



BERTHING OPTIONS SCREENING STUDY, PORT OF SALDANHA

DRAFT REPORT: EXECUTIVE SUMMARY TO INTERESTED AND AFFECTED PARTIES

September 2008

1. INTRODUCTION

Environmental Resources Management (ERM) Southern Africa has been appointed by the HMG Joint Venture (on behalf of Transnet Limited) to undertake a Screening Study to evaluate alternative berthing options for the future development of the Iron Ore Terminal at the Port of Saldanha. The Screening Study has run in parallel with the current Phase 2 Iron Ore Terminal Expansion EIA process and is anticipated to be completed by early October 2008. The Screening Study aims to demonstrate due-process and balanced evaluation of social, environmental, engineering, planning and financial considerations in selecting the preferred berthing option currently included in the Phase 2 Port EIA.

In the course of the Screening Study, ERM has interacted with Transnet (including the Operating Divisions and the HMG JV), the Phase 2 EIA Consultants PDNA/SRK JV and specialists involved in the Phase 2 EIA, particularly during the specialist workshops. ERM's findings in the Screening Report are based on an independent and unbiased process.

1.1 Existing Phase 2 Iron Ore Terminal Expansion EIA Process

Transnet has identified the need to expand the current capacity of the bulk iron ore handling facilities along the Sishen - Saldanha Export Corridor, culminating at the Port of Saldanha. This is in response to the increased requirements of the mining companies to export more product and thereby grow the economy of South Africa.

The expansion includes the increase of the iron ore handling capacity from approximately 45 to 93 million tonnes of iron ore per annum (MTPA), along with associated infrastructure at the port. The planned expansion of the iron ore handling facility will be undertaken in two stages: i.e. expanding infrastructure to cater for 67 MTPA (Phase 2A), and to cater for 93 MTPA (Phase 2B).

A Joint Venture of PD Naidoo & Associates (Pty) Ltd (PDNA) and SRK Consulting (SRK) (The Joint Venture) has been appointed by Transnet to undertake the required Phase 2 Environmental Impact Assessment (EIA) for the proposed expansion of the iron ore handling infrastructure at the Port of Saldanha.

Previously, EIAs were conducted for increases in export capacity, firstly from 24 to 38 MTPA (Phase 1A) and then from

38 to 45 MTPA (Phase 1B). In response to concerns raised by the environmental authorities and members of the public about this incremental approach, Transnet decided to conduct a comprehensive EIA to assess the cumulative impacts of an expansion in capacity up to 93 MTPA.

A summary of the Phase 2 Iron Ore Terminal Expansion EIA process to date is shown in Box 1.1 below:

Box 1.1 Summary of Phase 2 Iron Ore Terminal Expansion EIA process to date

- Transnet identified the need to expand the current capacity from 45 MTPA to 93 MTPA
- Previous EIAs include Phase 1A (24 to 38 MTPA) and Phase 1B (38 to 45 MTPA)
- Phase 1A approved in 2002, construction activities complete
- Final approval for Phase 1B issued in March 2007, construction activities on-going
- Phase 2 EIA commenced in May 2006
- First phase of Phase 2 EIA (Scoping) culminated in submission of Scoping Report to DEAT in June 2007
- DEAT acceptance of Scoping Report and Plan of Study for the EIA phase received in September 2007
- Specialist studies currently investigating environmental issues including those identified by I&APs during the Scoping Process

Source: PDNA/SRK JV Presentation - Follow up to alternatives information sharing meeting, 29th November 2007

1.2 Interested and Affected Party Consultation To Date

Throughout 2007, Interested and Affected Parties (I&APs) have indicated that they wanted to understand how Transnet selected the three stockyard alternatives being assessed in the process and why there was no alternative to the berthing locations. On the 20th September 2007, a meeting was held to provide further information about the selection criteria used for the consideration of alternatives (stockyard layouts and berthing locations). During this meeting, the advantages and disadvantages associated with different stockyard layouts and berthing locations, as included in the pre-feasibility engineering studies undertaken by Transnet were presented. In particular, I&APs were interested in how Transnet chose to locate two

new iron ore berths in Big Bay (Langebaan side), screening out development in Small Bay (Saldanha side).

It was agreed at this meeting that a follow-up meeting would be held in order for Transnet to report back on a number of the issues that were raised. This follow up meeting took place on 29th November 2007 where Prestedge Retief Dresner Wijnberg (Pty) Ltd (PRDW) presented a discussion on the development of the Port Development Framework and the Council for Scientific and Industrial Research (CSIR) presented opinions relating to the marine environment and the development in Small Bay.

At these meetings, I&APs expressed concern that environmental and social criteria did not appear to be part of the decision making process.

In response to the I&APs concerns, Transnet proposed to undertake a Screening Study to demonstrate due-process and balanced evaluation of social, environmental, engineering, planning and financial considerations in selecting the preferred berthing option. The objective of the Screening Study is to document the logic and the process undertaken.

The Screening Study has run in parallel with the current EIA process to supplement the Environmental Impact Report and will be undertaken to a level associated with a pre-application evaluation. This means that only existing information and expert knowledge will be used to screen out berthing options that are not feasible from a social, environmental, engineering, planning and financial perspective.

1.3 Previous Screening Studies

Prior to the Phase 2 engineering feasibility study and commencement of the Phase 2 EIA, a series of high level screening studies were undertaken to identify a range of design alternatives concerning the expansion. Only options that were identified to be reasonably practical were selected to be addressed in the feasibility study and the EIA process. Design alternatives included stockyard areas and berth positions. The pre-feasibility engineering screening study identified three locations for the two iron ore berths required as part of the Phase 2 expansion. The alternatives meeting on the 20th September 2007 presented a variation on Option 3 which is Option 4. These four locations are to be evaluated as part of the Screening Study (Option 1, Option 3 & Option 4 in Small Bay and Option 2 in Big Bay). Figure 1.1 (page 7) provides a summary map of the four berthing options.

1.4 Other Factors Affecting Port Development

A range of factors influence the outcome of port development generally and location of the iron ore terminal specifically. These factors are discussed below.

1.4.1 Transnet National Infrastructure Plan

The National Infrastructure Plan (NIP) is an investment plan compiled by Transnet that looks specifically at developing key port, rail and pipeline infrastructure. This plan ensures that capacity is provided ahead of demand in the interest of national economy.

Since the NIP includes all of the port, rail and pipeline infrastructure owned by Transnet, this document also considers the interplay between various ports and between the ports and the hinterland that they serve.

Transnet's cargo volume flows are concentrated in four ports and in five land corridors. The four ports are Richards Bay, Durban, Cape Town and Saldanha Bay.

The documents that inform the NIP in respect of the ports are the Port Development Framework Plans (PDFP's). A PDFP for each port has been developed and approved by Transnet during 2007.

The process of compiling each PDFP consisted of an assessment of the existing port infrastructure and demand for future capacity within the context of port specific opportunities and constraints to development. Based on a comprehensive cargo demand, port development options were identified and assessed, in collaboration with national and local operating division representatives, using selection criteria that included technical, economic, environmental and statutory parameters. The outcome of this process was to provide a spatial guideline for port development for the next 30 years.

In order to ensure a synergetic relationship between the Port of Cape Town and the Port of Saldanha, the spatial development plans for each port have taken into consideration the potential development plans of the other port. The importance of the PDFP within the NIP is therefore evident at a local, regional and national level.

1.4.2 Relocation of Oil Terminal to St Helena Bay

The option of relocating the oil terminal to render this part of the jetty free to be converted into a dual iron ore loading facility, with one berth on either side of this section of the jetty was previously investigated by Transnet. This change in use of the jetty implies that the oil terminal has to be relocated to another site such as St Helena Bay. Transnet undertook three contract investigations in parallel to investigate the feasibility of locating a Single Point Mooring (SPM) ⁽¹⁾ in St Helena Bay. These investigations included the following:

- CSIR Engineering and Environmental Feasibility Study;
- PRDW: St Helena Bay SPM – Prefeasibility Report; and
- Connell Hatch Oil Berth Conversion Project, Conceptual Study and Preliminary Engineering.

On completion of these investigations, it was concluded that locating the SPM in St Helena Bay was not feasible for a number of reasons. The costs associated with this were estimated to be R4.32 billion and the estimated time to complete the SPM was 4.5 years with considerable disruption of shipping during construction. Delays were also expected in the EIA process for the SPM and for the development of an on-land pipeline to the oil storage facilities. As a result the option of converting the existing oil terminal into an ore terminal was

(1) A SPM is a buoy to which a tanker is moored by a bow hawser and which also acts as a transfer facility for liquid cargo. The attached tanker is allowed to weathervane around the buoy with its bow hawser. The tanker has to pump its cargo through a floating pipeline to the SPM and subsequently to shore through a pipeline on the seabed.

not considered feasible and is therefore not considered as an option in this Screening Study.

1.4.3 Alternative Disposal Options for Excess Dredge Material

The requirement to create a shipping channel to allow access of the iron ore vessels to the new berths results in a significant amount of dredge material requiring handling either in a beneficial manner or disposal on land or offshore.

The HMG JV undertook studies to assess the alternative options for disposal of dredged material for both land-based and offshore options. The reports concluded that neither land-based nor off-shore options were feasible. As a result, for the purposes of Screening Study it is assumed that no other beneficial uses of alternatives exist other than to use the dredge material for reclaim in Big Bay.

2. APPROACH

2.1 Aims of the Screening Study

The aims of the Screening Study include the following:

- Develop a similar level of technical information (i.e. dredge volume, berth design, operational aspects etc) for the four berthing options;
- Undertake a comparative assessment of the four berthing options against social, environmental, engineering, planning and financial criteria through the review and analysis of existing information and specialist workshops; and
- Ensure a transparent, consistent and rigorous process to document this information that will lead to a logical conclusion as to the preferred berthing location.

The Screening Study comprised four steps which are outlined below.

2.2 Step 1 – Gather & Review Existing Information

ERM's initial step was to gather and review all existing information. This included the following:

- EIA and specialist studies undertaken for the General Cargo Quay/Multi-Purpose Terminal;
- Previous EIAs undertaken for the Port of Saldanha (Phase 1A, Phase 1B);
- Draft Specialist study reports currently being compiled for the Phase 2 Port of Saldanha EIA; and
- Port Development Framework Plan.

This information was analysed in order to gain an understanding of the existing level of information on the four berthing options.

2.3 Step 2 - Develop Criteria

Based on the above, criteria were developed against which the four berthing options could be assessed. The criteria include the following:

2.3.1 Environmental and Social Considerations

- Long-term Ecological Consequences
 - Phytoplankton
 - Dissolved Oxygen
 - Habitat Modification (shipping channel/dredge area)
 - Habitat Destruction (reclaim area)
- Dredge Head Sediment Suspension Impacts During Construction
 - Water Column Turbidity
 - Effects on Benthic Habitats
 - Remobilisation of Contaminants During Dredging
 - Effects on Phytoplankton Productivity
- Reclaim Area Suspended Sediment Impacts During Construction
 - Water Quality Turbidity
 - Effects on Benthic Habitats
 - Effects on Phytoplankton Productivity
- Shoreline Stability
 - Channel Dredging
 - Reclamation - Shoreline Stability
 - Reclamation - Beach amenity
- Operational Impacts Associated with Ballast Water and Discharges from Site
 - Ballast Water
 - Discharges from Site
- Noise During Construction
- Noise During Operation
- Visual Impact of Construction Activity
- Visual Impact of Turbidity Plumes (Construction)
- Visual Impact on Sense of Place (Operation)
- Air Quality Impacts During Construction
- Air Quality Impacts During Operation
- Social Impact During Construction
- Social Impact During Operation

2.3.2 Consideration of Environmental Risk

- Probability and fate of oil spills

2.3.3 Engineering and Operational Considerations

- Disruption of Existing Marine Related Activities and other Port Activities
- Berthing and Safe Mooring Conditions

2.3.4 Port & Regional Planning Principle Considerations

- Port Planning Considerations

2.3.5 Financial Considerations

- Costs for Construction

2.4 Step 3 - Workshop with Specialists

A series of three specialist workshops were held. Those specialists participating in the workshops comprised Transnet (including the Operating Divisions and the HMG JV), ERM, the Phase 2 EIA Consultants PDNA/SRK JV and specialists

involved in the Phase 2 EIA. The following workshops included:

- Workshop 1 - Engineering and Planning;
- Workshop 2 - Social, Visual, Noise and Air Quality; and
- Workshop 3 - Marine.

The aim of the workshops was firstly to agree on the assessment criteria. These criteria were then used to provide a comparative assessment of the risks associated with each of the four berthing options for the Phase 2 Iron Ore Terminal Expansion EIA. Workshop participants were asked to prepare a short report which discussed each option in terms of the identified criteria to develop a comparative assessment of the four berthing options.

It should be noted that at the time of compiling the Screening Study, the Phase 2 EIA specialist studies had progressed substantially. This allowed more detailed information to be available than would have been the case should the Screening Study have been completed before the start of the EIA.

2.5 Step 4 - Compile Screening report

Based on the findings from the specialist workshops and existing knowledge based on the work undertaken to date, the Screening Study Report has been prepared. A summary matrix which provides a comparative assessment for each of the criteria for the four options has been developed to summarise the comparative assessment of all the criteria and used as an initial screening tool to screen out those options that are clearly not viable. Further discussion has then been provided on the remaining options and recommendations as to the preferred berthing location presented.

The Draft Screening Report will be circulated to key stakeholders for a comment period of four weeks. All comments received will be addressed and integrated into the Final Screening Report. Box 2.1 provides a summary of the anticipated programme for the Screening Study.

Box 2.1 Summary of Screening Study Programme

- Specialist Workshops – June 2008
- Compilation of Comparative Assessment & draft Screening Report – July 2008
- I&AP comment period (20 working days) on draft Screening Study report – Anticipated September 2008
- Collate & address I&AP comments on draft Screening Report – October 2008

3. DESCRIPTION OF ALTERNATIVE BERTH OPTIONS

3.1 Berthing Options

The following sections provide a summary of the four berthing options considered in the Screening Study. All other infrastructure required for the export terminal upgrade, for example, stock yards, ship loaders, stacker-reclaimers, etc will remain the same. All options include using dredge material for reclaiming the area to the east of the port in Big Bay. Maps

summarising the positions for each berthing option and reclaim area are provided in Figure 3.1 – Figure 3.4 (pages 8-11) with more detail on each option outlined below.

3.1.1 Option 1: South of MPT (Small Bay)

Option 1 (Figure 3.1) (page 8) is located along side the existing iron ore quay in the Small Bay side of Saldanha Bay. The section of causeway available from the southern end of the multi-purpose terminal (MPT) and the existing iron ore jetty is approximately 1,000m long. A small portion of the causeway is currently used to accommodate Oil Pollution Control South Africa (OPCSA). In order for iron ore vessels to access these berths, dredging will be required to create an appropriately sized shipping channel.

3.1.2 Option 2: South of MPT (Big Bay)

Option 2 (Figure 3.2) (page 9) is located alongside the existing iron ore quay in the Big Bay side of Saldanha Bay. The section of causeway available between the existing iron ore stockpiles and the iron ore jetty is approximately 300m long. This section of causeway is relatively straight with the exception that the quay widens (50m) temporarily in the vicinity of the MPT. Dredging would also be required in this location.

3.1.3 Option 3: Alongside MPT (Small Bay)

Option 3 (Figure 3.3) (page 10) is located at the existing multi-purpose terminal. This location would require the conversion of the MPT to an iron ore terminal. The existing MPT is 874m long and consists of 4 berths numbered 201 to 204. Berth 201 is 250m long, consists of caisson units and extends to a depth of – 13.5 CD. Berths 202 to 204 consist of counterfort units and extend to a depth of – 15m CD. Dredging would also be required in this location.

3.1.4 Option 4: North of MPT (Small Bay)

Option 4 (Figure 3.4) (page 11) is located in the Small Bay side of Saldanha Bay to the north of the MPT. There are currently no existing berths at Option 4. This option is closely located to the Iron Ore stockpiles. Dredging would also be required in this location.

4. SPECIALIST INPUT

An analysis of the four berthing options has been undertaken by a number of specialists from the following considerations:

- Environmental and Social Considerations (marine, noise, air, visual and social);
- Consideration of Risk;
- Engineering and Operational Considerations;
- Port & Regional Planning Principle Considerations; and
- Financial Considerations.

Each specialist has provided a detailed assessment of the four options.

5. ANALYSIS

5.1 Initial Screening of Options

On completion of a detailed assessment by specialists, a summary matrix was completed to allow for a comparative analysis of the four options to be undertaken. The risk of impact has been graded from lowest risk of impact to highest risk of impact as follows:

- Green – lowest risk of impact
- Yellow – higher risk of impact
- Orange – highest risk of impact

The assessment and conclusions reached for each assessment criteria within the specialist reports has been used to allocate the relative risk for all assessment criteria for each of the four options. It is important to note that the assessment provided under each of the assessment criterion is a “comparative” assessment. While it could be argued for some criteria to either depict a “lower” or “higher” risk of impact for a specific option, this will result in the risk of impact of the other options having to be changed, resulting in no net difference in the comparative assessment of the options.

Summarising the assessment of the criteria for each of the four options in this way allows for easy comparison of the four options against one another, and allows some options to be screened out. From the summary matrix in Figure 5.1 (page 12) it is clear that Option 3 and Option 4 are less feasible than Option 1 and Option 2.

Option 3 would result in significant disruption to the existing operations and requires significantly more investment than Option 1, Option 2 and Option 4. While Option 4 would have less of a disruption on existing operations and requires slightly less investment than Option 3, it clearly has the most criteria assessed to have the highest risk of impact and is thus not considered as a feasible option. While it is argued that no further justification is required for screening out these options, further analysis is required to fully distinguish between Option 1 and Option 2.

5.2 Further Analysis of Option 1 and Option 2

When considering the conclusions of each of the specialist inputs, it can be concluded that several of the criteria can be excluded for use in a comparative assessment between Option 1 and Option 2. The reason for this being that, while there may be a comparative difference between the options, the actual impact may remain insignificant, irrespective of which option is selected i.e. Option 4 may present the highest risk of noise during both construction and operation, however the actual noise impact is unlikely to be significant irrespective of which option is selected.

As a result, the following criteria were selected to provide a substantive basis on which to differentiate Option 1 and Option 2:

- Long-term ecological consequences (marine environment);
- Probability and fate of oil spills;
- Port and regional planning consideration; and
- Financial considerations.

5.2.1 Long-term Ecological Consequences (Marine Environment)

The indices used (i.e. change in phytoplankton production, change in dissolved oxygen and change in physical habitat) in the assessment of the long-term ecological consequences of the four options have indicated that the morphological changes (and linked changes in ecosystem function) associated with either of Option 1 and Option 2 do not pose any identified long-term risk to the Saldanha Bay – Langebaan Lagoon ecosystem. Thus from a long term ecological perspective, either of these development options may be considered acceptable.

5.2.2 Consideration of Environmental Risk (Probability and Fate of Oil Spills)

The main environmental risks due to shipping in the Port of Saldanha are related to spillage of oil due to shipping accidents and disruption of oil tanker (un)loading. The risks of oil spills due to the realisation of Option 1 are significantly higher than for Option 2, due to the presence of a moored oil tanker (Saldanha bay side) adjacent to the navigation channel for the additional ore carriers. Furthermore, large spills as a result of a shipping accident with an oil tanker (Option 1 only) is likely to occur at the end of the causeway where ebb flow tidal currents and/or north-westerly wind conditions (under which such a spill is the most likely to occur) could easily allow an oil spill to enter Big Bay and possibly ultimately Langebaan Lagoon.

In most ports, oil tanker terminals are dedicated and separated facilities, where the movement of other vessels nearby is restricted as much as possible. In the case of the Port of Saldanha, passing of large ships along moored oil tankers should be reduced to the absolute minimum for minimum risk. Although the risks in absolute sense are small, they are not insignificant and cannot be ignored. In this regard Option 1 poses a significantly higher risk of impact than Option 2 due to the additional ore vessel traffic passing the oil tanker terminal located in Small Bay. However, it should be noted that with the Port of Saldanha's past track record it is classified as a “safe port for shipping” under the present shipping and port operational guidelines.

5.2.3 Port and Regional Planning Consideration

Option 1 will restrict the long-term development options for the MPT i.e. expansion in a southerly direction to meet long-term future demands. Expansion of the MPT would be forced in a northerly direction and the knock-on effect would be to limit the space available for the development of a container terminal. It has been reported that container growth in the Western Cape is expected to increase from 0.7 million TEU's (approximately 1.2 million containers) in 2007 to approximately 4.1 million TEU's (approximately 7 million containers) by 2036. The Port of Cape Town is currently the only container handling port in the Western Cape. Since it is unlikely that the Port of Cape Town will be able to accommodate the total future container demand, the possible need for the Port of Saldanha to develop a container terminal is very real.

Since development of a MPT or container terminal in Big Bay is not practical due to the harsher wave climate, the development potential of the port would be reduced with the result being a potential negative impact on the economy of the Western Cape. While it is challenging to predict the medium to long-term global, national and regional economic trends that may impact future port development, it is acknowledged that well recognised port planning principles and local opportunities and constraints have been used in compiling the Port Development Framework Plan for the Port of Saldanha. Option 1 is therefore considered to be less favourable than Option 2, which contributes to realising the full development potential of the Port.

5.2.4 Financial Considerations

Option 1 requires an estimated investment of R9.111 billion while Option 2 requires an estimated investment of R8.859 billion. Thus Option 2 requires approximately R252 million or 2.8% less investment than Option 1, making it the most cost effective option.

6. CONCLUSIONS

Four alternative berthing options were selected for consideration as potential locations for the establishment of the new iron ore terminal at the Port of Saldanha. The four options were assessed against a number of environmental, social, engineering, planning and financial criteria to establish the preferred option.

On completion of a detailed assessment, a summary matrix was completed to allow for a comparative analysis of the four options to be undertaken. From the summary matrix, it was evident that Option 3 and Option 4 posed significantly more risks than Option 1 and Option 2. As a result, Option 3 and Option 4 were screened out and Option 1 and Option 2 were then subjected to a more detailed comparative analysis.

Several of the criteria were excluded for use in more detailed comparative analysis of Option 1 and Option 2. The reason for this being that, while there may have been a comparative difference between the options, the actual impact may be insignificant, irrespective of which option is selected i.e. Option 4 may present the highest risk of noise during both construction and operation, however the actual noise is unlikely to be significant irrespective of which option is selected. As a result, the following criteria were selected to provide a substantive basis on which to differentiate Option 1 and Option 2:

- Long-term ecological consequences (marine environment);
- Probability and fate of oil spills;
- Port and regional planning consideration; and
- Financial considerations.

On completion of the more detailed comparative analysis of Option 1 and Option 2, the following was concluded:

- The overall consequences of the changes associated with Option 1 and Option 2 are likely to be insignificant in terms of the overall ecosystem functioning of the ecosystem of Big Bay and the coupling of the Big Bay –

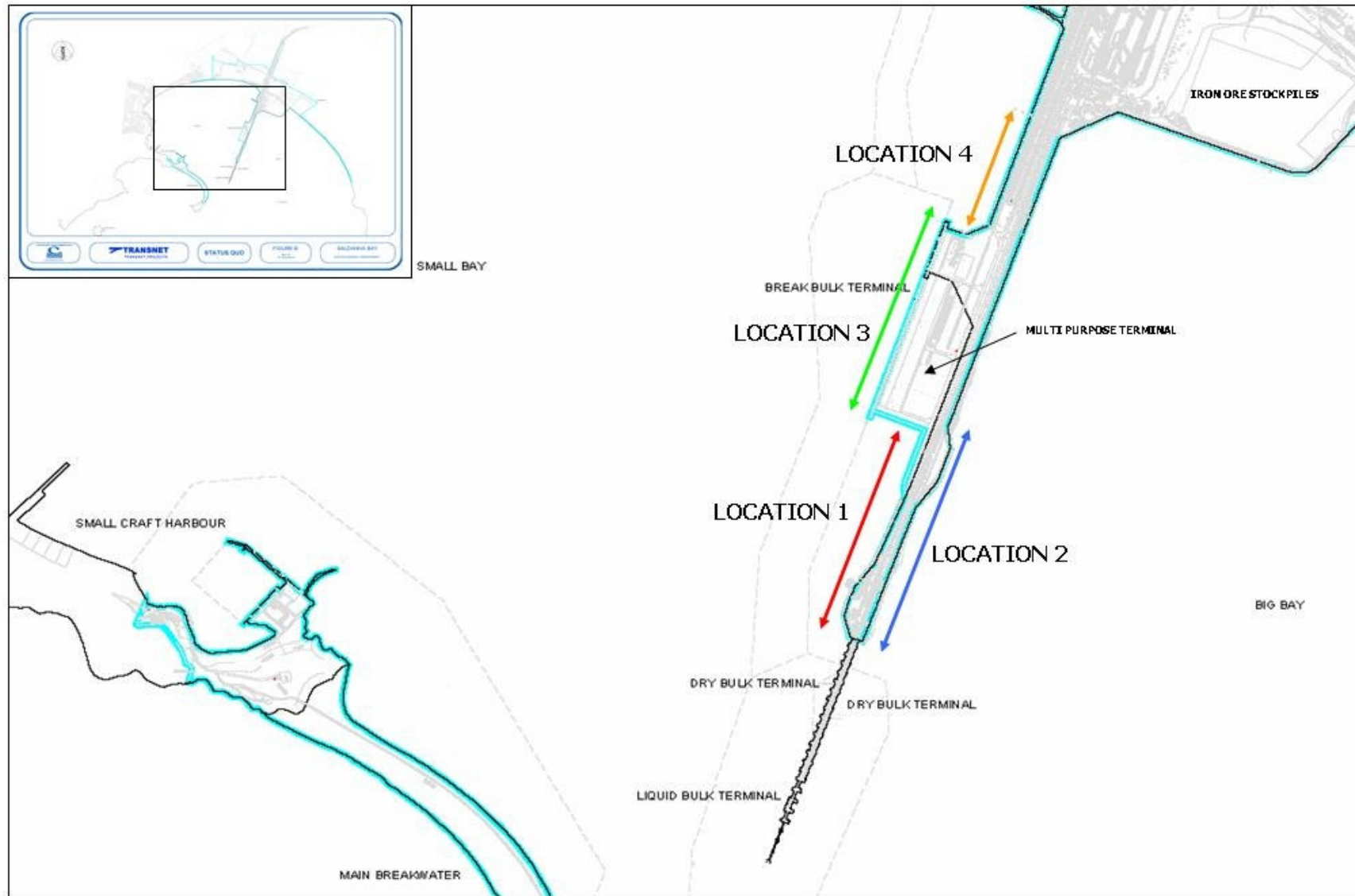
Langebaan Lagoon ecosystems. Thus from the long-term ecological perspective, this consideration does not differentiate between options ;

- When considering the potential of risk of oil spills Option 1 poses significantly higher risk than Option 2;
- Option 1 presents some conflicts with the long term development of the Port of Saldanha, while Option 2 optimises this potential; and
- Option 1 will require 2.8% more investment than Option 2.

From the above it can be concluded that Option 2 is the preferred option. However, in considering this conclusion it should be noted that the oil spill risks can be effectively managed through implementing appropriate port controls and adequate oil spill response planning thus minimising the difference between Option 1 and Option 2 for this aspect. Port and regional planning considerations and financial considerations remain as distinguishing criteria which remain in favour of Option 2.

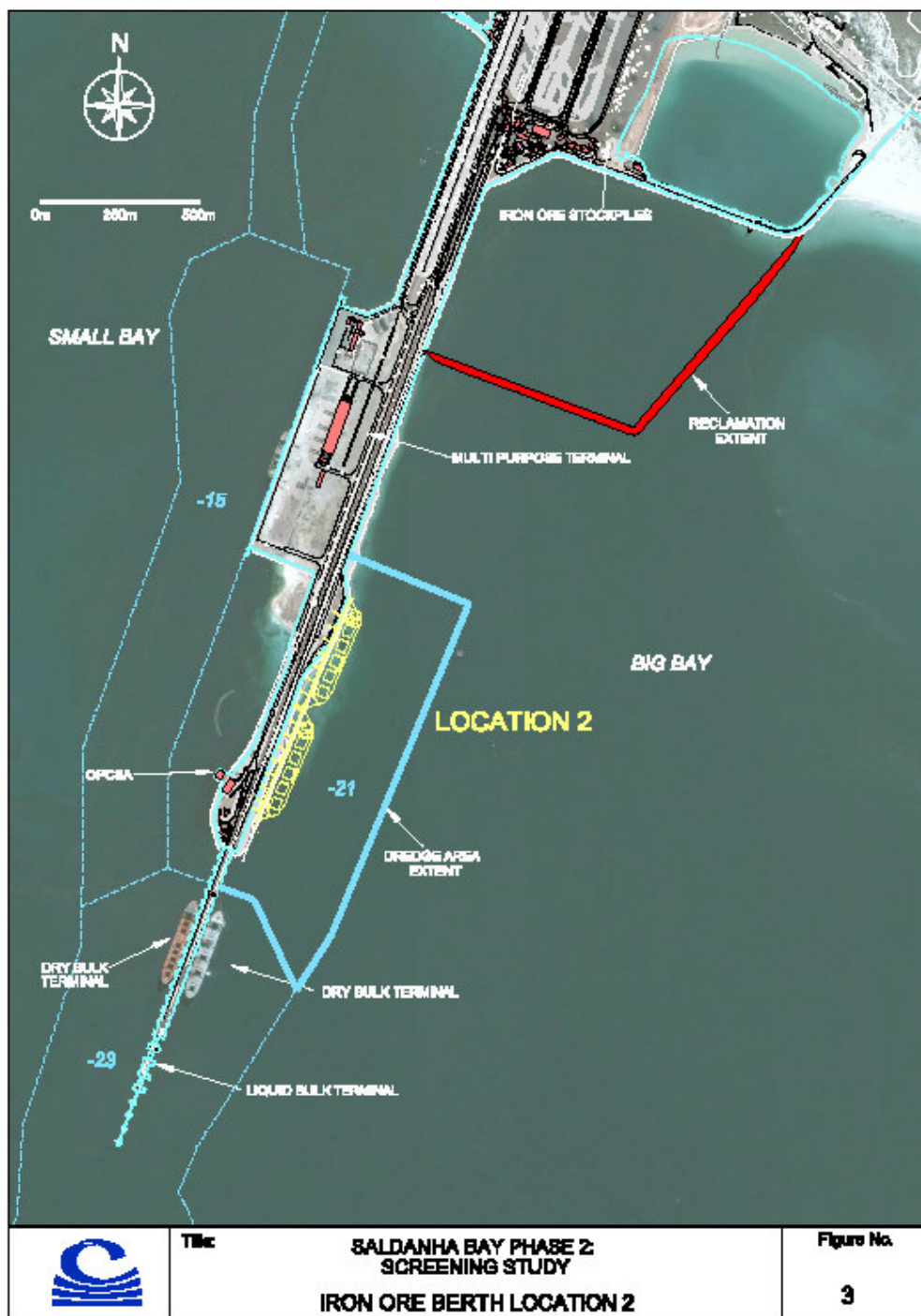
While it is concluded that Option 1 and Option 2 do not pose any identified long-term risk to the Saldanha Bay – Langebaan Lagoon ecosystem uncertainties exist where ecosystem thresholds lie for the linkages between Big Bay and Langebaan Lagoon. It is probable that extended development within Big Bay, be this port development or other operations such as mariculture, etc, may ultimately threaten ecosystem thresholds. The risk (in terms of linkages between Big Bay and Langebaan Lagoon) of similar extended development in Small Bay is likely to be lower.

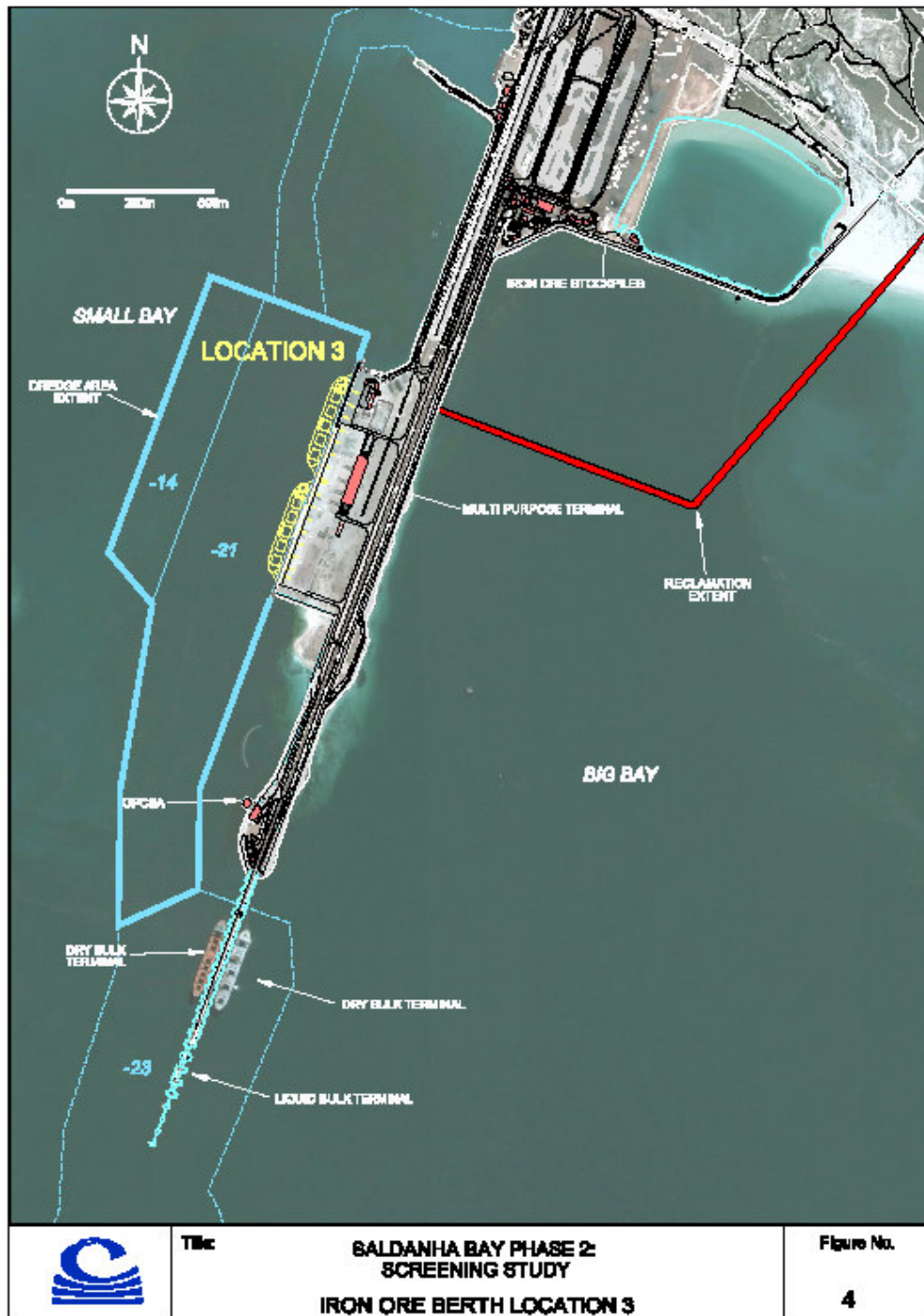
Thus, within the context of present available knowledge of the functioning of the Saldanha Bay - Langebaan Lagoon ecosystem and associated ecosystem thresholds, the selection of Option 2 on this occasion should not be considered to set a precedent for further development in Big Bay by either the port or other industry. Assessment of the acceptability of any further or extended development in Big Bay will need to be based on an improved understanding of potential ecosystem thresholds to ensure that the risks posed by such further development in Big Bay on the Saldanha Bay - Langebaan Lagoon ecosystems remain acceptable.



INDICATIVE ALTERNATIVE BERTH LOCATIONS









Port of Saldanha Assessment Criteria	Option 1	Option 2	Option 3	Option 4
A Environmental & Social Considerations				
1 Long-term Ecological Consequences				
1.1 Phytoplankton	Green	Green	Green	Yellow
1.2 Dissolved Oxygen	Green	Green	Green	Yellow
1.3 Habitat Modification (shipping channel/dredge area)	Green	Green	Yellow	Orange
1.4 Habitat Destruction (reclaim area)	Green	Green	Yellow	Orange
2 Dredge Head Sediment Suspension Impacts During Construction				
2.1 Water Column Turbidity	Yellow	Yellow	Yellow	Orange
2.2 Effects on Benthic Habitats	Green	Green	Yellow	Orange
2.3 Remobilisation of Contaminants During Dredging	Green	Green	Yellow	Orange
2.4 Effects on Phytoplankton Productivity	Green	Green	Yellow	Orange
3 Reclaim Area Suspended Sediment Impacts During Construction				
3.1 Water Quality Turbidity	Green	Yellow	Yellow	Orange
3.2 Effects on Benthic Habitats	Green	Green	Yellow	Orange
3.3 Effects on Pytoplankton Productivity	Green	Green	Yellow	Orange
4 Shoreline Stability				
4.1 Channel Dredging	Green	Green	Yellow	Yellow
4.2 Reclamation - Shoreline Stability	Green	Green	Green	Yellow
4.3 Reclamation - Beach amenity	Green	Green	Yellow	Orange
5 Operational impacts associated with ballast water release and discharge from site				
5.1 Ballast Water	Green	Green	Green	Green
5.2 Discharges from site	Green	Green	Green	Green
6 Noise				
6.1 Noise During Construction	Green	Green	Yellow	Orange
6.2 Noise During Operation	Green	Green	Yellow	Orange
7 Visual				
7.1 Visual Impact of Construction Activity	Green	Green	Green	Green
7.2 Visual Impact of Turbidity Plumes (Construction)	Green	Yellow	Yellow	Orange
7.3 Visual Impact on Sense of Place (Operation)	Green	Green	Yellow	Yellow
8 Air Quality				
8.1 Air Quality Impacts During Construction	Green	Yellow	Orange	Orange
8.2 Air Quality Impacts During Operation	Yellow	Green	Orange	Orange
9 Social				
9.1 Social Aspects During Construction	Green	Yellow	Yellow	Orange
9.2 Social Aspects During Operation	Yellow	Green	Orange	Yellow
B Consideration of Environmental Risk				
10.1 Probability and Fate of Oil Spills				
Collision of an iron-ore carrier with a moored oil tanker (impact on Langebaan Lagoon)	Orange	Green	Orange	Orange
Grounding of an iron-ore carrier or collision with a concrete structure (impact on Langebaan Lagoon)	Orange	Orange	Yellow	Yellow
C Engineering and Operational Considerations				
11.1 Disruption of Existing On-land Operations During Construction	Yellow	Green	Orange	Yellow
11.2 Berthing and Mooring Conditions	Green	Yellow	Green	Green
D Port & Regional Planning Principle Considerations				
12.1 Port Planning Considerations	Yellow	Green	Orange	Orange
E Financial Considerations				
13.1 Costs for Construction	Yellow	Green	Orange	Orange