OSCP Form 01 – record **time and date** on these forms). • Maintain safe working practices on site. • Instruct Shoreline Cleanup Team (SCT) members as required.		
Response Termination:	• Ensure that all team members are collected from the site and transported to Flinders Ports South Australia. • Ensure that all SCT members are provided with washing facilities, clean clothes, and transport home. • Ensure all equipment is returned to Flinders Ports South Australia. • Hand all completed Forms OSCP 006 to the **SRM.** • Complete incident forms for any accidents or other incidents and provide to **SRM.**		

TITLE	**PILOT**		
ABBREVIATION	**P**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**Pilots may be requested to lead and coordinate the efforts of groups of vessels, on site, during a spill response.**		
SPILL ACTION CHECKLIST:			
Mobilization:	• Attend a briefing meeting at ICC.		
Spill Response:	• Instruct boat masters in field (on site) activities during marine response activities in accordance with the OSCP and instructions of the **IC.** • Maintain a log of all instructions and activities.		
Response Termination:	• Compile logs and supply to **IC**. • Provide incident reports, if necessary, to the **IC**.		

TITLE	**TUGMASTER/BOATMASTER**		
ABBREVIATION	**TM/BM**	**EMERGENCY STATION**	**Incident Control Centre (ICC)**
ROLE DESCRIPTION:	**Tug or Boat Masters are responsible for the undertaking of field operations, at sea, during a spill response.**		
SPILL ACTION CHECKLIST: Mobilization:	• Alert crew. • Check equipment and report any needs to the **IC**. • Proceed to spill site as instructed.		
Spill Response:	• Undertake field operations as instructed by the **IC** or **Pilot.** • Ensure safe working practices on board. • Maintain a complete log of activities etc. • Keep the **IC** informed of spill response status (success etc). • Monitor waste recovery and advise **IC**. • Monitor waste holding capacity and advise **IC** of additional needs.		
Response Termination:	• Return all equipment to Flinders Ports South Australia for cleaning and storage. • Provide copy of log to IC. • Ensure that vessel is cleaned and equipment stowed. • Undertake a roll call at Flinders Ports South Australia. • Ensure that crew are provided with washing facilities, food and transport.		

UNCONTROLLED COPY if printed

Sample forms only

Flinders Ports SOUTH AUSTRALIA

OIL SPILL CONTINGENCY PLAN

Form 01	SPILL ASSESSMENT & REPORT FORM				
REPORT TO:	DATE:				
FROM:	TIME:				
SPILL INFORMATION					
TIME OF SPILL: AM/PM	QUANTITY OF OIL:				
LOCATION OF SPILL:	QUANTITY IN SEA:				
REASON/CAUSE OF SPILL:	TYPE OF OIL:				
	DESCRIPTION OF SPILLS/SLICKS				
	COLOUR: LENGTH:				
	WIDTH: OTHER:				
ENVIRONMENTAL CONDITIONS					
WIND SPEED:	WIND DIRECTION:				
TIDE DIRECTION:	WAVE HEIGHT:				
TIME TO NEXT CHANGE:	CURRENT SPEED (Est):				
	SEA STATE:				
ACTIONS TAKEN TO CONTROL SPILL	**LEVEL OF RESPONSE** (Tier) (I = Immediate Response Only)				
	FPCEO Request :	I ☐	1 ☐	2 ☐	3 ☐
	IC Confirmed :	I ☐	1 ☐	2 ☐	3 ☐
	SMPC Confirmed :	I ☐	1 ☐	2 ☐	3 ☐
SAFETY HAZARDS					
SPECIFIC REQUESTS/COMMENTS					

I:\HRM\Quality Management\OSCP\FORMS\01 SPILL ASSESSMENT AND REPORT FORM.doc

OSCP : FM01
Issue No: 01
Issue Date: 26/07/2005

Sample forms only

Flinders Ports SOUTH AUSTRALIA

OIL SPILL CONTINGENCY PLAN

Form 02 PRELIMINARY SHORELINE OILING ASSESSMENT

LOCATION:	REPORTING DETAILS:
MAP (No):	ASSESSMENT BY (Name) :
MAP REFERENCE:	POSITION:
Name of Beach or Location Description:	DATE: TIME:
	REPORT TO (Name):
	POSITION:
	DATE REC'D: TIME:

REASON FOR ASSESSEMENT

(Tick as appropriate)

☐ Public Report	☐ EPA Request	☐ Known Spill (Pre Clean)
☐ Known Spill (Post Clean)	☐ Exercise Only	

OIL DISTRIBUTION & CHARACTER

(see over page for Key to terms)

Parameter	LITZ			MITZ			UTIZ			SUPRATIDAL	
Coastal Type(1)											
Percentage Oil Cover(2)											
Oil Band Width											
Length of Coast Oiled											
Depth of Oiling(3)											
Surface Oil Thickness(4)											
Appearance(5)											
Debris Present(4x6)											
Oiled Debris(6)											

DIAGRAM/NOTES

I:\HRM\Quality Management\OSCP\FORMS\02 PRELIMINARY SHORELINE OILING ASS.doc

OSCP : FM 02
Issue No: 01
Issue Date: 26/07/2005

Sample forms only

Flinders Ports SOUTH AUSTRALIA

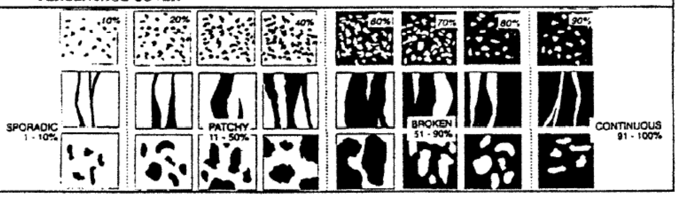
OIL SPILL CONTINGENCY PLAN

Form 02 | **PRELIMINARY SHORELINE OILING ASSESSMENT Key & Explanations**

1. COASTAL TYPE:

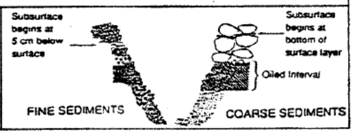
	ABBREVIATION	SEDIMENT SIZE	COMMENT
Cliff	CL	-	Vertical or sloped
Platform	PL	-	Broken (PLb) or unbroken (PL)
Boulder	B	>250mm	With Sand (Bs) or boulder overlay (B)
Cobble	C	60-250	With Sand (Cs) or cobble only (C)
Pebble	P	4-60	With Sand (Ps)
Gravel	G	2-4	
Sand	S	006-2	Shellgrit (Sh)
Mud	M	<0.06	Forms murky suspension in water

2. PERCENTAGE COVER



3. DEPTH OF OILING

For beaches other than cliff and platform.
Depth is measured below surface oily layer (see figure).
Depth should be checked by digging unless boulders or cobble prevent easy assessment. Depth noted should be that at which fluid oil, or coat or cover still persists.



4. SURFACE OIL THICKNESS

NAME	ABBREV.	THICKNESS	
Pooled	PO	>10mm	Fresher emulsified oil. pools
Cover	CV	1-10	Thick coat on coarse sediments and cracks
Coat	CT	0.1-1	Thick coat, can be scratched off solid surfaces.
Stain	ST	<0.1	Not easily scratched. Texture of sediment clearly visible below oil.
Film	FL	<<0.1	Transparent or translucent.

5. OIL APPEARANCE

- AP Asphalt Pavement - cohesive mixture of weathered oil and sediment situated completely below a surface sediment layer(s) (note thickness on SOS form in comments box).
- OP Oil-Filled Pores - pore spaces in the sediment matrix are completely filled with oil. Often characterized by oil flowing out of the sediments when disturbed.
- PP Partially Filled Pores - pore spaces filled with oil, but generally does not flow out when exposed or disturbed.
- OR/C Cover (0.1 - 1.0 cm) or Coat (0.01 - 0.1 cm) of oil residue on sediments and/or some pore spaces partially filled with oil.
- OR/S Stain (0.01 cm) or film oil residue on the sediment surfaces. Non-cohesive.
- TR Trace - discontinuous film or spots of oil on sediments, or an odor or tackiness with no visible evidence of oil
- NO No Oil - no visual or apparent evidence of oil

6. DEBRIS Heavy (H) Moderate (M) Light (L) or None (-)

Flinders Ports SOUTH AUSTRALIA

OIL SPILL CONTINGENCY PLAN

Form 03	REQUEST FOR REVISION TO OSCP
Please attach copies of pages showing requested revision	

TO:	(GMMO, SMPC, IC)
FROM *(Name)*:	
COMPANY:	
POSITION:	
DATE:	TIME:

DETAILS OF REVISION

SECTION/FORM NO:	PAGE(S):
WHAT TYPE OF DOC: *(Text, Figure, Table,etc)*	
Does this change affect any other documents: If YES please supply details.	
DETAILS OF REQUIREMENT FOR AMENDMENT TO DOCUMENT :	
PLEASE ENSURE YOU HAVE ATTACHED ALL RELEVANT PAGES FOR REVISION	

REVISION APRROVAL

TO BE COMPLETED BY FLINDERS PORTS GMMO

- ☐ AMENDMENTS HAVE BEEN ACCEPTED
- ☐ AMENDMENTS HAVE BEEN REJECTED
- ☐ AMENDMENTS HAVE BEEN ACCEPTED WITH MODIFICATION AS SHOWN ON DOCUMENT

Signed:	Name:	Please print

PLEASE FORWARD TO FLINDERS PORTS HUMAN RESOURCES FOR ACTION

I:\HRM\Quality Management\OSCP\FORMS\03 REQUEST FOR REVISION.doc
OSCP : FM 03
Issue No: 01
Issue Date: 26/07/2005

UNCONTROLLED COPY if printed

Sample forms only

Flinders Ports SOUTH AUSTRALIA OIL SPILL CONTINGENCY PLAN

Form 04	WASTE HANDLING LOG
COMPLETED BY	LOG SUBMITTED
VESSEL:	TO:
MASTER:	DATE:
SHORELINE:	
NAME:	
	RECEIVED BY WMC:
WMC/WMO:	TIME:
	DATE:

DATE/TIME	WASTE TYPE(1)	QUANTITY(2)	STORAGE/CONTAINER	OFFLOADED / COLLECTED BY

(1) LO Liquid Oil
LW Water
SO Solid Oil
SD Solid Debris

(2) In Volume, number of containers, etc

(3) Drums, Bags Skips, etc

Name/Location and time

I:\HRM\Quality Management\OSCP\FORMS\04 WASTE HANDLING LOG.doc

OSCP : FM 04
Issue No: 01
Issue Date: 26/07/2005

Flinders Ports SOUTH AUSTRALIA

OIL SPILL CONTINGENCY PLAN

Form 05	SHORELINE CLEANUP TEAM DAILY WORK REPORT
DATE:	TO: SHORELINE MANAGER
LOCATION:	FROM:
	TEAM NO:
DEPLOYMENT DETAILS	
TIME OF ARRIVAL FPSA : AM/PM	TIME OF DEPARTURE : AM/PM
TIME OF ARRIVAL ON SITE : AM/PM	OFF SITE: AM/PM
TEAM DETAILS :	TEAM SUPERVISOR :
Team 1.	6.
2.	7.
3.	8.
4.	9.
5.	10.
DESCRIPTION OF ACTIVITIES	
AM:	PM:
NUMBER OF WASTE LOADS TRANSPORTED	
Type: No:	Type: No:
Type: No:	Type: No:

Sample forms only

Flinders Ports SOUTH AUSTRALIA OIL SPILL CONTINGENCY PLAN

Form 06	EQUIPMENT / SUPPLIES USED				
MRM, SRM, SOC or DSOC to check upon return					
Item	No:	Item	No:	Item	No:

CONSUMABLES (DISPERSANTS, SORBENTS OTHER)			
Item	No/Qty	Item	No/Qty

INCIDENTS/COMMENTS

I:\HRM\Quality Management\OSCP\FORMS\06 EQUIPMENT.doc

OSCP : FM06
Issue No: 01
Issue Date: 26/07/2005

1 INTRODUCTION

The key to a successful response to a spill is the level of training of the individuals within the response organization. Therefore, Flinders Ports South Australia will ensure that all staff, contractors and other personnel assigned to the Flinders Ports South Australia response team will undertake appropriate training and will participate in regular exercise of both the Oil Spill Contingency Plan and use of the specialised oil spill combating equipment at Flinders Ports South Australia ports.

1.1 Training the Flinders Ports South Australia Oil Spill Response Team

All members of the Flinders Ports South Australia response team, both employees and contractor personnel, will participate in appropriate on site courses.

All personnel involved in the direct running of any oil spill response will undertake a five-day "Oil Spill Clearance Course", this is designed to cover the theoretical, scientific, managerial and practical aspects of the strategies and techniques of oil spill response.

Flinders Ports South Australia and contractor staff allocated the tasks of equipment deployment and recovery will undertake the three-day "Operators Course". This course is designed to be essentially practical and provides "hands on" training in the operation and maintenance of pollution response equipment. Some basic theory is also involved.

Flinders Ports South Australia administration, senior management personnel and contractors would undergo a one-day "Familiarisation Course". The "familiarisation Course" is intended to familiarise staff with an appreciation of the problem caused by oil pollution of the marine environment. These staff would normally be called upon to make management decisions relating to the commitment of personnel, material and finances and this course will give them an overview of the problems associated with oil spills and their effects.

A draft outline of the content of these courses is provided below:

Oil Spill Clearance Course

• Course fate and Strategies • Environmental Considerations • Oil Spill Trajectory • Dispersants • Surveillance and Tracking • Contingency Planning • Boom • Recovery Systems • Offshore Boom and Recovery • Shoreline Cleanup	• Environmental Implications of Shoreline Cleanup • Safety and Welfare • Inland Spills • Practical Management of Oil Spills • Dealing with the Media • Practical and Legal Considerations

Operators Course	**Familiarisation (Senior Management Course**
• Types and Effects of Oil • Spill Responses and Logistics • Safety and Welfare • Communication • Use of Boom • Recovery System • Shoreline Cleanup • Storage Transportation & Disposal of Residual Oil • Use of Chemicals	• Cause, Fate and Effects • Use of Booms and Skimmers • Use of Dispersants • Shoreline Cleanup • Oil and Debris Disposal • Legal Regimes • Oil Spill Management

2 TRAINING IN THE USE OF PURCHASED OIL SPILL RESPONSE EQUIPMENT

The procurement contracts for the various items of specialised oil spill response equipment for Flinders Ports South Australia includes a training component whereby the equipment supplier will provide on site training in the operation and maintenance of their equipment.

However, this training should continue on a regular basis until Flinders Ports South Australia operators are thoroughly familiar with the operation of equipment.

3 TRAINING IN THE USE OF OIL SPILL RESPONSE EQUIPMENT AVAILABLE THROUGH TRANSPORT SA, AUSTRALIAN MARITIME SAFETY AUTHORITY AND AMOSC.

The Flinders Ports South Australia staff and contractor personnel will be encouraged to participate in spill response exercises which are conducted by individual companies or through Transport SA.

Subject to their availability, this can include, but is not limited to:

- Assisting in the deployment of equipment;
- Deploying Flinders Ports South Australia equipment in support of Transport SA or individual company exercises;
- Observing the conduct of exercises organised by individual companies or Transport SA.

4 SPILL RESPONSE EXERCISE

4.1 Oil Spill Contingency Plan

In order to ensure that the Flinders Ports South Australia Oil Spill Contingency Plan remains current and is updated on a regular basis it is intended to run “Table Top Oil Spill Simulation Exercises” at least twice yearly.

These simulation exercises will, inter alia, include reporting, alerting of concerned agencies, verification of contact numbers in Appendix II, and assessment of trajectories of simulated oil spills. Each exercise will be observed and the overall response evaluated by an independent auditor. A report on the exercise will be prepared together with any recommendation for revision of the OSCP and forwarded to the Manager, Flinders Ports South Australia, for appropriate action. Recommendation for revisions should be recorded on the OSCP FM 03 Request for Revision Form.

1. INTRODUCTION

When an oil spill occurs claims for clean-up costs and damages can be brought against its ship owner responsible for the incident and his insurer.

TOVALOP, to which virtually all of the worlds tanker tonnage belongs, in an agreement entered into by tanker owners and bareboat charter to which the parties agree to assume certain obligations for which they might not otherwise be legally liable. For TOVALOP to apply it is not necessary to demonstrate that the tanker owner or bareboat charter was at fault, and there are only a very limited number of circumstances in which a policy will be totally free of any obligation under the Agreement (i.e. war or terrorism).

The Two International Conventions are the International Convention on Civil Liability for Oil Pollution Damage, 1969 (CLC) and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 (Fund Convention).

2 PREPARATION OF CLAIMS

Normally an Administration will co-ordinate the submission of the various claims and it is essential that accurate detailed records are kept to support such claims.

Each claim should contain the following particulars:-

(a) The name and address of the claimant and his representative, if any;
(b) The identity of the ship involved in the incident;
(c) The date, the place and specific details of the incident;
(d) The type of oil, the clean-up measures taken, and the kind of pollution damage as well as the place where it was experienced;
(e) The amount of the claim.

Depending on the amount and nature of the claim, the claims report should be broken down into different categories, such as: -

- Costs of preventive measures and cleanup’
- Replacement and repair costs;
- Economic loss.

These may in turn be structured to ensure that all information is clearly stated. A general format is outlined below:

1. COSTS OF PREVENTIVE MEASURES AND CLEANUP

1.1 Summary of events, including a description of the work carried out in different areas and of the working methods chosen in relation to the circumstances prevailing during the incident.

1.2 Delineation of the area affected, describing the extent of pollution and identifying those areas most heavily contaminated. This should be presented in the form of a map or chart supported by photographs or videotapes.

1.3 Analytical and/or other evidence linking the oil pollution with the ship involved in the incident (e.g. chemical analysis, wind, tide or current data, observation and plotting off floating oil movement).

1.4 Dates on which work was carried out (weekly or daily costs)

1.5 Labour costs (number and categories of response personnel, regular and overtime rates of pay, days/hours worked).

1.6 Equipment and material costs (types of equipment used, rate of hire, consumable material, quantity and cost).

1.7 Transport costs (number and types of vessels/aircraft, vehicles use, number of days/hours operated, rate of hire or operating cost).

1.8 Costs of temporary storage (if applicable) and final disposal of recovered oily material.

It is essential that comprehensive records are kept detailing all operations and expenditures. Daily work sheets should be compiled by supervisory personnel of the operations in progress, the equipment in use, where and how it is being used, the number of personnel employed, how and where they are deployed and the materials consumed. Using standard work sheets, an example of which is shown as OSCP FM 05, facilitates recording such information.

The foregoing activities usually result in the major expenditures in an oil spill incident, which may involve aircraft, vessels, specialized equipment, heavy machinery trucks and manpower. Some of these resources will be government owned and others will be the subject of contractual arrangements. To ensure that adequate control of expenditures is kept a financial controller should be assigned to the response team.

2. REPLACEMENT AND REPAIR COSTS

2.1 Extent of pollution damage to property.

2.2 Description of items destroyed, damaged or needing replacement or repairs (e.g. boat, fishery, net, sail) including its location at the time of oil pollution damage.

2.3 Cost of repair work or replacement of item.

2.4 Age of item to be replaced

With regard to this category, it is likely that numerous claims will be made from the public, and private sector, such as fishermen, pleasure boat owners, marina operators, etc. In this case it may be desirable to arrange through the vessel's insurers to appoint insurance adjusters to whom claimants may be referred by the Incident Controller. In some cases a special telephone number and office has been established to process claims and the public advised through the media that this service is available.

3. ECONOMIC LOSS

3.1 Nature of loss, including demonstration that loss resulted directly from the incident.

3.2 Comparative figures for profits earned in previous periods and for the period during which such damage was suffered.

3.3 Comparison with similar areas outside the area affected by the spill.

3.4 Method of assessment of loss.

These losses can include but are limited to: restriction of fishing activity, closure of coastal industrial and processing installations, loss of income by resort operators, etc. In many cases the financial records for previous years may be readily available, although difficulties may arise in distinguishing losses caused by the oil spill from those caused by other unrelated factors such as bad weather or overfishing.

3 CONCLUSIONS

The principal categories of claims, which are likely to prove acceptable, have been discussed. However, there may be other categories of claims. In all cases the claim should be presented clearly and in sufficient detail so that it is possible to assess the amount of damage suffered on the basis of the facts and the documentation presented. In order to assist Administrations in preparing and presenting claims for compensation for oil pollution damage an example of a claim for reimbursement of clean-up costs is attached over page (H-5 to H-7). It should be noted that an invoice, or other relevant documentation such as daily work sheets and explanatory notes must support each item of the claim.

For claims made to AMSA, a copy of the "Statement of Expenditure – Oil Pollution" is also attached.

Example of Claims Document

From: The National Shipping Administration.

Re: Flying Dutchman Incident on 31 March 1986

A Costs for cleanup operations on the beach north of the Port of Erehwon, 4 kms of coastline.

1. Personnel

1-10 April 10 days use of workforce of 25 men

(a)	2000 working hours at $5 per hour	$10,000	
(b)	Overtime 150 hours at $2.50	$ 375	
			$10,375

For details of the use of the personnel, see enclosed worksheets (enclosures 1- 11)

2. Consumable Material

(a)	10 bales of sorbent pads at $50 per bale	$ 500	
(b)	250 gloves at $1	$ 250	
©	25 protective overalls, which became too polluted to be cleaned, at $10	$ 250	
			$1,000

see enclosed invoices (enclosures 12-14)

3. Transport

(a)	Use of three lorries with drivers on the beach for the removal of collected oil and debris: the lorries were hired at $120 per day, for 10 days (enclosure 15).	$ 1,200
(b)	Hire of front-end loader and operator at $200 per day for 10 days (enclosure 16)	$ 2, 000
©	Transport of personnel to and from the beach by bus every morning and afternoon for 10 days, hire of bus $50 per day (enclosure 17)	$ 500

			$ 3,700
5.	**Disposal**		
	Costs for handling oily debris at municipal dumpsite 50 tons at $20 (enclosure 18)		$ 1,000
6.	**Food for Personnel**		
	Packed meals brought to the site of the clean-up operation; 250 lunches at $2.50 (enclosure 19)		$ 625
	SUB TOTAL		**$16,700**

B **Clean-up Operations at sea**

1.	Helicopter surveillance at sea on 31 March and 2 April, 3 hours per day at $100 per hour (enclosure 20)	$ 900	
2.	Hire of vessel for 6 hours at $35 per hour used for spraying dispersants on 1 April (enclosure 21)	$ 210	
3.	Costs of dispersants, 10-200 litre drums at $300 per drum (enclosure 22)	$ 3,000	
4.	Hire of vessel laying and recovering booms on 1 and 3 April, 2 days at $400 (enclosure 23)	$ 800	
5.	Boom rental charges, 3 days at 2000 metres at $6 per metre per day (enclosure 24)	$ 3,600	
6.	Skimmer rental charges, 3 days at $100 per day (enclosure 25)	$ 300	
7.	Rental of tank truck and driver to remove recovered oil, $180 per day for 3 days (enclosure 26)	$ 540	
8.	Costs of cleaning booms (enclosure 27)	$ 1,200	
	SUB TOTAL		**$10,550**
	GRAND TOTAL		**$26,550**

APPENDIX V	GUIDELINES FOR THE COLLECTION OF OIL SAMPLES

UNCONTROLLED COPY if printed

The following guidelines are to be adhered to for the taking of oil samples and the transportation of samples:

1. Samples of at least 100grams, must be taken with the minimum of delay to minimise changes in composition. Every effort should be made to obtain an uncontaminated sample of oil for comparison purpose, particularly if prosecution is envisaged. It is imperative that a Chain of Custody Form be correctly filled in and accompanies the samples to the designated laboratory.

2. Samples are to be placed in clean glass jars/bottles obtained from Transport SA and are to be individually sealed with paper/wax seal.

3. Sample bottles are to be appropriately numbered and noted with:

   - Name of officer taking the sample
   - Time and date of sample taken
   - Location at which sample was taken
   - Reference to the incident being investigated
   - For those samples taken from a vessel, certification from a representative of that vessel
   - Details of direction of the movement of the oil, wind and current

4. Once taken, the sample bottles are to be placed in a lockable transportation box, locked and sealed. If more than one officer is involved with the collection of samples, each officer should have a box for the samples that they have taken.

5. When the sampling has been completed, the transportation box is to be kept in the possession of the officer who collected the samples until he/she sends it by courier to the designated laboratory. A Chain of Custody Form must accompany each box.

6. The sealed transportation box is then delivered by courier to the designated laboratory, where written confirmation of delivery is obtained.

7. The chemist analysing the samples is the only person to break the seal on the box.

Designated Laboratory:

Laboratory Manager
Australian Government Analytical Laboratories
3 Clive Road
COTTESLOE WA 6011

Phone: (08) 9384 1511

AMSA has an MOU with AGAL, WA to carry out oil analysis.
For further details contact AMSA or AGAL.

Spencer Gulf Port Link

Spencer Gulf Port Link
Port Bonython EIS Project Team

c/o Arup
Level 7, 182 Victoria Square
Adelaide SA 5001

Phone: 1800 657 248

Web: www.spencergulfportlink.com.au