TRANSNET

SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT

Scoping and Environmental Impact Assessment for the proposed Manganese Export Facility and Associated Infrastructure in the Coega Industrial Development Zone, Port of Ngqura and Tankatara area

DRAFT EIA REPORT

CHAPTER 11:

MARINE ECOLOGY

SUMMARY

Manganese can be introduced into the marine environment as a consequence of dust being washed or blown off the quay during shiploading.

The likelihood of this happening is considered small as a result of the dust abatement measures planned for the proposed manganese ore export facility. The Air Quality Specialist survey (Chapter 5) in fact indicates that very little dust will be blown into the Ngqura Harbour and even less blown further afield. There is no indication that the dust could reach any of the Islands in Algoa Bay.

The dust that does land in the harbour water was found to be of such low volumes that smothering or other physical interference with the ecology of the Harbour was deemed to be unlikely.

Manganese is not soluble in sea water and leachate tests conducted on the manganese ore (with fresh water) revealed low concentrations of trace metals. This entails that trace metals would be even less readily mobilised in sea water. Thus the possibility of chemical contamination of the water, sediment or marine organisms too was deemed to be improbable.

This marine ecology assessment identified five potential impacts on the marine environment that are directly attributable to the manganese ore export facility (i.e. Impacts 1, 2, 3a, 3b and 4 in Table 5-4). They were all found to have low significance.

A further five potential impacts as a result of increased shipping in Algoa Bay at large and Ngqura Harbour were identified which include:

- Impact 5a: Chemical contamination from ballast water
- Impact 5B: Release of alien species from ballast water
- Impact 6a: Small scale spill of fuel in the Harbour
- Impact 6b: Large fuel spill in Algoa Bay
- Impact 7: Collisions between ships and whales and dolphins

Of these, the possible release of alien species was assessed to have a medium significance and a large oil spill in Algoa Bay was assessed to have a high significance. However, none of these five potential impacts indicate that the manganese ore export facility is environmentally unsound. Rather they note the increased risks associated with a developing harbour. The responsibility for managing these risks does not lie with the manganese ore export facility management but with Port Authorities. It is also noted that the development of the Port of Ngqura was subject to an earlier Environmental Impact Assessment and the risks associated with generic expansion and development were approved by the National Department of Environmental Affairs and Tourism. Thus only impacts specific to the manganese ore export facility are assessed in this document as acceptance of the impacts 9of generic increases in shipping is implicit in the approval of the harbour.

All the potential impacts associated with the manganese ore export facility are of low significance and can be readily mitigated.

GLOSSARY

Acute effect: Rapid adverse (lethal) effect caused for example by contaminants or physical processes. The term can be used to define either the exposure or the response to an exposure (effect).

Amphipod: A kind of malacostracan crustacean

ANOVA: Analysis of variance; statistical test to determine differences in an attribute or attributes between groups and/or treatments

Anthropogenic: Produced or caused by humans

Benthic: Referring to organisms living in or on the sediments of aquatic, estuarine and marine habitats

Benthos: The sum total of organisms living in, or on, the sediments of aquatic habitats

Biodiversity: The variety of life forms, including the plants, animals and micro-organisms, the genes they contain and the ecosystems and ecological processes of which they are a part

Biogeochemistry: The study of the relationship between geochemistry of a region and the biology in that region

Biomass: The living weight of a plant or animal population, usually expressed on a unit area basis

Biota: The sum total of the living organisms of any designated area

Bivalve: A mollusc with a hinged double shell

CDC Coega Development Corporation

Chronic effect: Sub-lethal effect lingering or continuing for a long time; often for periods from several weeks to years. Can be used to define either the exposure of an aquatic species or its response to an exposure (effect).

Community: An assemblage of organisms characterised by a distinctive combination of species occupying a common environment

Community composition: All the types of taxa present in a community

Community structure: All the types of taxa present in a community and their relative abundances

Contaminant: Biological (e.g. bacterial and viral pathogens) and chemical introductions capable of producing an adverse response (effect) in a biological system, seriously injuring structure and/or function

Crustacea: A highly diverse class of organisms containing crabs, shrimps, lobsters, isopods, amphipods etc

DEAT/MCM: Marine and Coastal Management Directorate of DEAT

DEAT:	Department of Environmental Affairs and Tourism
Detritus:	Unconsolidated sediments composed of both inorganic and dead and decaying organic material
Echinoderms:	Phylum of marine invertebrates that includes sea urchins, starfish, brittle stars, sea cucumbers. All are characterised by tube feet and five-part radially symmetrical bodies
EIA:	Environmental Impact Assessment
Endangered:	A taxon is regarded as endangered when it faces a high risk of extinction in the wild. This is defined as a 20% probability of extinction within 20 years
Epifaunal:	Organisms, which live at or on the sediment surface being either attached (sessile) or capable of movement.
GIPME:	Global Investigation of Pollution in the Marine Environment.
Habitat:	The place where a population (e.g. animal, plant, micro-organism) lives and its surroundings, both living and non-living.
IMO:	International Maritime Organisation
Infauna:	Animals of any size living within the sediment. They move freely through interstitial spaces between sedimentary particles or they build burrows or tubes.
Isopod:	Any of various small terrestrial or aquatic crustaceans with seven pairs of legs adapted for crawling
IUCN:	International Union for Conservation of Nature and Natural Resources
Macrofauna:	Animals >1 mm.
Macrophyte:	A member of the macroscopic plant life of an area, especially of a body of water; large aquatic plant
MARPOL:	IMO international convention for the control of marine pollution from ships
MCM:	Marine and Coastal Management Directorate, Department of Environmental Affairs and Tourism.
Molluscs :	A phylum of organisms containing snails, mussels, oysters
Mysids:	Small shrimp-like crustaceans
NEMA:	National Environmental Management Act
NPA:	National Ports Authority
Oxic:	Containing oxygen, aerobic
PEL:	Probable effective levels
PCB:	Polychlorinated Biphenyls
Piscivorous:	Feeding on fishes

Pollution:	The introduction of unwanted components into waters, air or soil, usually as result of human activity; e.g. hot water in rivers, sewage in the sea, oil on land that cause adverse change(s)
Polychaetes:	A class of mainly marine worms
Population:	Population is defined as the total number of individuals of the species or taxon
Recruitment:	The replenishment or addition of individuals of an animal or plant population through reproduction, dispersion and migration
RSA:	Republic of South Africa
SAN Parks:	South African National Parks
Species:	A group of organisms that resemble each other to a greater degree than members of other groups and that form a reproductively isolated group that will not produce viable offspring if bred with members of another group.
Sipunculids:	Small unsegmented marine worm that when disturbed retracts its anterior portion into the body giving the appearance of a peanut.
Taxon (Taxa):	Any group of organisms considered to be sufficiently distinct from other such groups to be treated as a separate unit (e.g. species, genera, families)
TEL:	Threshold effective levels
Toxicity:	The inherent potential or capacity of a material to cause adverse effects in a living organism
Vulnerable:	A taxon is vulnerable when it is facing a medium risk of extinction in the wild in the medium-term future, defined as a 10% probability of extinction within 100 years.

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CHAPTER 11: MARINE ECOLOGY IMPACT ASSESSMENT

This chapter presents the Marine Ecology Specialist study undertaken by Errol Cerff, Sue Lane and Dr Robin Carter from Lwandle Technologies (Pty) Ltd, under appointment to CSIR, as part of the Environmental Impact Assessment for the proposed Manganese export facility and associated infrastructure in the Coega Industrial Development Zone, Port of Ngqura and Tankatara area.

11.1 INTRODUCTION AND METHODOLOGY

11.1.1 Scope and Objectives

Transnet intends developing a Manganese Facility at the Port of Ngqura in order to enable an increase in export volumes of manganese. Manganese is currently mainly exported through the Port of Port Elizabeth at a throughput of approximately 5 Million tonnes per annum (Mtpa). The Port Elizabeth manganese terminal is planned to be decommissioned in 2017 and manganese will be exported through the new facility planned at the Port of Ngqura only. Lwandle Technologies (Pty) Ltd has been commissioned to conduct an assessment of potential impacts on the marine environment attendant on the proposed development.

The required EIA end-product from the marine ecology specialist study is to provide a detailed assessment of all potential risks (and the significance of these risks) to the marine ecology (e.g. effects of dust on the marine environment and sediment quality in the Port of Ngqura) and beneficial users in the marine environment.

11.1.2 Terms of References

This Scope of Work is based on the following broad ToRs which have been identified through the Scoping process (refer to Final Scoping Report, CSIR, August 2012) and specified for the specialist study on marine ecology:

- Ascertain what risks may be presented by the construction and operation of the proposed manganese ore export facility on marine ecology in Algoa Bay, including shipping impacts (e.g. ballast water), Mn ore handling, outfall discharge, etc.;
- Ascertain risks and impacts of the project on beneficial users of the marine environment, such as aquaculture and recreational and commercial fishing, including the squid fishery;
- Characterise the marine environment in the area with specific reference to the islands off the Port of Ngqura;
- Characterise and quantify, where possible, the identified risks coordinating as required with other specialists;
- Assess potential impacts and the significance of the same;
- Provide detailed site specific mitigation measures to reduce or prevent such impacts.

11.1.3 Approach and Methodology

A number of EIAs and specialist studies have been conducted on the various development phases of the Port of Ngqura. These, together with the existing bio-monitoring data, comprise a valuable resource of information that will be used to identify direct and indirect risks to the marine environment of the proposed project and these will be evaluated against the various characteristics of and processes in that environment. The following gives a brief overview of the scope of work that was undertaken.

11.1.3.1 Collation of background information

Information was derived from:

- Existing completed environmental studies for the Coega IDZ/Port of Ngqura, including the EIA for the development of the Port of Ngqura that included risk studies of increased shipping as a consequence of the ongoing expansion or port usage.
- Export facility design and operation specifications.
- Experiences from existing projects of a similar nature.
- Requirements from Coega Development Corporation.
- Chapter 5 Air Quality Specialist study by uMoya-NILU Consulting (Pty) Ltd.

11.1.3.2 Site Inspection and initiation workshop

A site inspection of the development site followed by a specialist information workshop was held on 24thApril 2012; an objective of this was to ensure synergy between various specialist inputs.

11.1.3.3 Environmental baseline description/s

The environmental baseline description was compiled from existing baseline descriptions and updated where required with new data/information as needed and possible. A high level site investigation in the port itself was conducted as this area has not been well covered in the existing information.

11.1.4 Assumptions and Limitations

This marine ecology assessment is based upon the following assumptions:

- The pollution control and dust suppression measures detailed in the project description will be implemented and will be as efficient as specified.
- All machinery and equipment at the berth will be maintained regularly and frequently to prevent failure that may result in severe spillages of ore or release of dust.
- All staff are appropriately and regularly trained in the use of the equipment and standard pollution response procedures.
- All run-off from the stockpiles and conveyors will be contained on site and will not be able to enter the harbour or adjacent coastal waters.

- The baseline (without mitigation) assessed is based on the above assumptions. If any additional mitigation measures are proposed over and above those already planned, the impact assessment is then adjusted to the "with mitigation" condition.

The following are limitations of this marine assessment:

- Given the low risk of toxicity effects from release (dissolution) of manganese (regardless of the oxidation state) from manganese ore in seawater (ANZECC 2000, WHO 2004 Stauber *et al* 2000, and Apte *et al.* 2007), this study is limited to a 'desktop' approach and is absolutely reliant on data provided by CSIR, Transnet and published reports on both the nature of the proposed project and the effects of manganese on marine organisms. No physical testing or primary research was conducted to verify any of the information used. There is not likely to be a huge difference in leachate potential between fresh and sea water but irrespective, the amounts released will be minute especially when diluted with the harbour water. The concentrations that result will still not reach those at which Manganese becomes toxic.
- Separate specialist studies assessing the risk of dust-fall out and containment on the land-based facilities and their ability to contain any dust fall-out and prevent it from reaching *inter alia* the marine environment were conducted. For this reason assessment of the risks of land-based facilities is excluded from this marine ecology specialist study.

11.1.5 Source of Information

A record of all information used in this assessment is contained in section 11.9 below.

11.1.6 Declaration of Independence

The declaration of independence by the marine ecology specialist is provided in Box 11.1 below:

BOX 11.1: DECLARATION OF INDEPENDENCE FOR MARINE IMPACT ASSESSMENT

I declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Manganese ore export facility, Port of Ngqura, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Robin Carter.

Robin Carter, Ph.D, Pri Sci. Nat (400245/06)
Registered as a Professional Natural Scientist with SA Council for Natural Scientific Professions

11.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO MARINE ECOLOGICAL IMPACTS

For a general overview of the project description for the proposed manganese ore export facility, refer to Chapter 2 (Project description) of this EIA Report. The following section provides additional detailed information on specific aspects of the proposed project that is relevant to the potential impacts on marine ecology.

The only operations which could impact on the marine environment are those involved in the transportation of the ore from the conveyors into the ships.

Two possible sources of manganese ore dust result from these operations:

1. Ore can be spilled onto the quay from the shiploaders once the ship's holds are full since the conveyor continues running. Any dust generated from the ore could then vulnerable to wind and rain dispersal.
2. Ore dust can be blown from the distal end of the shiploader while loading the ship if the ore being transported is dry or not sufficiently wet.

Each conveyor system will contain a surge bin facility located at the stockyard with a capacity of approximately 1 250 tonnes and six vibrating feeders with a capacity ranging between 900 and 1300 tons/hour. The surge bins serve as a buffer between the reclaimer and the ship loader during frequent ship loader hatch changes. Furthermore, the surge bins will assist in reducing potential spillages of material by leveling the load onto the ship loading conveyor.

Manganese Ore will be conveyed from the surge bin to the ship loading conveyors, alongside the C100 and C101 quay. The manganese ore will be loaded onto the ship loader boom conveyor, via a tripper. It is proposed that the ship loaders will be designed to load Panamax vessels at a rate of 3 000 tons/hour. The shiploaders are telescopic so that the end of the chute is positioned inside the opening to the ships' hold thereby reducing the potential for wind dispersal of the dust.

The existing dry bulk quays C100 and C101 will be utilised for the proposed project as the designated manganese ore handling quays. The design of these specific quays were analysed to ascertain the maximum size of ships that could be loaded. Based on the analysis it was determined that two Mini-Cape ships of 80 000 DWT can also be moored simultaneously at the C100 and C101 quays. It is anticipated that the facility will service 5 to 6 ships per week.

11.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The study area is initially the entire Algoa Bay area extending from Cape Recife in the west to the Bird Island Group in the east (*Figure 11-1*) incorporating the sea area, islands and island shores, the shoreline and the Swartkops and Sundays River estuaries. It is then focused on the Port of Ngqura (*Figure 11-2*).

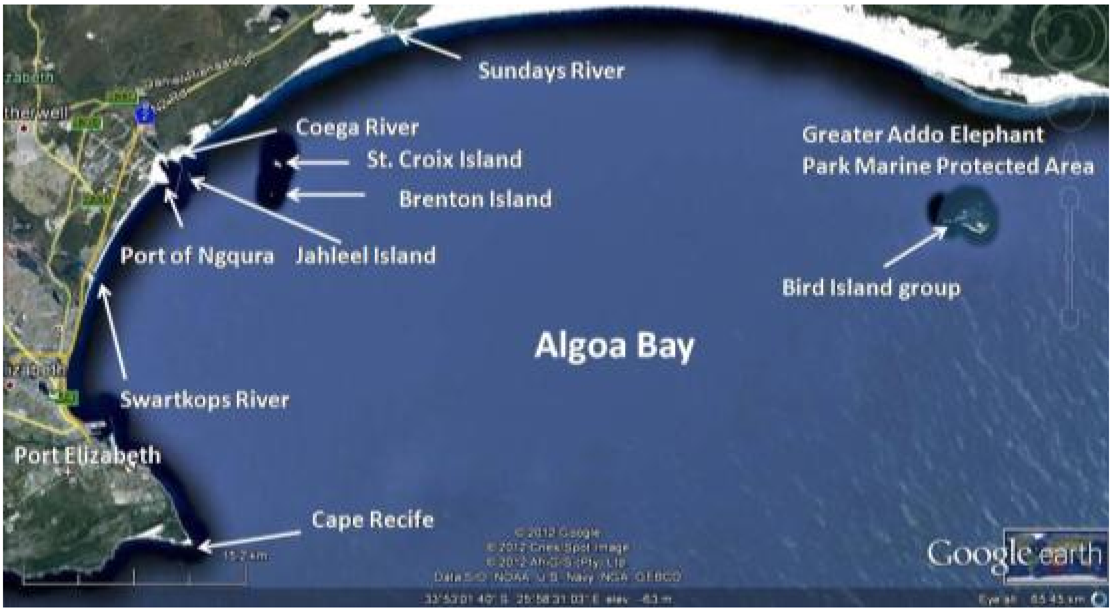

Figure 11-1: Google Earth image of Algoa Bay showing the locations and features discussed in this assessment (Source: Google Earth, 2012)

Figure 11-2: The Port of Ngqura (Source: Google Earth, 2012)

11.3.1 Regional Overview

Algoa Bay is a large log-spiral bay (Rust 1991), anchored by rocky headlands at Cape Recife in the south east, and Woody Cape and the Bird Island group in the north east (Figure 11.1). The bay contains the relatively large Zwartkops and Sundays Rivers and the much smaller Papenkuils and

Coega rivers that discharge into it. The coastline consists mainly of quartzitic sands backed by sand dunes which are largely unvegetated and mobile north east of the Sundays River mouth.

Algoa Bay contains two groups of islands; the St Croix/Brenton/Jahleel group in the south and the Bird Island group towards the north east. The bay is relatively shallow being generally <50 m in depth. The seabed is mostly sandy but has portions of partly exposed bedrock, which in places may be covered by a thin layer of coarse sediment. Coarse sediments appear to be associated with the island groups and are probably indicative of high turbulence around these features (Illenberger, 1997).

11.3.1.1 Oceanography

Waves

Wave directions are dominated by the direction sector SSE – ESE. This is due to the refraction effects on southerly and south-westerly ocean waves around Cape Recife resulting in waves approaching the region of interest from the SSE. Waves may also approach from an easterly direction; these are weakly refracted and consequently retain high wave energy and may cause damage to coastal structures and ships (CSIR 2002).

Tides

Tides around South Africa are classified as semidiurnal microtidal, with a dominant M2 tide (i.e. there are two high tides and two low tides per day). The tidal period is 12 hours and 25 minutes, with a slight diurnal inequality (Schumann *et al.*, 1996). Spring- neap tide variation is significant. Tide ranges vary from as little as 0.5 m during neap tides to over 2 m at spring tides (South African Navy Tide Tables).

Longer-period water level variations also occur as a result of meteorological influences, particularly wind. Coastal trapped waves along the south coast have amplitudes that on occasion are in excess of 0.5 m (Schumann and Brink, 1990). Consequently net water level variations in Algoa Bay are a combination of wind and wave set-up as well as tidal variations. Offshore current variability associated with the Agulhas Current may result in slow (periods of 20 days or more) and relatively small water level variations.

Coastal currents

Both modeling (CSIR, 2002) and measurement programs (Goschen and Schumann, 1988, 1990, Schumann *et al* 2005, Roberts 2010) have provided a reasonably good understanding of the circulation in Algoa Bay.

The Agulhas Current exerts large scale forcing functions in the wider Algoa Bay even though its core is generally located around the 200 m depth contour. However, in the immediate vicinity of the Port of Ngqura this influence may be limited to the modification of water masses, seawater temperatures and water column stratification. In common with the rest of the RSA continental shelftidal currents are likely to be small in Algoa Bay as a result of its open geometry and the small tidal phase lag along the East Coast (SA Naval Hydrographic Office data show high tide at Mossel Bay, Port Elizabeth and East London occurring within 3 minutes of each other). However, Schumann *et al* (2005) detected significant energy at the M2 period in the vicinity of Port Elizabeth harbour implying that here; at least, there may be tidal influences on the currents.

Currents measured in the immediate vicinity of the Port of Ngqura (S4 instrument deployed near the head of the breakwater in 17.5 m water depth) appear to be predominantly wind-driven, as they respond rapidly to wind conditions. This is consistent with observations by Roberts (2010) east of the Sundays River mouth who shows alternating eastward and westward alongshore flows aligned with the dominant wind directions. Currents can reverse rapidly in response to changes in the wind (2-7 hrs), and can attain velocities of 50 cm/s near the seafloor while surface currents are projected to exceed 1 m/s (Roberts 2010). Currents within Algoa Bay are complex, however, as Schumann *et al* (2005) show surface and bottom currents can run counter to the wind for appreciable periods of time (~45 days). These authors indicate that entrainment of bottom waters by the Agulhas Current is the most plausible explanation for their observations. Wave-driven currents predominate in the nearshore zone adjacent to the Port of Ngqura. Depending on the wave conditions these flows may be either SW or NE. Under high wave conditions these nearshore currents are of a significant magnitude. The Port of Ngqura obstructs the alongshore flow somewhat and results in a zone to the NE of the eastern breakwater that is at times quiescent or a zone of persistent re-circulation. A similar quiescent or recirculation zone exists to the SW of the Port of Ngqura.

A rough characterisation of surface current speeds from modelling studies (CSIR 2002) indicates that the maximum simulated surface current speeds 500 m offshore of the port are approximately 0.5 m/s, while maximum current speeds in the nearshore zone may exceed 0.6 m/s on occasion. These compare with an average velocity of 0.04 and an apparent maximum flow of ~0.2 m/s at the 10 m depth contour adjacent to the Papenkuils river mouth measured by Schumann *et al*(2005), and the higher measured and projected velocities east of the Sundays River mouth (Roberts 2010 above). In the deeper (~17 m) areas of the southern section of Algoa Bay these authors measured maximum current velocities of >0.4 m/s at mid-depth and >0.35 m/s close to the sea floor. In general the current speeds 500 m offshore are greatest in spring and summer, less in autumn and lowest in winter when the water column is well mixed. In the nearshore zone the currents are strongest in winter and spring.

Due to its constrained mouth area and relatively small water body flows within the Port of Ngqura are predicted to be mainly tidal and aligned with the main axis of the port. These flows would probably be barotropic. It is possible that in northerly wind conditions the surface water is blown out of the port and is replaced by counter flows at the bottom of the water column, i.e. the flow becomes baroclinic.

11.3.1.2 Ecology

Marine ecosystems comprise a range of habitats each supporting a characteristic biological community. The important habitats in Algoa Bay are sandy beaches and surf zones, rocky shores on the adjacent Jahleel Island and in the vicinity of the abalone farm site east of the Ngqura port,the subtidal zone in the bay itself, the islands, the water body in Algoa Bay, and artificial surfaces and the water body in the port. These are all vulnerable in the event of a large scale product spill.

The description of the beach, nearshore ecology and areas of special interest (marine protected areas, abalone farm) are based on a number of existing reports (e.g. CES, 2001, Wood, 2002).[1]

Sandy beaches and surf zones

Sandy beaches in the region extending eastwards from the Zwartkops River mouth are classified as being intermediate in the dissipative/reflective continuum with transverse bars and rip currents. Surf

[1]Note that taxonomic nomenclature used in this report follows that used in the previous assessments for the region and that in Branch *et al* (2004). It is acknowledged that some of the names used are no longer applicable (e.g. *Nodilittorina*, Ridgeway *et al* 1998) but uniformity within the series of assessments and monitoring reports on the Port of Ngqura may have been compromised by changing to the currently valid taxonomic names.

zones fluctuate with wave height but may be 250-300 m wide. Beach swash zones are usually shallow with low waves. Net sand transport on both the shore and the wave dominated shallow subtidal is north and north eastwards. This type of beach is characteristic of eastern Algoa Bay and has a wide distribution in the region.

A major ecological feature of these beaches/surfzones is the development of dense patches of the diatom *Anaulus australis* which may comprise more than 95% of the total algal production (Campbell & Bate, 1988). Consequently this species is a critical component in the nearshore food web driving interstitial, microbial and macroscopic food chains. The partition of the energy is 20%, 40% and 20% respectively with the balance exported to the adjacent nearshore water column and benthic environments. The macrofauna consists of a large number of animals, although the number of species is relatively low. Molluscs dominate the macrofaunal biomass with the dominant forms in the surfzone area being scavenging plough snails (*Bullia* spp.) and the filter feeding sand mussels *Donaxserra* and *D. sordidus*. Sand mussels are apparently largely dependent on *Anaulus* and consequently reach their highest biomasses where *Anaulus* blooms are most frequent, north east of the Sundays River mouth. Swarming mysids (*Gastrosaccus* and *Mesopodopsi* ssp) are also important in the surfzone food web, and sand mussel and mysids specifically are important prey species for various fish including sand sharks, rays, mullet, blacktail, white steenbras, white stumpnose etc, and the three spot swimming crab *Ovalipes*.

High concentrations of food organisms, *Anaulus* blooms and swarms of mysids, lead to north eastern Algoa Bay surfzones being important nursery areas for a wide range of fish species. 30 species have been recorded of which approximately half also occupy surfzones as adults contributing to the more than 70 species of teleost and cartilaginous fish recorded from the surfzones and nearshore of Algoa Bay. The biological structure of Algoa Bay beaches and surfzones is unique in South Africa and is considered to merit a high conservation status. This is reflected in the proposed establishment of a marine protected area east of the eastern breakwater of the Ngqura port as part of the Greater Addo Elephant National Park.

Rocky shores on the adjacent Jahleel Island and in the vicinity of the abalone farm site

Eastern Algoa Bay does not have extensive rocky shores, these being limited to isolated stretches immediately east of the Coega river mouth and the island shores of which those of Jahleel Island are closest to the Ngqura port. The Island shores have been quantitatively surveyed as part of the suite of environmental monitoring associated with the port development (e.g. Klages and Bornman, 2003, 2005a, 2005b, Klages *et al* 2006), but there is apparently no information available on isolated rocky shores that mainly comprise wave cut terraces north east of the port, e.g. abalone farm site at Hougham Park.

The island shores exhibit characteristic zonation patterns extending down the intertidal zone; namely Littorina, Upper Balanoid, Lower Balanoid Mussel and Cochlear zones. Both the macroalgae and fauna appear to be typical of the Algoa Bay region. The macroalgae fall into the south coast biogeographic region (Bolton and Stegenga, 2002), with dominant taxa being *Porphyra*, *Ulva*, *Gelidium*, *Enteromorpha*, *Hypnea*, *Laurencia* spp and *Cheilosporum*. Emanuel *et al* (1992) classify the macrofauna of the Port Elizabeth area as falling within the 'Warm temperate south coast community'. Dominant macrofauna include the winkle (Molluscan gastropod) *Nodilotorina africana*, the limpets *Patella cochlear*, *P. granularis*, *Siphonaria* sp and keyhole limpets (probably *Fissurella* sp.), the brown mussel *Pernaperna*, amphipod and isopod crustaceans, barnacles, primarily *Tetraclita serrata* and *Octomeris angulosa* and echinoderms.

Rare and/or endangered species have not (yet) been recorded from Jahleel island shores but this may be a function of survey intensity rather than the absence of such species.

Subtidal zone

The subtidal sea floor adjacent to the Port of Ngqura is dominated by low relief emergent rock reefs interspersed by various grades of sands. Mud, silt and clay sediments generally do not occur in this area, probably due to high shear stresses at the seafloor associated with waves. Although not well known, the available research/observation literature indicates that the major primary producers are phytoplankton and a fine macroalgal turf growing on the shallower emergent reef surfaces. The Coega River is apparently an important contributor of nutrients to the shallow subtidal as elevated phytoplankton biomasses have been recorded adjacent to the river mouth. The sand areas support a benthic macrofauna distribution expected for a nearshore depth gradient, i.e. suspension feeders dominate the shallow areas, predators and scavengers are most common at intermediate depths and deposit feeders dominate in the deeper areas. Biomass covaries with lowest levels in the nearshore and highest levels at the deeper locations. (CSIR, 2007)

The benthic macrofauna include all of the major groups expected to be found in RSA inner continental shelf unconsolidated sediments. Crustaceans and polychaetes comprise the numerical dominants followed by molluscs and echinoderms. Subsidiary taxa such as sipunculids have also been recorded in the area. The pelagic fauna is perhaps different from other east and southeast coast beaches in that, aside from the ubiquitous fish species, the mysid *Mesopodopsis wooldridgei* forms dense swarms out to approximately 10 – 20 m depths and moves inshore to just behind the breaker line at night to feed. Here it consumes phytoplankton, including *Anaulus*, and is preyed on in turn by various fish. This mysid is probably instrumental in transporting primary production from the surfzone into the shallow and deeper subtidal regions.

Biodiversity and conservation

The available biological records for Algoa Bay, encompassing the Ngqura port, indicate that none of the marine algae, fish and invertebrate species/taxa has either restricted distributions or small population sizes. In fact some of the organisms have extremely wide distributions in South African coastal waters with apparently robust populations. Consequently none of the recorded species are classifiable as either rare or endangered in terms of their conservation status. Note that the initial tentative classification of a phyllocarid crustacean (*Nebalia*) in the subtidal benthos (Newman *et al* 2001) appears to have been erroneous.

The colonial breeding coastal seabirds that utilize the Algoa Bay Islands, including Jahleel, as nesting sites and specifically the Humpback dolphin *Sousa chinensis,* are exceptions to this.

The St Croix Island group, incorporating Jahleel Island, held a significant proportion of the global African penguin *Spheniscus demersus* population (~ 40%, Barnes (1998)) in the 1990s. These birds move between the islands and, although not as important as St Croix Island itself due to its size and terrain, Jahleel Island has hosted important numbers of penguins. African penguins are classified as globally threatened according to Birdlife International (2004). Accordingly islands in the St Croix Island group are denoted as Important Bird Areas (Barnes, 1998) and are currently provincial nature reserves. The reserve boundaries extend 500 m offshore of the islands as Marine Protected Areas. These Islands have been incorporated into a National conservation area; the Greater Addo Elephant Park.

The marine mammal fauna of South Africa comprises in excess of 30 whale, dolphin and seal species. Nine species (4 whales, 4 dolphins, 1 seal) are relatively common in the area, albeit some only seasonally (CSIR, 2001). The two largest cetaceans are present in winter and spring only, when the Southern Right Whales give birth and nurse their young in shallow waters, and when the Humpback Whales migrate through to their more tropical nursery areas.

Humpback Dolphins (nationally a Critically Endangered species) and Bottlenose Dolphins use the surfzone extensively as a feeding ground. Common and Risso's Dolphins are usually encountered somewhat further offshore. The Cape Fur Seal has a wide at-sea distribution (Smale *et al*., 1994). The southern African population of Humpback dolphin has been estimated at <1000 individuals and 200 – 400 of these appear to be resident in Algoa Bay. Due to its low population size this species classifies as near-threatened under the IUCN criteria (IUCN, 2012). The individuals in Algoa Bay are mainly distributed around rocky reefs in the nearshore south west of the Sundays River mouth. According to Wooldridge *et al* (1997), the surf zone off the Coega River mouth and around the St Croix Islands were an important foraging and socializing area for this species. Some of this habitat has already been altered by the construction of the Ngqura Port breakwaters which has unpredictable consequence for the local (Algoa Bay) sub-population.

Two broad foraging guilds are recognisable in the assemblage, based on where marine mammals pursue their prey: inshore and reefs, or epipelagic. As is the case with seabirds, Anchovy and Sardine are the most important prey species for the open-water species of cetaceans, whereas a wide variety of perciform reef fish (such as *Sparidae*, *Lutjanidae*, *Mugilidae*) form the common prey of the inshore feeders.

Summary

From the above it is apparent that Algoa Bay is rich in biodiversity and supports populations elsewhere as a consequence of its function as a nursery and breeding ground. Any pollutants which adversely affect these functions are therefore to be avoided.

11.3.1.3 Resources, and Commercial and Recreational Fisheries

In excess of 70 fish species inhabit Algoa Bay comprising species endemic to South African coastal waters and fish with wider distributions. None of these species have distributions limited to the Algoa Bay area, i.e. they cannot be considered as rare and/or endangered or having narrow habitat preferences. Commonly occurring species include southern mullet, blacktail, sand and white steenbras, olive rock grunter, white stumpnose, and strepie. Leervis, elf and kob are present seasonally. Sharks, e.g. bronze whaler, dusky, lesser sandshark and rays, e.g. blue stingray, eagle ray are encountered in the region along with many other species (see distribution ranges for individual fish species given by Heemstra and Heemstra (2004)). Pilchard, anchovy, red eye also occur in Algoa Bay and are important food resources for their common predators, e.g. piscivorous seabirds, dolphins etc.

Some of these species support commercial linefishing and are the basis for a significant recreational fishery in Algoa Bay. No trawling is allowed within the confines of Algoa Bay inshore of a line extending from Cape Recife to Woody Cape. No fishing at all is permitted in the Bird Island Marine Protected area (above).

Algoa Bay is important for commercial (and recreational) caches of squid (*Loligo vulgaris reynaudii*), a valuable fishery within the South African context. Squid spawn in Algoa Bay throughout the year but with apparent peaks in the spring/summer period. The squid attach their egg pods to the sea floor for egg maturation and hatching. Direct observations indicate that preferred substrate types for pod attachment are coarse sands and shell, flat and high profile reef and sand interspersed with reef (Roberts 1998). Egg pods have not been observed in fine sands and silt which is possibly due to insecure attachment. There are a minimum of 26 individual spawning sites in Algoa Bay. During spawning, at least, squid are mainly benthic predators consuming the larger polychaetes and crustacea (Sauer and Lipinski, 1991).

11.3.2 Site specific detail on the port area

11.3.2.1 Subtidal benthic macrofauna

Klages *et al.* (2006) indicate that the harbour structures supported brown mussel *Perna perna* and rock oyster *Striostrea margaritacea,* as well as attached epiphytic and filamentous algae, barnacles (*Tetraclita, Chthamalus*). These species can be considered as being typical of the region. Changes in benthic macrofauna community structure at impact and control sites located around the Port of Ngqura were reported over the years 2003 – 2006 (Klages, 2006). In this data set Klages and Bornman (2005b) demonstrated changes linked to proximity to the harbour development and across years but identified some 'recovery' in 2005. These authors and Klages *et al* (2006) reached almost identical conclusions that the observed changes in community structure were 'consistent with an environment that in 2004 had experienced high turbidity and the presence of dredging fines being distributed across the study site from the actual dredge spoil dump site'. Unfortunately their sampling methods and level of taxonomic resolution were not uniform over the period making the interpretation of the observed distributions problematical. Further, the sampling sites that had been designated as controls (i.e. distant from the disturbance) also showed strong variability over time.

All of the major groups persisted through the observation period with polychaetes and crustaceans dominating the fauna. The major change is the large proportional reduction in molluscs between 2003 and 2004; which appears to persist into 2005/2006. Unfortunately the effects of changes in sampling methodologies between 2003 and 2004 cannot be excluded as being responsible for the observed changes between these years. In a meta-analysis of the responses of phyla to organic and chemical pollution Warwick and Clarke (1993) demonstrated that molluscs are relatively sensitive to anthropogenic disturbances. This supports the contentions of Klages and Bornman (2005c) and Klages *et al* (2006) on the impacts of the harbour development. However, Warwick and Clarke (1993) also demonstrated that echinoderms were amongst the most sensitive of all of the groups they considered which is supported by Swartz *et al* (1986) who found ophiuroids (echinoderms, brittle stars) to be indicative of non-polluted conditions off southern California.

In view of the above and the known spatial and temporal variability in benthic macrofaunal communities over relatively small scales (e.g. Morrisey *et al*1992a, 1992b), the changes observed during the monitoring cannot be unequivocally attributed to port construction activities.

11.3.2.2 Island intertidal flora and fauna

Intertidal flora and fauna were monitored at St Croix and Jahleel islands in 2000 and subsequently at these two islands and Bird Island in 2003, 2005 and 2006 (Klages and Bornman, 2005a, Klages *et al* 2006). Species composition was that expected of intertidal shores in the Algoa Bay region as defined by Bolton and Stegenga (2002) and Emmanuel *et al* (1992). Some temporal variability occurred during the observation period; with the higher shore areas of both Jahleel and St Croix supporting less algal biomass (= cover) after construction than before. Algal species such as *Hypnea tenuis* and *Porphyra capensis* showed declines compared to pre-dredge conditions whilst lower down on the shore *Gelidium pristoides* became more dominant than was the case prior to construction.

The ecological significance of the observed changes is unknown as are any direct or indirect links to disturbance generated by the harbour construction. Dye (1998), in a long term study of variability in intertidal zones on the Transkei coast, demonstrated high 'natural' variability over small horizontal distances and at intra- and inter-annual temporal scales. Klages and Bornman's (2005a) and Klages *et al*'s (2006) observations may also be reflecting such variability and the authors do not propose any mechanistic links to construction activities.

11.3.2.3 The port water body and infrastructure

According to Dicken (2010), the Port of Ngqura offers a hard substrata habitat, which contrasts the soft sediment habitat associated with the adjoining sandy beaches. Based on this contrast, the Port of Ngqura has the potential of altering the abundance, distribution and diversity of fish species in the marine environment. Due to its nature the port undoubtedly plays a regionally important role as a fish nursery area within Algoa Bay. The port water body supports a wide range of fish species ranging from mainly herbivorous strepie to top predators such as kob, leervis ragged tooth and dusky shark. White shark, whale shark and manta ray have also been observed within the confines of the port (Dicken 2010). Sampling by Dicken (2010) yielded 4 559 fish with 47 species distributed in 27 families, i.e. a highly diverse species assemblage. Part of the reasons for high fish densities in the port is prohibition of angling. Most of the fish were marine as opposed to estuarine species. These species included the Cape stumpnose, pufferfish, kob, elf and garrick, as well as subtropical kingfish (Dicken, 2011) and queen mackerel (*Scomberomorus plurilineatus)* which were never previously recorded from any recreational shore or boat-based fisheries in the Eastern Cape (Dicken, 2010). The fish caught were predominantly juveniles (71.4%) but dusky shark and kob were almost all juvenile animals. This and subsequent analyses led Dicken (2011) to conclude that the port is an important habitat and activity zone for both juvenile and neonate dusky shark.

The study also highlighted the unexpected abundance and diversity of shark species in the Port itself (Dicken, 2011). These species included bronze whalers, hammerheads, various cat sharks, dusky sharks (*Carcharhinus obscures)* and gully sharks. The dusky and gully sharks were determined to be the most common species as a result of the sheltered environment the port creates, as well as the abundance of fish prey.

Owing to the various infrastructures within the port, three distinct habitats were identified during this study such as the Dolosse, Quay Wall, and the Sandy Shore. The Dolosse provided a habitat within which the highest number species were recorded (43 species) in comparison to the Quay Wall (24 species) and Sandy Shore at the base of the eastern breakwater (21 species) (Dicken, 2010). In terms of abundance (as shown by fish yields per angler hour) the former substrates were equal with the shore habitat being less productive. Differences in species distributions indicate that in the Dolosse and the Quay wall habitats, kob and elf were common whereas in the Sandy shore habitat, leervis and dusky shark dominated.

Extrapolating from the research by Dicken (2010), recovery of the ecology of the Port of Ngqura takes between 5 and 10 years after a catastrophic disturbance. Dicken found healthy fish communities by 2006/2007 (5-6 years after construction commenced and 2 years before it was completed) implying the presence of benthic and intertidal communities as food sources. At this stage the eastern breakwater was completed and the extension to the main quay was still in progress.

11.3.2.4 Coastal seabirds

The Oceans and Coasts Branch of the National Department of Environmental Affairs conducts regular censuses of coastal seabirds around South Africa. Important amongst these are counts of nesting pairs of African penguins *Spheniscus demersus* and total nest area estimates for Cape gannet *Morus capensis* on the Algoa Bay Islands. Gannets appear to have been stable or increasing on specifically Bird Island over the recent past. This may be attributable to an eastward shift in sardine *Sardinops sagax* (Van der Lingen *et al* 2005) and therefore an increase in food availability for this species. Penguins in Algoa Bay, on the other hand, have shown a marked decrease from ~22 000 pairs in the period 1987-2001 to ~11 000 pairs in 2003-2009 (Crawford *et al* 2011). This decline has been most evident at St Croix Island where the numbers of breeding pairs have decreased from ~20 000 in 1993 to ~7 000 in 2009. At Jahleel Island numbers have also declined from ~550 pairs in 1993 to ~200 pairs in 2011. Crawford *et al* (2011) show a close relationship between the numbers of nests occupied by penguins and the combined spawner biomass of anchovy and sardine for both Eastern (primarily Algoa Bay) and the Western Cape. Fluctuations in breeding penguins, and thus the overall penguin population, are considered to be primarily responsive to prey availability as opposed to other human disturbance factors.

The strong decline in African penguin numbers have seen the species being reclassified from vulnerable to endangered according to the IUCN conservation criteria (IUCN 2012). Therefore, wherever possible all feasible precautions need to be taken to prevent further losses or disturbances to the African penguin population, including efforts to prevent overall habitat deterioration.

11.3.2.5 Fisheries

Commercial fisheries that operate in Algoa Bay and immediately adjacent areas comprise pelagic (sardine), demersal and line fish and squid. The area appears to be occasionally important for sardine, e.g. ~14 000 tonnes landed in 2003, but relatively unimportant for demersal fish (0.5% of RSA 2004 demersal net hauls, DEAT/MCM data). Squid are the most important of the fisheries as it is ranked third in terms of relative value in South Africa (Sauer *et al* 1997). The fishery is mainly located between Plettenberg Bay in the west and Port Alfred in the east although squid are widely distributed on the South African continental shelf (Roberts 2004). The fishery largely concentrates on spawning aggregations. Spawning occurs throughout the year (Sauer *et al* 1991) but there is a marked summer peak in catches (DEAT/MCM data). Annual catches are variable and range from 2200 tonnes to 10 000 tonnes. Catches in Algoa Bay are similarly variable and range from <10 tonnes to 1 500 tonnes and may comprise 15% - 20% of the fishery.

Monthly catch data for squid in Algoa Bay for the 20 year period January 1985 to July 2005 are highly variable which has been variously attributed to large variations in effort, especially before 1998,and strong dependence on environmental factors (Augustyn 1990, Roberts and Sauer 1994, Roberts 1998, Schon 2000, Dorfler 2002, Downey 2005). Schon (2000) showed that temperature range and turbidity were the more important of the environmental variables affecting squid catches with the latter accounting for 13% of the 32% of the explained catch variability. Dorfler (2002) presented data indicating that turbidity levels exceeding 15 – 20NTU reduced squid catch rates by >90%.

Research indicates that, although variable, there is no apparent fluctuation in squid catches coincident with the Phase 1 port construction and the major dredging accompanying this. Therefore factors that may have impacted squid landings such as increased turbidity of bottom waters and inundation of squid spawning grounds in the preferred 28m – 32m depth range (Dr M., Lipinski, DEAT/MCM, *pers. comm.*) by dredge spoil have had no clear expression in the fishery. This tends to support the conclusions of CES (2001) who considered that effects of dredging, if any, would be localised. However, fishery independent squid distribution surveys in 2006 showed that squid were displaced to deeper waters in Algoa Bay (>100m) compared to Seal and Jeffries Bay where the bulk of the population was located in the preferred depth ranges (<50m; Lipinski and Mqoqi 2006). Possible reasons for this include modification of sediment properties, e.g. granulometry, rendering the historically preferred spawning depth range unsuitable for egg pod attachment and chronically elevated turbidity in bottom waters disrupting spawning behaviour. Communication between squid appears to be via chromatophores (Hanlon *et al* 1994, Sauer and Smale 1993) and highly turbid water would prevent or limit this with associated effects on pairing and mating. Displacement of squid spawning to deeper water may lead to lower production of paralarvae due to lower temperatures prolonging egg development and increasing mortalities (Roberts and Sauer 1994). The implications for the squid population and the fishery are difficult to predict because of the life history of the paralarvae and larval, sub-adult and adult squid migration patterns on the Agulhas Bank (Roberts 2004). One consequence at least may be reduced over all recruitment to the adult stock that is the target of the fishery.

11.4 IDENTIFICATION OF KEY ISSUES

It is from the shiploaders and distal end of the conveyors that any possible impacts of manganese ore dust fall out on the marine environment will arise. In addition the increased numbers of ships berthing could result in further impacts.

Impacts could arise from:

- Accidental spillage of manganese ore from the quay during loading of ships adversely affecting marine ecology (and therefore also other users such as the squid fishing industry) in the harbour resulting in;
  - Possible toxicity and bioaccumulation of manganese in marine organisms;
  - Bioaccumulation of trace metals adhering to the manganese ore particles; and,
  - Smothering of sessile organisms in the harbour during major spills.
  - Changing the chemical composition of the harbour sediment with implications on the disposal of dredge spoil in addition to affecting the benthic communities:
- Discharge of contaminated ballast water in the port releasing chemical pollutants and alien species; and,
- Increased number of ships in Algoa Bay and Ngqura Harbour adversely affecting the local marine ecology through:
  - oil/fuel spills; and,
  - Physical/ auditory disturbance of whales and dolphins.

The distance between the compilation yard and the sea and harbour water precludes any impacts on the marine environment.

The above issues can be divided into five key concerns:

1. That the marine ecology of Ngqura Harbour and/ or Algoa Bay will be adversely affected by the presence of chemical contaminants in the area. These contaminants can result from release of chemicals from spilled manganese ore and dust, release of contaminated ballast water and from oil and fuels spills. The concern centers on the possibility that the presence of these chemical contaminants could impair the natural marine systems potentially making them less viable. This could adversely affect the ecological systems themselves but also users of the systems such as the fisheries industries. Furthermore there is a concern that accumulation of such contaminants in the food chain could in fact be toxic to end users such as people eating fish products from the area.
2. The second concern relates to the increased possibility of the release of alien species from ballast water. Such releases were they to result in the species becoming invasive could result in the natural ecology of the area being disrupted with similar results to those detailed in the previous point.
3. The third concern is that benthic and intertidal marine communities could be smothered by spilled oils and fuels washing onto intertidal communities or fall-out of manganese ore dust. The possible result would be similar to those in the previous two points but would result from physical, rather than chemical or biological disturbance. The impact of this could be far more significant on the islands in Algoa Bay than in the harbour itself due to the presence of threatened species on the islands.
4. The fourth concern is that any releases of chemical contaminants from the manganese ore falling on the harbour floor, or from the release of contaminated ballast water would change

the chemical composition of the harbour sediment. The concern is that if this change to the chemical composition was sufficiently great, it could result in a probation of disposal of dredge spoil to sea in terms of the London Convention. This would greatly interfere with the essential regular maintenance of the harbour.

5. The final concern is that the general increase in shipping from this additional activity in the port could result in physical disturbance of marine mammals such as whales and dolphins.

All of the above potential impacts are associated with the **operational** phase. No significant impacts on marine ecology were identified and assessed for the **construction** phase since this project involves the use of existing infrastructure in the port area. The erection of shiploaders and conveyors will not result in significant changes to existing structures and therefore do not warrant further assessment since no marine construction activities are part of the scope of the project.

Similarly the **decommissioning** phase will involve the removal or re-use of the shiploaders and conveyors. This is also not likely to have any impact on the marine environment and so is not assessed further.

11.5 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

No permits are required for the activities as planned. However some of the legislation which regulates the activities and mitigation measures are listed in Table 11-1 below.

Table 11-1: List of applicable legislation

Legislation	Significance to this report
Marine Pollution (Control and Civil Liability) Act (Act 6 of 1981)	Details liabilities in the event of pollution of the marine environment
Regulations Relating to the Prevention and Combating of Pollution of the Sea by Oil, 1984	Prohibits and controls pollution of the marine environment but specifically oil
Marine Pollution (Prevention of Pollution from Ships) (No 2 of 1986)	Prohibits and controls pollution of the marine environment
Marine Pollution (Intervention) Act (No 64 of 1987)	Prohibits and controls pollution of the marine environment
Marine Traffic Act (No 2 of 1981)	Details rights and mechanisms for controlling marine traffic in South African waters
National Environmental Management: Integrated Coastal Management Act (No 24 of 2008)	Prescribes measures to protect the coastal assets of South Africa
National Environmental Management: Protected Areas Act (No 57 of 2003)	Prescribes measures and mechanisms for declaring areas protected for the preservation of ecosystem or species.
National Environmental Management: Waste Management Act (No 59 of 2008)	Prescribes measures to minimise and manage waste and prevent pollution.
Marine Living Resources Act (No 18 of 1998)	Defines South Africa's living resources and measures to be taken to protect them.
Sea Shore Act (No 21 of 1935) (as amended)	Prescribes measures to protect the coastal assets of South Africa
The Constitution of the Republic of South Africa (108/1996	Enshrines people's rights to a healthy and safe environment.
National Environmental	Sets out the environmental management principles that

Management Act (107/1998)	are to be applied by all organs of state when taking decisions that significantly affect the environment.
National Ports Act (No 12 of 2005	Requires the NPA to protect the environment in its area of jurisdiction (at #49(2) the Authority has the power to take any action, it considers necessary for the performance of any functions relating to the protection of the environment, which may be conferred or imposed upon it under this Act or any other law).
Port Regulations in force in terms of section 21 of the Legal Succession to the South African Transport Services Act (9/1989	Address safety and environmental protection in the port.
PORTS RULES (GN31986 2009	Address safety and environmental protection in the port.
National Ports Authority of South Africa: Environmental Policy (11/10/2001)	Sets out the environmental policy, and guidelines for implementation. These commit the NPA to comply with relevant environmental legislation and, in particular, to: prevent pollution, improve environmental performance; influence the implementation of acceptable environmental practices by its clients; and to develop environmental management systems to the ISO 14001 international standard by the end of 2003 in order to give effect to its policy.
Marine Living Resources Act (No 18 of 1998)	Governs the conservation of marine ecosystems, the delimitation of marine protected areas, limits to vessel proximity to whales, etc.
Seabird and Seals Protection Act (No 46 of 1973).	Protects seabirds and seals
Convention on Biological Diversity (1992), & the RSA White Paper & Bill on the Conservation & Sustainable Use of South Africa's Biological Diversity (1997) –	To protect and to minimize adverse impacts on biological diversity.
National Environmental Management: Biodiversity Act (No 10 of 2004) –	Protection of threatened or protected species and control of alien and invasive species.
National Parks Act (No 57 of 1976)	Actions to be taken by National Parks to protect species and ecosystems.
National Environmental Management Act (No 107 of 1998) –	Chapter 5 provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals.
London (Dumping) Convention (and 96 Protocol)	–see South African guidelines for the management of dredge spoil in coastal waters controlling dredge spoil quality. - Specifying dredge spoil dump area monitoring.
MARPOL 73/78 –	International convention controlling the discharge of wastes from shipping. The Algoa Bay region forms part of a MARPOL Annex 1 zero oil discharge Special Area accepted by the IMO Marine Environmental Protection Committee for ratification by IMO in 2006. One of the express purposes of the special area is to protect endangered and/or threatened seabirds, e.g. the African penguin and Cape gannet, from oiling.
Dumping at Sea Control Act (No 73 of 1980)	Sets limits on dumping substances that may pollute or, for reasons of their bulk may interfere with fishing or navigation.
Marine Pollution (Prevention of Pollution from Ships Act) (No 2 of 1986)	Limits the operational (oil, garbage, plastics) discharges from the dredge and vessels operating in the port area.
National Water Act (No 36 of 1998)	Sets limits to the quality of effluent & water run-off into the harbour area.
UN Convention on Law of the Sea (1982)	Includes provisions on prevention of pollution, amongst others.

11.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

This section discusses the potential impacts and assesses them with and without mitigation measures.

It is again noted that since the construction phase will only involve the installation of the shiploaders and conveyors, no impacts on the marine environment other than those already incurred in the construction of the existing quay are anticipated. Similarly, decommissioning would involve the removal of the shiploaders and conveyors, once again not affecting the marine environment if standard best practice approaches are used.

The discussion below therefore focuses on the operational phase of the proposed Manganese ore export facility.

11.6.1 Accidental spillage of manganese ore

Ore dust will be generated during shiploading. The dust can result from wind action across the end of the telescopic ship-loader or acting on dry patches of ore. This would distribute dust directly onto the quay and may disperse it further afield onto supratidal and intertidal communities as well as onto the water surface of the harbour whereupon it will sink to the floor. Manganese ore dust from facilities further afield such as the stockpile yard will have a similar effect. Manganese ore dust can also result when a ship's hold is full and there is still ore on the conveyor. (It is understood that this is unlikely as weightometers will limit the amount of ore on the conveyors. It is however still considered possible that small amounts of ore may remain on the conveyors when the ships hold is full). Under these circumstances, the ore on the conveyor is deposited onto the quay. The ore is then removed from the quay and returned to the stockpile by trucks. While on the quay and during retrieval and transportation, dust can be generated by wind action on the ore, as well as dispersed by rain to the harbour water and floor.

Manganese is considered to be the 12th most abundant element in the biosphere. It is ubiquitous in the environment and comprises about 0.1% of the Earth's crust. Crustal rock is a major source of manganese found in the atmosphere. Ocean spray, forest fires, vegetation, and volcanic activity are other major natural atmospheric sources of manganese. The major anthropogenic sources of environmental manganese in the environment include municipal wastewater discharges, sewage sludge, mining and mineral processing, emissions from alloy, steel, and iron production, combustion of fossil fuels, and, to a much lesser extent, emissions from the combustion of fuel additives.

Concentrations of manganese in open ocean seawater range from 0.4 to 10 µg/litre. In enclosed seas and nearshore areas such as the North Sea, the north-east Atlantic Ocean, the English Channel, and the Indian Ocean, manganese content ranges from 0.03 to 4.0 µg/litre. Levels found in coastal waters of the Irish Sea and in the North Sea off the coast of the United Kingdom range from 0.2 to 25.5 µg/litre. Higher concentrations (up to 500 µg/litre) have been reported for anaerobic layers of open seawater. Hypoxic conditions below 16% saturation can increase the concentration of dissolved manganese above that normally found in seawater to concentrations approaching 1 500 µg/litre.

Reported sediment concentrations for manganese include concentrations ranging from 29 to 170 mg/kg dry weight in Arabian Gulf mangroves, 100-1 000 mg/kg in an intertidal sand/mud flat in Korea and 200-800 (mean=370) mg/kg in the northern Adriatic Sea. Surface sediments in the Baltic Sea contained mean manganese concentrations of 3 550 (Bothnian Sea), 5 070 (Gulf of Finland), and 8 960 (Bothnian Bay) mg/kg dry weight. These high concentrations are attributed to ferromanganese concretions and riverine loads.

The behavior of manganese in oxic seawater indicates that most of the ore dust that deposits on the sea surface will sink to the seabed sediments. In oxic sediments it will remain in the particulate form, primarily manganese dioxide (MnO_2), and possibly complexed with organic and iron compounds. In anoxic conditions the manganese may be reduced to its soluble ionic form Mn(ll). This is bioavailable but does not appear to be taken up by benthos, especially when iron is also present (WHO, 2004). The ionic form is particulate reactive and will bind with other sorbtive compounds or aggregates, especially iron hydroxides, and be removed from solution. If such aggregates contain particulate organic matter, they may be consumed by benthic deposit feeders. In such cases the low pH conditions in their digestive systems (pH ~2) will solubilise the manganese. If, as is probable, iron is present, assimilation of the manganese is likely to be low with little risk of adverse effects on the deposit feeding benthos community. The ultimate fate of sedimented manganese appears to be to bind with carbonates to form stable manganese carbonate layers in the sediments, which are non-bioavailable and basically inert (WHO 2004).

Dissolved manganese concentrations in southern African waters (32-35˚ S, 16-19˚ E) are low with mean levels ranging between 0.38 and 2.87 µg/l (n = 600, SADCO data). These are at the lower end of the ranges reported for locations outside of the region (above).

Measured concentrations of manganese in South African sediments are listed in Table 7-1 below.

Table 11-2: Manganese concentrations in port and open coast sediments

Locality	Mean Mn Concentration (mg/l)	No of samples	Reference
Saldanha Bay- Small Bay	16.0	17	Lwandle 2007
Saldanha Bay – Big Bay	16.5	8	
Langebaan Lagoon	10.0	8	
Cape Town Harbour	136	74	
Port Elizabeth Harbour	199	17	CSIR 2007
St Helena Bay	46	35	CSIR 2007 data
Milnerton	7.0	11	CSIR 2009 data

Elevated concentrations in Port Elizabeth harbour are attributed to the manganese ore loading facility there while the approximately comparable concentrations in the Port of Cape Town are possibly linked to stormwater flows into the harbour. In medium sand sediments off Milnerton beach concentrations are low, probably due to remoteness from sources and wave action preventing settlement of particulate manganese. Manganese levels in St Helena Bay are intermediate between the open coast levels and the two ports. Concentrations within Langebaan lagoon are similarly low. The average concentrations in Small and Big Bays within Saldanha Bay are elevated compared to those in Langebaan Lagoon. Note that the levels are considerably lower than those reported for the Baltic area and Korea, pointing to relatively low loads flowing in RSA ports and nearshore areas.

The environmental risks of manganese in the marine environment include:

- Direct toxicity to marine organisms in the dissolved phase
- Enrichment of seabed sediments with trace metals scavenged by sedimenting manganese dioxide aggregates with possibly direct toxicity effects of these on benthos ,
- Providing a pathway for trace metals into benthos through their ingestion of organically enriched manganese dioxide and (scavenged) trace metal aggregates, and
- Inundation of sediments and benthos by particulate manganese.

11.6.1.1 Potential Impact 1: Toxic effects of manganese ore on marine organisms

The dissolved manganese can result from dust being blown or washed off the quay through the storm water system to the Harbour water during ship loading. It can also arise from wind blown dust from the shiploaders and from small temporary piles of ore on the quay awaiting transport back to the main stockpiles falling into the water and coating intertidal organisms.

Manganese is weakly toxic to marine organisms and its toxicity is strongly linked to its chemical speciation. Colloidal and particulate forms (e.g. MnO_2) have low bioavailability and therefore are generally benign. Dissolved Mn(II) and Mn(VII) and organically bound manganese are toxic at high concentrations (mg/l). Experiments on *Artemia* (brine shrimp) show toxic effects at 100 mg/l. However, manganese precipitated at 10 mg/l so it is moot whether the observed effects were due to dissolved or particulate forms. Other data in ANZECC (2000) indicate toxicity threshold concentrations of 70 mg/l for crustacea, 16 mg/l for molluscs and 25.7 mg/l for algae. All of these are higher than generally occur in coastal waters (above). Sediment toxicity thresholds are equally high with an estuarine amphipod surviving 10 day exposures to concentrations of 345 mg Mn/kg (pore water concentration 1.5 mg Mn(II)/l (Stauber *et al.* 2000).

Manganese does not appear to bio-magnify through trophic levels (WHO 2004) and therefore risks in terms of food quality appear to be remote.

Fatoki and Mathabatha (2001) found mean annual concentrations of Manganese in the water of Port Elizabeth Harbour as high as 11.4 µg/l and of 423 µg/l[2] in the sediment. This was deemed by the researchers to be excessive but in the absence of legislated standards, they did not postulate a concentration limit (Linked Environmental Services Draft Scoping Report, February 2009).

Based on the leachate analysis conducted for the manganese ore dust, and the volumes of manganese ore predicted to fall on the harbour water by the Air Quality Specialist study (Refer to Chapter 5), the amounts of manganese and trace metals that would be released into the marine environment would be very small. These volumes would be further diluted by the harbour water making their concentrations approaching or even possibly exceeding the limits of detection. Thus it is apparent that neither manganese nor any associated trace metals will be available in sufficiently high concentrations in the marine environment to be toxic to the marine communities.

Significance rating

- **Extent** – The extent of this impact is anticipated to be **site specific** as manganese ore is not soluble in sea water and will be likely to settle very quickly once deposited and remain in the same place albeit sinking further into the native sediment. In addition, the Air Quality specialist study has shown that manganese ore dust is not blown far afield, so any effects of wind-dispersed dust will also be site-specific. The effects are therefore likely to be confined to the Harbour and immediate surrounds.
- **Duration**–The duration of the effect on marine communities would be **temporary**. The very low concentrations of manganese in the ore dust would not constitute a toxicity threat and dilution by wave action would further reduce the risk. The manganese ore dust would settle deeper into the sediment of the harbour reducing the probability of any long-term toxicity effects.
- **Reversibility** – The impact will be highly reversible since the source of the impact (the manganese ore dust) would sink into the sediment and become inactive.

[2] It is probable that this unit is intended to be µg/kg

- **Irreplaceability** – There are no irreplaceable species in the area so any individuals or populations which could conceivably be lost are readily replaceable through recolonisation from surrounding areas.
- **Intensity** – The intensity will be low as the toxicity of manganese to marine organisms is **low**.
- **Probability**– The probability of the impact occurring is **improbable** as it has been shown that the concentration of manganese that would be leached are below those regarded as toxic to marine organisms
- **Status of impact** – The impact is **negative** as the marine organisms are adversely affected.
- **Degree of confidence** – the level of confidence of this assessment is **high** since it is based upon international and local published research.

Given the above, the significance of the impact is **low** as the likelihood of toxic effects is low.

Management actions

The main additional measures which could assist in reducing the likelihood of dust being available to be dispersed by wind or storm water includes reducing the amount of time any ore is resident on the quay by removing temporary stockpiles as soon as possible and adhering to the good housekeeping philosophy or protecting them from wind and rain with tarpaulins in the interim.

These measures will reduce the likelihood of events occurring which would deposit manganese ore dust in the harbour or intertidal zone but would not reduce the significance of the impact.

11.6.1.2 Potential Impact 2: Bioaccumulation and biomagnification of trace metals adhering to the manganese ore particles

Concern has been raised that the manganese ore may contain trace metals which could affect the marine ecology if released into the environment. If the impact does occur, trace metals will accumulate in marine organisms and increase in concentration up the food chain resulting in increased concentrations of trace metals in top predators some of which are food sources for human consumption.

Manganese dioxide (MnO_2) precipitates have a large surface area, are negatively charged and adsorb trace metals. Lead, manganese itself, cobalt and copper are most easily incorporated and nickel and cadmium less so. The aggregates sink at the velocity of silt sized particles (0.1 mm/s), although this may be slower due to their generally amorphous structure (WHO, 2004), and can therefore relatively rapidly transfer scavenged trace metals from the water column to the underlying sediments. If these are anoxic and have low pH levels, e.g. as occurs in sulphidic sediments, the aggregate will disassociate, releasing the trace metals into the pore water of the sediment, adding to its toxicity levels. Alternatively, although only weakly associated with particulate organic matter (WHO 2004), in oxic sediments the aggregates may be taken up by benthic deposit feeders. Manganese solubilization and trace metal release will occur in the acidic gut fluids (pH ~2) with possible direct absorption through the gut wall of the liberated trace metals (e.g. Rainbow 2007).

This mechanism may therefore prejudice benthos communities in localities where manganese and trace metals may co-occur such as the Ngqura harbour if and when manganese ore export is instituted. However, the discussion in the previous section of this report indicates that firstly there are only minute amounts of manganese available for biological uptake and that the amounts which are available are unlikely to accumulate. Therefore the probability of this impact eventuating is small.

Bioaccumulation is the absorbtion of toxins by organisms which are then stored in their tissues. Biomagnification is the ingestion by organisms higher up the trophic scale resulting in the toxins becoming increasingly concentrated in their tissues. For bioaccumulation or biomagnification of trace metals to occur, the trace metals must be present in the manganese ore and be bio-available. Given the above, it is unlikely given the prevailing conditions at Ngqura.

Significance rating

- **Extent** –The extent of the impact would be **site-specific** as the concentrations of trace metals drops off rapidly with distance from an ore dust deposit.
- **Duration**–The duration of the effect on marine communities would be **temporary.** The trace metals would leach out of the ore dust with time and through dilution become even less available for bioaccumulation or biomagnification.
- **Reversibility** – If the impact were to occur, the result would be highly reversible since the chemical contaminants would become increasingly dilute over time and therefore less detrimental.
- **Irreplaceability** - There are no irreplaceable species in the area so any individuals or populations which could conceivably be lost are readily replaceable through recolonisation from surrounding areas.
- **Intensity** – The intensity will be **low** as bio-absorbtion of trace metals by marine organisms is low.
- **Probability**– The chances of this impact being detectable is **improbable** since the rate of uptake is so low and the likelihood of bio-available trace metals being available in sufficient concentrations to permit noticeable uptake is low.
- **Status of impact** – if this impact occurred its status would be **negative** as it impairs the health of the marine organisms affected.
- **Degree of confidence** – This impact is assessed with a **medium** level of confidence since the behaviour of trace metals and the nature and extent of their uptake and bio-accumulation is complex and the assessment was based on generic studies rather than specific tests in the location of the study area.

Given the above, the impact has a **low** significance since it will not substantially affect the ecology of the area. In addition it can be readily mitigated by preventing the ore from being deposited in the harbour.

Management actions

The main additional measures which could assist in reducing the likelihood of dust being available to be dispersed by wind or storm water include. This would entail reducing the amount of time any ore is resident on the quay by removing temporary stockpiles as soon as possible and protecting them from wind and rain with tarpaulins in the interim.

These measures will reduce the likelihood of events occurring which would deposit manganese ore dust in the harbour or intertidal zone but would not reduce the significance of the impact.

11.6.1.3 Potential Impact 3: Smothering of sessile organisms in the harbour and adjacent communities

Accumulations of manganese ore dust settling onto the floor of the harbour and in flat areas along the breakwater have the potential to smother sessile organisms. This could affect their ability to breathe and feed. Furthermore, Linkd (2009) suggested that accumulations of this black dust on intertidal organisms changed their colour thereby affecting their heat balance. The latter impact presumably would eventuate with lower accumulations of manganese ore dust than the former. For this reason they are dealt with as separate impacts.

Benthos can be smothered by sedimenting manganese ore if volumes are sufficiently large and the flux to the seafloor sediments rapid. Maurer *et al*. (1980, 1981 & 1982) have shown that the major animal groups within the benthos can survive and escape from instantaneous burial up to depths of 30 cm. The only process that can cause burial depths higher than this would appear to be ore lost over the side of ships during loading. This would require a severe malfunction of the ore loading mechanisms. Such lost ore would fall directly to the seabed at the berth and any effects would be limited to the berth area. So, even if such losses were to occur, the spatial extents of any effects would be limited.

Manganese has a specific gravity of 7.21 g cm^{-3}. When compared to quartzitic sediments such as those found in and around Ngqura Harbour which have specific gravity in the region of 2.5 g cm^{-3}, it is probable that any manganese ore dust settling on the harbour floor will rapidly sink through the native sediments thus removing the threat of smothering the benthic organisms. This process is likely to be speeded up by the action of the waves and the ships and ships' propellers themselves.

Experiments conducted on the north-facing slopes of St Croix Island suggest that manganese ore coatings on intertidal animals increase their solar heat load by darkening the animals' shells thereby interfering with heat load management mechanisms (Erasmus and De Villiers, 1982).The dust dispersion modelling conducted by uMoya-NILU Consulting (Pty) Ltd (Chapter 5 Air Quality Specialist study of this EIR) shows that it is unlikely that any dust will reach any of the offshore islands and only very small amounts would be deposited on the sandy shores to the north-east of the Harbour. It is therefore unlikely that any intertidal animals will be smothered or suffer interference to their heat management systems.

It can thus be stated that:

- The manganese ore is likely to have a low solubility and therefore will mostly remain in the particulate phase if deposited in the marine environment. Manganese has a low toxicity to marine organisms, effects only being observed at the mg/l concentration level. A water quality guideline for the dissolved form considered to be protective of 95% of species at a 50% confidence level is 140 µg/l. Mass balance calculations indicate that it is unlikely that this concentration will be generated by routine ore loading operations.
- Neither marked toxicity effects of manganese itself or trace metals that may be associated with manganese aggregates are predicted for benthic deposit feeders.
- The ultimate fate of manganese ore dust lost to the marine environment is probably incorporation into the sediment as insoluble manganese carbonates.
- Loss of manganese ore directly to the marine environment due to malfunctions during ship loading will bury benthos in the immediate area of the discharge. This is an upset condition and remediation steps would be needed.

11.6.1.3.1 Potential Impact 3a: Physical smothering of sessile organisms

Significance rating

- **Extent**–The extent of this impact will be **site-specific.** The Air Quality Specialist study (Chapter 5 of the EIR) indicated that only very low amounts of manganese ore dust will travel beyond the breakwater. The effects will therefore be confined to the harbour itself and a short stretch of sandy beach to the north-east of the Harbour.
- **Duration**–The marine animals most likely to be affected are in the intertidal zone. Given the specific gravity of the manganese ore dust a single tidal cycle will redistribute the dust which will then sink into the harbour sediment and no longer be available to smother the organisms. It is unlikely that any intertidal animals would die as a result of being smothered for this duration since they are adapted to anoxic conditions. If any organisms are in fact killed the areas would be recolonized rapidly (<5years). The duration of the impact will therefore be **Temporary.**
- **Reversibility** – the impact were it to occur would be highly reversible since the ore, being more dense than the native sediment will rapidly sink lower into the harbour floor thereby become less of a problem to intertidal species.
- **Irreplaceability** - There are no irreplaceable species in the area so any individuals or populations which could conceivably be lost are readily replaceable through recolonisation from surrounding areas.
- **Intensity** – **low** as no natural systems will be affected.
- **Probability**– The probability of intertidal organisms dying as a result of being smothered is **improbable.**
- **Status of impact** – This impact is **negative** as it would impact sessile organisms
- **Degree of confidence** – **High** based on published literature.

Given the above, the impact has a **low** significance

Management Actions

The main additional measure which could assist in reducing the likelihood of dust being available to be dispersed by wind or storm water include reducing the amount of time the ore remains on the quay. This would entail having a good housekeeping and reducing the amount of time any ore is resident on the quay by removing temporary stockpiles as soon as possible or protecting them from wind and rain with tarpaulins in the interim.

These measures will reduce the likelihood of events occurring which would deposit manganese ore dust in the harbour or intertidal zone but would not reduce the significance of the impact.

11.6.1.3.2 Potential Impact 3b: Alteration of heat balance characteristics of sessile organisms

Significance rating

- **Extent**–.The extent of this impact will be **site-specific.** The Air Quality Specialist study (Chapter 7 of the EIR) indicated that only very low amounts of manganese ore dust will travel beyond the breakwater. The effects will therefore be confined to the harbour itself and a short stretch of sandy beach to the north-east of the Harbour.
- **Duration**–The marine animals most likely to be affected are in the intertidal zone. Given the specific gravity of the manganese ore dust a single tidal cycle will redistribute the dust which will then sink into the harbour sediment and no longer be available to smother the organisms. It

is unlikely that any intertidal animals would die as a result of their heat balance being disrupted for this duration since they are adapted to exposure to the sun during low tides. If any organisms are in fact killed the areas would be recolonized rapidly (<5 years). The duration of the impact will therefore be **Temporary.**

- **Reversibility** – If the impact were to occur, the result would be highly reversible since the ore would be washed off the intertidal animals on the next tide.
- **Irreplaceability** - There are no irreplaceable species in the area so any individuals or populations which could conceivably be lost are readily replaceable through recolonisation from surrounding areas.
- **Intensity – low** as no natural systems will be affected.
- **Probability**– The probability of intertidal organisms dying as a result of being smothered is **improbable.**
- Status of impact – Negative
- **Degree of confidence – High** based on published literature.

Given the above, the impact has a **low** significance

Management Actions

The main additional measures which could assist in reducing the likelihood of dust being available to be dispersed by wind or storm water include. This would entail reducing the amount of time any ore is resident on the quay by removing temporary stockpiles as soon as possible and protecting them from wind and rain with tarpaulins in the interim.

These measures will reduce the likelihood of events occurring which would deposit manganese ore dust in the harbour or intertidal zone but would not reduce the significance of the impact.

11.6.1.4 Potential Impact 4: Changing the chemical composition of the harbour sediment with implications on the disposal of dredge spoil

The South African government is a signatory to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter(1972) (the London Convention) and to the 1996 Protocol to the London Convention (the London Protocol). The London Convention and London Protocol regulate the deliberate disposal of waste materials in the marine environment. In South Africa, the Integrated Coastal Management Act 2008 (Act 24 of 2008) (ICM Act) gives effect to the provisions of the London Convention and London Protocol. There are seven categories of waste and other material that are regulated under the ICM Act. Of these, the largest volume of material that requires disposal in offshore waters of South Africa is dredged material, derived predominantly from maintenance and capital dredging in ports.

The Waste Assessment Guidelines of the London Protocol state ‘Each Contracting Party shall develop a national Action List to provide a mechanism for screening candidate wastes and their constituents on the basis of their potential effects on human health and the marine environment’, and that ‘An Action List shall specify an upper level and may also specify a lower level’. The Waste Assessment Guidelines are clear on the intent of the upper and lower Action Levels, as follows: ‘The Upper Level should be set so as to avoid acute or chronic effects on human health or on sensitive marine organisms representative of the marine ecosystem. The upper Action Level is intended to provide a definitive decision, namely prohibition of the waste under consideration for marine disposal unless it is further managed. Application of an Action List should result in three possible categories of waste:

- wastes which contain specified substances, or which cause biological responses, exceeding the relevant upper level shall not be dumped, unless made acceptable for dumping through the use of management techniques or processes;
- wastes which contain specified substances, or which cause biological responses, below the relevant lower levels should be considered to be of little environmental concern in relation to dumping; and
- wastes which contain specified substances, or which cause biological responses, below the upper level but above the lower level require more detailed assessment before their suitability for dumping can be determined'.

Concern has been raised that as a consequence of deposition of manganese ore dust, the chemical composition of the sediment on the floor of the Ngqura Harbour will be altered to the extent that it is no longer possible to dispose dredge spoil. This would thereby jeopardize current dredging and dredge disposal options by contravening the London Convention. This could result from the addition of manganese as well as trace metals. However, the analyses of the leachate of the manganese ore reveals that the trace metals will be released in extremely low concentrations which will be diluted to the extent that their presence will not be detectable.

Manganese is not, however a substance specifically listed by the London Convention or on South Africa's Action List. Elevated levels would not change the current dredging management plans.

Significance rating

- **Extent**–The extent of the impact would be confined to the harbour and would therefore be **site-specific.**
- **Duration**– The impact would only last as long as it took for the trace metals to leach out of the ore dust. Once that had taken place the dilution of the trace metals would be so great that they would not be detectable against background values. The duration of the impact would therefore be **temporary.**
- **Reversibility** – the impact were it to occur would be highly reversible the minute amount of contaminants released would rapidly be rapidly diluted.
- **Irreplaceability** – Not relevant as not species are lost in this impact.
- **Intensity** – The intensity of the impact would be **low** as the concentrations will be low.
- **Probability**– The probability of this impact occurring is **improbable** since the concentrations of trace metals in the ore dust are so low that they will be undetectable against background values.
- **Status of impact** – If this impact eventuated it would be **negative.**
- **Degree of confidence** – This assessment has a **high** level of confidence.

Given the above, this impact has a **low** level of significance.

Management Actions

The main additional measures which could assist in reducing the likelihood of dust being available to be dispersed by wind or storm water include. This would entail reducing the amount of time any ore is resident on the quay by removing temporary stockpiles as soon as possible and protecting them from wind and rain with tarpaulins in the interim.

These measures will reduce the likelihood of events occurring which would deposit manganese ore dust in the harbour or intertidal zone but would not reduce the significance of the impact.

11.6.2 Potential Impact 5: Discharge of ballast water in the port

Concern has been raised that during loading of the manganese ore, ships will discharge ballast water containing pollutants **other than manganese** and alien species into the harbour, so altering the chemical composition of the harbour water body and sediments and possibly introducing invasive species. For this to happen, both ballast water and sludge at the bottom of the ballast tanks would need to be emptied into the Harbour water. This is currently illegal in South Africa.

Ships have to exchange their ballast water in the open ocean before entering South African Harbours. A small amount of dilute chemicals may still remain in the ballast tanks but they will be further diluted on discharge. Thus most chemicals or alien species should have already been discharged prior to entering the Harbour.

Ballast water is usually discharged from ships when loading to maintain an even draft below the ship. Ballast water discharges bring the risk of releasing organisms and chemical pollutants in source ports into the receiving port environment. In this regard IMO cites cases of cholera (*Vibrio cholerae*) apparently attributable to ballast water discharges (http://www.imo.org/ Conventions). Once released into ports, alien species can become invasive through the establishment of populations and disrupt ecological processes. In view of the recorded negative effects of alien species transfers, the IMO considers their introductions to new environments via ship's ballast water, or other vectors as one of the four greatest current threats to the world ocean. Pollutants released can adversely affect the marine ecology of the harbour and the quality of the sediment.

The problem of invasive species in ships' ballast water is largely due to the expanded trade and traffic volume over the last few decades and since the volumes of seaborne trade continue to increase the problem may not yet have reached its peak. The effects in many areas of the world have been devastating. Quantitative data show the rate of bio-invasions is continuing to increase at an alarming rate and new areas are being invaded all the time.

The spread of invasive species is now recognized as one of the greatest threats to the ecological and the economic well-being of the planet. These species are causing enormous damage to biodiversity and the valuable natural riches of the earth upon which we depend. Direct and indirect health effects are becoming increasingly serious and the damage to environment is often irreversible.

Two possible mechanisms to prevent this exist:

1. Replace all ballast water at sea (ballast water exchange) where the likelihood of any invasive species being able to survive and colonise is severely reduced, or
2. To pump ballast water into an onshore Ballast Waste Management System (BWMS) while loading. The onshore facility is then responsible or sterilizing and treating the ballast water to render it harmless to the local environment.

In November 1993, the IMO Assembly adopted resolution A.774(18) based on the 1991 Guidelines requesting the MEPC and the MSC to keep the Guidelines under review with a view to developing internationally applicable, legally-binding provisions. While continuing its work towards the development of an international treaty, the Organization adopted, in November 1997, resolution A.868(20) - Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens inviting its Member States to use these new guidelines when addressing the issue of IAS.

After more than 14 years of complex negotiations between IMO Member States, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted by consensus at a Diplomatic Conference held at IMO Headquarters in London on 13 February 2004. The Convention will require all ships to implement a Ballast Water and Sediments Management Plan.

During the Convention development process, considerable efforts were made to formulate appropriate standards for ballast water management. They are the ballast water exchange standard and the ballast water performance standard. Ships performing ballast water exchange shall do so with an efficiency of 95 per cent volumetric exchange of ballast water and ships using a ballast water management system (BWMS) shall meet a performance standard based on agreed numbers of organisms per unit of volume. A précis of the requirements of the convention is presented in Section 11.10 Appendices.

The increased number in ships traversing Algoa Bay and entering the Port of Ngqura increases the risk of invasive species transfer through release of ballast water. Since no on-shore ballast treatment facilities are planned for Ngqura, ships will need to exchange their ballast water before entering the port.

For this to be effective, such exchange must be actively enforced and monitored. However, as evidenced in Saldanha, the controls are not completely effective.

As the two impacts have different spatial extents they are dealt with separately.

11.6.2.1 Potential Impact 5a: Alteration of water and sediment quality

Significance rating

- **Extent** –Modification of water quality and sediments in the harbour is likely to be **site-specific** in extent as any chemical contaminants remaining in the ballast water after mid-ocean exchange will be very dilute and will be further diluted upon discharge.
- **Duration**– The duration of impact would be **temporary** as dilution would take place rapidly on discharge.
- **Reversibility** – the impact were it to occur would be highly reversible the minute amount of contaminants released would rapidly be rapidly diluted.
- **Irreplaceability** – Not relevant as not species are lost in this impact.
- **Intensity** – The intensity of the impact would be **low** as there would be no effects on the Harbour water or marine communities as a consequence of the extreme dilution of any such contaminants.
- **Probability**– This impact is **improbable** since all vessels entering South African Ports must comply with IMO regulations regarding mid-water ballast exchange. Thus it is not likely that such a release of contaminated water would take place.
- **Status of impact** – The impact would be **negative** if it affected the water and sediment quality.
- **Degree of confidence** – This assessment is made with a **high** level of confidence.

Given the above, the significance of the impact will be **low** as a consequence of the dilution of any such contaminants.

Management Actions

As per IMO ballast water management requirements it is recommended the Port Authority checks compliance via the ballast water log, from each ship's master, before any loading is permitted

These measures will reduce the likelihood of events occurring which would release contaminants but would not reduce the significance of the impact.

11.6.2.2 Potential Impact 5b: Release of alien Species

Significance rating

- **Extent** –The extent of species invasion would be determined by a species being able to survive and reproduce in the new habitat. The alien species must also not only survive but spread to the exclusion of indigenous species to be considered invasive. For this reason only shallow water and intertidal species would potentially be able to colonise the Harbour and adjacent intertidal areas. The extent would therefore be **site-specific** in the short term but secondary transfers and/or range extensions can lead to larger parts of the RSA coast and shallow water environment being affected.
- **Duration**– The duration of the impact would be **permanent** if colonisation and invasion occurred. Eradication of a marine species that has become invasive is very difficult if not impossible.
- **Reversibility** -This impact would be irreversible should it occur. It is extremely difficult to remove alien marine species especially if they become invasive, once they have established. Furthermore, by the time the colonies have been identified they have frequently moved further afield as well making their removal virtually impossible.
- **Irreplaceability** – It is difficult to assess the irreplaceability of species or populations lost through such an impact. It is therefore rated as moderate.
- **Intensity** – The intensity could be **medium to high** as invasions can negatively affect natural ecosystems.
- **Probability**– The probability of this impact occurring is **improbable** in view of the existing controls requiring the exchange of ballast water at sea before entering the Harbour.
- **Status of impact** – The status of the impact is **negative** as it may adversely affect local ecosystems.
- **Degree of confidence** – This assessment has a **medium** degree of confidence as some invasions have occurred in places such as Saldanha Bay in spite of existing controls.

Given the above, the significance of the impact will be **high**

Management Actions

As per IMO ballast water management requirements it is recommended the Port Authority require presentation of the ballast water log by each ship's master before any loading takes place. It is also recommended that ongoing biological monitoring of the harbour and adjacent ecosystems is conducted to detect any invasive species. Once detected suitable management interventions need to be applied to prevent or restrict range expansions.

With the effective implementation of the above mitigation measures, the significance of this impact is predicted to be **medium to low**.

11.6.3 Increased number of ships in Algoa Bay and Ngqura Harbour

The commissioning of the manganese ore berth will increase the number of ships entering the Port of Ngqura by 5 to 6 ships per week (one ship per day). This increases the risk of collision and release of fuels and oils as a consequence. It may also increase the disturbance to whales and dolphins in Algoa Bay.

11.6.3.1 Potential Impact 6: Oil/fuel spills as a result of collisions

The ecological consequences of hydrocarbon spills are usually fouling, suffocation and/or introduction of toxins resulting in organisms death and/or ecological impairment.

Small Scale Spill in the Harbour

The proposed development poses a risk of the spillage of fuel into the Port of Ngqura during refuelling of vessels transporting manganese ore. The risk of such spills occurring is not specific to the manganese ore export facility. As the Ngqura Harbour expands, each new development will increase the shipping traffic. The risk associated with the manganese ore export facility is therefore proportional to the extra number of ships entering the harbour to transport manganese ore.

In the event of a small spill between the ship and the quay, it is possible that the organisms attached to the side of the quay and its supports will be coated with hydrocarbons with possible lethal effects. This is likely to be very localised due to the small quantities being spilled and will be unlikely to spread to other areas in the port or in Algoa Bay. The volume of hydrocarbon which could be suspended or mixed into the water column is also considered to be small. While there may be localised die off of plankton and any other free swimming species in the immediate vicinity of the spill, it is unlikely that there would be significant effects on the ecology of the harbour as a whole. Given the speed with which the intertidal organisms colonised berth B100 after construction, recolonisation after a die-off is likely to be relatively rapid (between 5 to 10 years).

Large Scale Spill in the Port of Ngqura or in Algoa Bay

- In the event of a large spill inside the Port of Ngqura, it is possible that the spill will spread across the entire harbour resulting in die-off of all intertidal and possibly mobile species in the harbour. Depending on the nature of the product spilled, there could also be die-off of organisms on the seabed in the harbour as a consequence of suffocation by heavier fractions. The fuels and oils are likely to coat the surfaces and sediment which will retard recolonisation. This will not only have a negative impact on the ecology of the Port itself but may also affect recreational and commercial fishing and off-shore ecology as a whole as a consequence of the disruption of the nursery function the Port has come to play.
- In the event of a large spill in Algoa Bay, the islands off the coast as well as the estuaries and aquaculture sites will all be at risk. If the spill is not contained it could make landfall on any or all of the islands to the detriment of the intertidal organisms and birds on the islands. The floating slick will smother any seabirds, especially penguins that encounter it. It could also smother or foul fish. A large spill could therefore have a profound negative impact on the ecology of Algoa Bay at large and in turn have negative downstream socio-economic impacts.

For such an event to occur, a collision between two ships resulting in the release of fuel and/ or hydrocarbon cargo is required. The risk of such spills occurring is not specific to the manganese ore export facility and cannot be used in the assessment of its suitability alone. As the Ngqura Harbour expands each new development will increase the shipping traffic. The risk associated with the manganese ore export facility is therefore deemed to be proportional to the extra number of ships entering the harbour to transport manganese ore.

Areas that could be affected by pollution are as follows:

a) For buoyant plumes (most hydrocarbons)
    a. Island shores
    b. Breakwater communities

c. Sandy beaches
d. Rocky shores (mainly wave cut terraces at Hougham Park – below abalone farm and adjacent to prawn farm), and
e. Seabirds – mainly penguins as they will have to swim through the oil slick but also possibly cormorants and gannets through swimming (former) and diving (latter).

b) For negatively buoyant compounds
   a. Seafloor communities – sand, mixed rock and sand, rock substrates and associated benthic organisms.

The impact is the large scale smothering of marine organisms and birds in Algoa Bay as a consequence of an accidental release of a large quantity of hydrocarbons in Algoa Bay.

The effects are anticipated to be as follows:

- Effects on seabirds could be severe and long term. Penguins may be damaged to the point that adults are prevented from breeding leading to the loss of breeding output for at least one year at the nearby islands. At the more distant islands effects could be less severe but given the precarious status of penguins there can be consequences at the population viability level. Oiling of cormorants and gannets will lead to some losses but probably not severe due to their behaviour. For example gannets will probably avoid oil as they cannot see through it so there is no reason to dive into it.
- Effects on island shores and breakwater communities can be severe but probably medium term as they will recover through new recruits following weathering of deposited hydrocarbons.
- Effects on sandy shores can be severe but probably medium term as they will recover through new recruits but, if the oil is buried, there can be chronic effects over longer (year) time scales as it leaches out and then weathers
- Effects on mainland rocky shores, severe but medium term as for islands/breakwater.
- Seafloor communities – The effects are uncertain. Effects can be smothering and toxicity with medium term recovery.

In the marine environment a disturbance can be relatively short-lived (e.g. accidental spill of toxic material which is diluted in the water column below threshold limits within days) but the effect of such a disturbance may have a much longer lifetime (e.g. the toxin affects the gills of fish and thus reduces their survival chances). The assessments and rating procedures below address the effects and consequences rather than the cause or initial disturbance alone. In this report, the word impact thus describes the disturbance and the effect(s) this disturbance may have on the environment.

A risk assessment of the Port of Ngqura conducted by WSP Walmsley (WSP 2001) noted that increased shipping, with shipping lanes and traffic provided, is expected to result in collisions between vessels of greater than 700 tonnes, of below two incidents in ten years. Collisions between smaller vessels are lower than these figures. It is anticipated that 92% of incidents involving pollution and oil spills will be caused by releases of 7 tonnes or less contained mostly within the harbour area. An incident such as the MV Treasure occurring is statistically low, with only 7 incidents expected world-wide each year. Such large releases of pollution from cargo spills or from heavy petroleum product releases are deemed to be of a low risk because of their low probability of occurrence.

11.6.3.2 Potential Impact 6a: Small Scale Spill in the Harbour

Significance rating

- **Extent – Site specific.** The effect of such a spill is likely to be confined to the area immediately adjacent to the ship to or from which transfers are being made and will primarily affect organisms in the intertidal zone as the hydrocarbon products are less dense than sea water and will therefore float. The organisms in the immediate vicinity may be coated and smothered. Since the volumes of liquids which may be spilled will be small, they will be unlikely to spread away from the quay wall thereby restricting the geographic spread of the impact. Any spreading that does occur will dilute the film to such an extent that its physical effects will be negligible. No risks of the small scale spills leaving the harbour are foreseen as a consequence of both the size of the spill and the nature of the currents and wave regime in and out of the port. There is a very low likelihood of impacts on the surrounding coastline, islands or sensitive operations.
- **Duration– Short term**; episodic events. The light fuels should dissipate rapidly through evaporation and photolysis and degrade over time. In addition, re-colonisation should be relatively rapid (<5 years).
- **Reversibility** – the impact were it to occur would be highly reversible since the fuels would rapidly disperse and break down through the action of sunlight thereby become less of a problem to intertidal species.
- **Irreplaceability** - There are no irreplaceable species in the area so any individuals or populations which could conceivably be lost are readily replaceable through recolonisation from surrounding areas.
- **Intensity – low**
- **Probability**– Should there be a spill (which is considered unlikely), the probability of the impact occurring is **definite**. The implementation of the pollution prevention measures, with equipment detailed in the project description should ensure that the likelihood of the spill occurring remains improbable.
- **Status of impact – Negative**
- **Degree of confidence – High.** In the event that hydrocarbons are spilled, the impact on the marine organisms is certain based on published literature on similar events.

Given the above, the significance rating of this impact is **Low**

Management Actions

Ngqura Port Authority should use bubble barriers around the ships during cargo transfer and, where possible, deploy skimmers during cargo transfer to improve the speed and efficiency of clean-up in the unlikely event of a spill occurring. Recovery can be expedited by the oil spill response team removing the hydrocarbon film from harbour walls and breakwater rock where possible using jets of high pressure sea water. (Note: the use of detergents and/ or dispersants in the water jet is not recommended).

The mitigation will reduce the likelihood of the event occurring and may reduce the intensity of the impact but not the significance rating.

11.6.3.3 Potential Impact 6b: Large Scale Spill in Algoa Bay

Significance rating

- **Extent – Local** but could affect a greater area of the Algoa Bay and become **regional** if not adequately contained.
- **Duration**– Since the recovery of the breeding colonies and intertidal zone may take a number of years, the duration of the impact is **short to medium term**.
- **Reversibility** – the impact were it to occur would be moderately reversible. The damage to populations on the islands would take a considerable time to recover.
- **Irreplaceability** – The replaceability of the populations damaged by this impact would be low. Especially the penguin colonies which are already under threat.
- **Intensity–High**. The functioning of the breeding colonies and intertidal zones will be disrupted.
- **Probability** – The probability of the impact occurring **if** such an accidental release occurred is **definite.** The likelihood of the accident occurring is considered unlikely.
- **Status of impact – Negative**
- **Degree of confidence** –There is some uncertainty in published literature over the impact on benthic communities and the rate of recovery from such a spill so the degree of confidence of this assessment is **medium**.

Given the above, the significance of this impact is predicted to be **High**, due to the extent of the spill and therefore the geographic extent and magnitude of the die-off of organisms and possible effects on seabird communities. This significance does not, however, indicate a “no-go” for the proposed facility. Rather, it is a caution for Transnet National Ports Authority (TNPA) to implement the proposed mitigation measures to prevent and/ or limit the occurrence of such a spill.

Management Actions

- Existing shipping management systems to control the movement of vessels in Algoa Bay and the approach channels of Ngqura Harbour must be rigorously implemented by TNPA.
- NPA needs to implement a rigorous environmental management and control plan to limit ecological risks from operational accidents coupled with ensuring efficient and safe operation of shipping in the port approaches to the port.
- Oiled seabirds must be collected and sent to SANNCOB, or similar entity, for cleaning and feeding. In severe spills non-oiled penguins can be caught and relocated to, e.g., Robben/Dassen/Dyer island to allow the spill in Algoa Bay to dissipate whilst they migrate back to Algoa Bay (as done in reverse with the Treasure Spill, Wolfaardt *et al* 2009).
- In addition, the oil spill contingency plan which is currently being reviewed must be kept up to date. All equipment used for the oil spill response must be kept in good order and all personnel adequately trained and drilled by the NPA.

This will reduce the probability of a spill occurring and perhaps the extent of the impact, but will not reduce the overall significance particularly on the vulnerable bird communities.

11.6.3.4 Potential Impact 7: Physical disturbance of whales and dolphins at southern African population level

WSP Walmsley (WSP 2001) also noted that some ten species of marine mammals are identified as being relatively common in the Algoa Bay area, either in transit or residing permanently (Woolridge, Klages and Small, 1997; Draft EIA, page 8, 2001).Vessel movements pose a genuine threat to marine mammals. Collisions between the endangered Northern Right Whale (*Eubalaena glacialis*) and shipping are a leading (40%) cause of death. Most lethal strikes involve ships greater than 80m in length that are moving at greater than 14 knots (National Marine Fisheries Service,1999; Laist, *et al*. 2001).

The species identified as being of greatest risk to be in a collision with shipping are the larger cetacean species (Draft EIA, page 178; Sauer and Kroese, 1998), in particular the Southern Right Whale (*Eubalaena australis*) that uses shallow parts of the bay for calving (WSP 2001). It is assumed for this purpose that during the period of June to November there are between 5 and 10 whales present in Algoa Bay, and that the cow and calf pairs would be resident for periods of 59 days on average (Branch, pers. comm.; Best, 2000) (WSP 2001). These low numbers of whales in Algoa Bay reduce the likelihood of whales occupying the same space as ships in shipping channels to in the region of12.5×10^{-3}.Past evidence indicates that within Algoa Bay, three non-fatal collisions have previously occurred, two of these incidents involving dredgers. Awareness and avoidance measures on the part of the vessel and shipping control can help to minimise collision incidents occurring.

The Southern Right Whale is slow moving (0.1 to 2.9 km/hr) and swims just below the surface with only the flat of their backs visible. This makes it hard to see from an approaching vessel and their slow speed reduces the opportunity of avoidance. It was these characteristics of the whale (along with its plentiful blubber) that made it easy to hunt this species, hence the species' common name (Best, 2000 and WWF, 2001) (WSP 2001).

The risk of such collisions or disturbances occurring is not specific to the manganese ore export facility and cannot be used in the assessment of its suitability alone. As the Ngqura Harbour expands each new development will increase the shipping traffic, the extent to which the traffic increases being proportional to the increased risk. The risk associated with the manganese ore export facility is therefore deemed to be proportional to the extra number of ships entering the harbour to transport manganese ore. The following assessment is not based on the number of collisions of ships that are using the manganese ore export facility but rather the total number of ships using the harbour in general and is used as a proxy for assessing the impact of the ore export facility specifically. It is based on the risk assessment conducted by WSP (2001).

Significance rating

- **Extent** –The extent of the impact will be international because of the high conservation status of whales.
- **Duration**– The duration will be **temporary** since once the damage to the whale or dolphin occurs, the animal with either heal or die. No residual effects are likely.
- **Reversibility** – The impact is unlikely to be reversible since a whale ore dolphin injured by a ship cannot be treated.
- **Irreplaceability** - There are no irreplaceable species in the area so any individuals or populations which could conceivably be lost are readily replaceable through recolonisation from surrounding areas.
- **Intensity** – Since only a very small percentage of the population/s would be affected the intensity is **low**

- **Probability**- The likelihood of an impact on the population/s is **improbable** (<1% of breeding stock).
- Status of impact – Negative
- Degree of confidence – High

Given the above, the significance of this impact is predicted to be **Low.**

Management Actions

Vessels to travel at lowest, navigationally safe speeds to give whales time to move away. WSP (2001) recommends that whale sightings be reported to port authorities so that ships can be warned to avoid collisions. In addition, awareness raising efforts by port authorities are recommended to sensitise ship's masters to the presence of whales and dolphins. These should be implemented and may help to reduce the probability. It must be noted that the Port has implemented a marine mammal monitoring programme that addresses the above recommendations.

These measures will reduce the likelihood of events occurring which would result in a collision with a whale or dolphin but would not further reduce the significance of the potential impact.

11.6.4 Cumulative Impacts

Since Manganese ore dust fallout has not been found to have a detrimental effect on the marine ecology, no cumulative impacts are anticipated when Mn ore dust is added to the effect of the dust of any other plant development.

The cumulative impacts of shipping are not specific to the manganese ore export facility but to the development of the Port of Ngqura in general, with the probability of a collision increase in proportion of the increase of shipping.

11.7 INTERNATIONAL BEST PRACTICE

Operation of sea going bulk carriers involves numerous hazards. Careful planning and exercising due caution for all critical shipboard matters are important. For this reason, various codes which apply in most ports have been adopted which attempt to ensure that safe movement and safe passage of shipping in and out of harbours world-wide. These include:

- **International Maritime Solid Bulk Cargoes Code (IMSBC Code)**

  The aim of the mandatory IMSBC Code is to facilitate the safe stowage and shipment of solid bulk cargoes by providing information on the dangers associated with the shipment of certain types of cargo and instructions on the appropriate procedures to be adopted.

  The Code highlights the dangers associated with the shipment of certain types of bulk cargoes; gives guidance on various procedures which should be adopted; lists typical products which are shipped in bulk; gives advice on their properties and how they should be handled; and describes various test procedures which should be employed to determine the characteristic cargo properties. The Code contains a number of general precautions and says it is of fundamental importance that bulk cargoes be properly distributed throughout the ship so that the structure is not overstressed and the ship has an adequate standard of stability. A revised version of the Code was adopted in 2004 as Resolution MSC.193(79) Code of safe practice for solid bulk cargoes, 2004

- **SOLAS Chapter XII Additional Safety Measures for Bulk Carriers**
- **December 2002 SOLAS amendments relating to bulk carrier safety**

The details of these provisions are contained Appendix 11.1.

Table 11-3: Impact assessment summary table

Construction Phase

Not applicable – none of the activities involved during construction will have an impact on the marine environment

Operational Phase

Direct Impacts

Manganese ore export facility and associated infrastructures (including shiploading)

Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	***With Mitigation***	
Impact 1: Toxic effects on marine organisms	Reduce amount of ore on quay that can be transported to harbour by wind or rain	Site-specific	Low	Short term	High	Replaceable	Improbable	Low	Low	**High**
Impact 2: bioaccumulation and biomagnifications of trace metals in marine organisms	As above	Site- specific	Low	Short term	High	Replaceable	Improbable	Low	Low	**Medium**
Impact 3a: smothering of sessile organisms	As above	Site- specific	Low	Short term	High	Replaceable	Improbable	Low	Low	**High**
Impact 3b: alteration of heat balance of sessile organisms	As above	Site- specific	Low	Short term	High	Replaceable	Improbable	Low	Low	**High**

Impact 4: changing chemical composition of Harbour water and sediment	As above	Site- specific	Low	Short term	High	Replaceable	Improbable	Low	Low	**High**
Impact 5a: chemical contamination from ballast water	Enforce IMO ballast water management	Site- specific	Low	Short term	High	Replaceable	Improbable	Low	Low	**High**
Impact 5b: Release of alien species from ballas water	Enforce IMO ballast water management	Site- specific	Medium to high	Permanent	Non-reversible	Moderate	Improbable	High	Medium	**Medium**
Impact 6a: small scale spill of fuel in the Harbour	Use bubble barriers, maintain oil response team	Site- specific	Low	Short term	High	Replaceable	Definite	Low	Low	**High**
Impact 6b: large fuel spill in Algoa Bay	Port Authorities must implement rigorous traffic control, maintain oil spill response teams and rapid response	Local to regional	High	Short to medium	Moderate	Low	Definite	High	High	**Medium**
Impact 7: Collisions between ships and whales and dolphins	Raise awareness of ship's masters and implement a whale reporting system	International	Low	Short term	Low	Replaceable	Improbable	Low	Low	**High**

Decommissioning Phase

Direct Impacts
Not applicable- none identified

11.8 CONCLUSION

Manganese ore can be introduced into the marine environment as a consequence of dust being washed or blown off the quay during shiploading.

The likelihood of this happening is considered small as a result of the dust abatement measures planned for the proposed manganese ore export facility. The Air Quality Specialist survey (Chapter 5) in fact indicates that very little dust will be blown into the Ngqura Harbour and even less blown further afield. There is no indication that the dust could reach any of the Islands in Algoa Bay.

The dust that does land in the harbour water was found to be of such low volumes that smothering or other physical interference with the ecology of the Harbour was deemed to be unlikely.

Manganese is not soluble in sea water and leachate tests conducted on the manganese ore (with fresh water) revealed low concentrations of trace metals. This entails that trace metals would be even less readily mobilised in sea water. Thus the possibility of chemical contamination of the water, sediment or marine organisms too was deemed to be improbable.

This marine ecology assessment identified five potential impacts on the marine environment that are directly attributable to the manganese ore export facility (i.e. Impacts 1, 2, 3a, 3b and 4 in Table 11-3). They were all found to have low significance.

A further five potential impacts as a result of increased shipping in Algoa Bay at large and Ngqura Harbour were identified which include:

- Impact 5a: Chemical contamination from ballast water
- Impact 5b: Release of alien species from ballast water
- Impact 6a: Small scale spill of fuel in the Harbour
- Impact 6b: Large fuel spill in Algoa Bay
- Impact 7: Collisions between ships and whales and dolphins

Of these, the possible release of alien species was assessed to have a medium significance and a large oil spill in Algoa Bay was assessed to have a high significance. However, none of these five potential impacts indicate that the manganese ore export facility is environmentally unsound. Rather they note the increased risks associated with a developing harbour. The responsibility for managing these risks does not lie with the manganese ore export facility management but with Port Authorities. It is also noted that the development of the Port of Ngqura was subject to an earlier Environmental Impact Assessment (CES, 2001) and the risks associated with generic expansion and development were approved by the National Department of Environmental Affairs and Tourism. Thus, only impacts specific to the manganese ore export facility are assessed in this document as acceptance of the impacts of generic increases in shipping is implicit in the approval of the harbour.

All the potential impacts associated with the manganese ore export facility are of low significance and can be readily mitigated.

Concern was raised about the potential impact of Mn ore dust on other users of the bay such as the squid fisheries and recreational industries. The analysis above indicate that firstly the geographic spread of any dust fallout is localised to the port of Ngqura and secondly that no detrimental impact on the marine communities (either chemical or physical) are anticipated. Therefore, as a consequences no impact on other users of the bay are anticipated.

11.8.1 Cumulative Impacts

Since Manganese ore dust fallout has not been found to have a detrimental effect on the marine ecology, no cumulative impacts are anticipated when Mn ore dust is added to the effect of the dust of any other plant development.

The cumulative impacts of shipping are not specific to the manganese ore export facility but to the development of the Port of Ngqura in general, with the probability of a collision increase in proportion of the increase of shipping.

The main recommendations from this specialist study include the following:

- Reducing the likelihood of dust being available to be dispersed by wind or storm water by reducing the amount of time any ore is resident on the quay by removing spillages as soon as possible and protecting them from wind and rain with tarpaulins if cleanup is delayed for any reason.
- As per IMO ballast water management requirements it is recommended the Port Authority checks compliance via the ballast water log, from each ship's master, before any loading is permitted
- It is also recommended that ongoing biological monitoring of the harbour and adjacent ecosystems is conducted to detect any invasive species. Once detected suitable management interventions need to be applied to prevent or restrict range expansions.
- These measures will reduce the likelihood of events occurring which would release contaminants but would not reduce the significance of the impact.
- Ngqura Port Authority should both use of bubble barriers around the ships during cargo transfer and deploy skimmers during cargo transfer to improve the speed and efficiency of clean-up in the unlikely event of a spill occurring. Port Authorities must implement rigorous traffic control, maintain oil spill response teams and rapid response
- Vessels to travel at lowest, navigationally safe speeds to give whales time to move away. WSP (2001) recommends that whale sightings be reported to port authorities so that ships can be warned to avoid collisions. In addition, awareness raising efforts by port authorities are recommended to sensitise ship's masters to the presence of whales and dolphins.

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11.10 APPENDICES

It is vital to reduce the likelihood of over-stressing the ship's structure and also complying with all essential safety measures for a safe passage at sea. The following are guidelines of information that should be transferred from the Port Authorities to the ship's master to limit the possibility of accidents.[3]

Required information from terminal to ship prior loading / unloading bulk cargo

Terminal to Ship information

On receipt of the ship's initial notification of its ETA, the terminal should give the ship the following information as soon as possible:

- The name of the berth at which loading or unloading will take place and the estimated times for berthing and completion of loading or unloading;
- Characteristics of the loading or unloading equipment, including the terminal's nominal loading or unloading rate and the number of loading or unloading heads to be used;
- Features of the berth or jetty the master may need to be aware of, including the position of fixed and mobile obstructions, fenders, bollards and mooring arrangements;
- Minimum depth of water alongside the berth and in approach or departure channels;
- Water density at the berth;
- The maximum distance between the water line and the top of cargo hatch covers or coamings, whichever is relevant to the loading operation, and the maximum air draft;
- Arrangements for gangways and access; Which side of the ship is to be alongside the berth;
- Maximum allowable speed of approach to the jetty and availability of tugs, their type and bollard pull;
- The loading sequence for different parcels of cargo, and any other restrictions if it is not possible to take the cargo in any order or any hold to suit the ship;
- Any properties of the cargo to be loaded which may present a hazard when placed in contact with cargo or residues on board;
- Advance information on the proposed cargo handling operations or changes to existing plans for cargo handling;
- If the terminal's loading or unloading equipment is fixed, or has any limits to its movement;
- Mooring lines required;
- Warning of unusual mooring arrangements;
- Any restrictions on de-ballasting;

[3] http://bulkcarrierguide.com/information-to-ship.html

- Maximum sailing draught permitted by the port authority; and
- Any other items related to the terminal requested by the master.

Information on estimated times for berthing and departure and on minimum water depth at the berth should be progressively updated and passed to the master on receipt of successive ETA advices.

The terminal representative should be satisfied that the ship has been advised as early as possible of the information contained in the cargo declaration as required by chapter VI of SOLAS 1974, as amended.

The terminal should furnish as applicable:

- The expected maximum and average loading/unloading rates may be discussed and clarified during completion of the ship/shore checklist at the arrival meeting between the terminal representative and the master.
- Information regarding draught survey requirements where applicable.
- Information regarding any draught surveys to be carried out, usually requesting ballast tanks to be either full or empty, containing clean seawater ballast where possible.
- Usual anchorage and pilot embarkation area.
- Whether ships may berth/depart at any time, or if it is necessary to wait for certain tidal conditions.
- If ship or shore gangway is to be used, clarification of responsibility for ensuring that it is maintained in a safe manner throughout the ship's stay in port.
- Information on precautions regarding strong tides or currents, swell, "stand-off" effect at piled jetties, passing traffic, or high winds.
- Arrangements for immobilization of ship's engines alongside.
- Information on the characteristics and properties of the cargo to be loaded.
- The shipper of the cargo is responsible for ensuring that this information is provided to the master in good time.

Additional measures to ensure the safety of the ship’s structure have been adopted by the IMO[4]. These measures need to be adopted and enforced by the Port Authorities at Ngqura.

International Maritime Solid Bulk Cargoes Code (IMSBC Code)

The International Maritime Solid Bulk Cargoes Code (IMSBC Code), and amendments to SOLAS chapter VI to make the Code mandatory, were adopted by the Maritime Safety Committee (MSC), 85th session, in 2008. .

[4] http://www.imo.org/blast/mainframe.asp?topic_id=349

The aim of the mandatory IMSBC Code is to facilitate the safe stowage and shipment of solid bulk cargoes by providing information on the dangers associated with the shipment of certain types of cargo and instructions on the appropriate procedures to be adopted.

The international Code of Safe Practice for Solid Bulk Cargoes (BC Code) includes recommendations to Governments, ship operators and shipmasters. Its aim is to bring to the attention of those concerned an internationally-accepted method of dealing with the hazards to safety which may be encountered when carrying cargo in bulk.

The Code highlights the dangers associated with the shipment of certain types of bulk cargoes; gives guidance on various procedures which should be adopted; lists typical products which are shipped in bulk; gives advice on their properties and how they should be handled; and describes various test procedures which should be employed to determine the characteristic cargo properties. The Code contains a number of general precautions and says it is of fundamental importance that bulk cargoes be properly distributed throughout the ship so that the structure is not overstressed and the ship has an adequate standard of stability. A revised version of the Code was adopted in 2004 as Resolution MSC.193(79) Code of safe practice for solid bulk cargoes, 2004

SOLAS Chapter XII Additional Safety Measures for Bulk Carriers

Following a spate of losses of bulk carriers in the early 1990s, IMO in November 1997 adopted new regulations in SOLAS containing specific safety requirements for bulk carriers, Chapter XII - Additional Safety Measures for Bulk Carriers. In the same month, the 20th Assembly of IMO adopted the "BLU Code" - the Code of Practice for the safe loading and unloading of bulk carriers (resolution A.862(20).

Following the 1998 publication of the report into the sinking of the bulk carrier Derbyshire, the Maritime Safety Committee (MSC) initiated a further review of bulk carrier safety, involving the use of Formal Safety Assessment (FSA) studies to help assess what further changes in regulations might be needed.

In December 2002, at its 76th session, the MSC adopted amendments to SOLAS chapter XII and the 1988 Load Lines Protocol and also agreed to a number of recommendations to further improve bulk carrier safety.

In December 2004, the MSC adopted a new text for SOLAS chapter XII, incorporating revisions to some regulations and new requirements relating to double-side skin bulk carriers. These amendments entered into force on 1 July 2006.

SOLAS Chapter XII - Additional Safety Measures for Bulk Carriers

The new SOLAS chapter XII Additional Safety Measures for Bulk Carriers was adopted by Conference held in November 1997 and it entered into force on 1 July 1999.

The regulations state that all new bulk carriers 150 metres or more in length (built after 1 July 1999) carrying cargoes with a density of 1,000 kg/m^3 and above should have sufficient strength to withstand flooding of any one cargo hold, taking into account dynamic effects resulting from presence of water in the hold and taking into account the recommendations adopted by IMO.

For existing ships (built before 1 July 1999) carrying bulk cargoes with a density of 1,780 kg/m3 and above, the transverse watertight bulkhead between the two foremost cargo holds and the double bottom of the foremost cargo hold should have sufficient strength to withstand flooding and the related dynamic effects in the foremost cargo hold.

Cargoes with a density of 1,780 kg/m^3 and above (heavy cargoes) include iron ore, pig iron, steel, bauxite and cement. Lighter cargoes, but with a density of more than 1,000 kg/m3, include grains such as wheat and rice, and timber.

The amendments take into account a study into bulk carrier survivability carried out by the International Association of Classification Societies (IACS) at the request of IMO. IACS found that if a ship is flooded in the forward hold, the bulkhead between the two foremost holds may not be able to withstand the pressure that results from the sloshing mixture of cargo and water, especially if the ship is loaded in alternate holds with high density cargoes (such as iron ore). If the bulkhead between one hold and the next collapses, progressive flooding could rapidly occur throughout the length of the ship and the vessel would sink in a matter of minutes.

IACS concluded that the most vulnerable areas are the bulkhead between numbers one and two holds at the forward end of the vessel and the double bottom of the ship at this location. During special surveys of ships, particular attention should be paid to these areas and, where necessary, reinforcements should be carried out.

The criteria and formulae used to assess whether a ship currently meets the new requirements, for example in terms of the thickness of the steel used for bulkhead structures, or whether reinforcement is necessary, are laid out in IMO standards adopted by the 1997 Conference.

Under Chapter XII, surveyors can take into account restrictions on the cargo carried in considering the need for, and the extent of, strengthening of the transverse watertight bulkhead or double bottom. When restrictions on cargoes are imposed, the bulk carrier should be permanently marked with a solid triangle on its side shell. The date of application of the new Chapter to existing bulk carriers depends on their age. Bulk carriers which are 20 years old and over on 1 July 1999 have to comply by the date of the first intermediate or periodic survey after that date, whichever is sooner. Bulk carriers aged 15-20 years must comply by the first periodical survey after 1 July 1999, but not later than 1 July 2002. Bulk carriers less than 15 years old must comply by the date of the first periodical survey after the ship reaches 15 years of age, but not later than the date on which the ship reaches 17 years of age.

December 2002 SOLAS amendments relating to bulk carrier safety

The MSC at its 76th session in December 2002 adopted amendments to chapter XII (Additional Safety Measures for Bulk Carriers) of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended to require the fitting of high level alarms and level monitoring systems on all bulk carriers, in order to detect water ingress.

The recommendation for the fitting of such alarms was first highlighted during the meeting of the Working Group on Bulk Carrier Safety held during the MSC's 74th session in December 2001, following on from recommendations of the United Kingdom Report of the re-opened formal investigation into the loss of the Derbyshire.

The new regulation XII/12 on Hold, ballast and dry space water level detectors will require the fitting of such alarms on all bulk carriers regardless of their date of construction. The requirement is expected to enter into force on 1 July 2004, under the tacit acceptance procedure.

In addition, a new regulation XII/13 on Availability of pumping systems would require the means for draining and pumping dry space bilges and ballast tanks any part of which is located forward of the collision bulkhead to be capable of being brought into operation from a readily accessible enclosed space.

A further regulation affecting bulk carriers was also adopted: Access to spaces in cargo areas of oil tankers and bulk carriers. The new regulation II-1/3-6 in SOLAS chapter II-1 (Construction - structure, subdivision and stability, machinery and electrical installations), Part B (Subdivision and stability), is intended to ensure that vessels can be properly inspected throughout their lifespan, by designing and building the ship to provide suitable means for access. Associated Technical provisions for means of access for inspections, also adopted, are mandatory under the new regulation.

December 2004 - revised SOLAS chapter XII adopted

The MSC at its 79th session in December 2004 adopted a new text for SOLAS chapter XII (Additional safety measures for bulk carriers), incorporating revisions to some regulations and new requirements relating to double-side skin bulk carriers. The amendments entered into force on 1 July 2006.

The amendments include the addition of a new regulation 14 on restrictions from sailing with any hold empty and requirements for double-side skin construction as an optional alternative to single-side skin construction. The option of double-side skin construction will apply to new bulk carriers of 150m in length and over, carrying solid bulk cargoes having a density of 1 000 kg/m^3 and above.

The MSC also adopted mandatory standards and criteria for side structures of bulk carriers of single-side skin construction and standards for owners' inspections and maintenance of bulk carrier hatch covers.