Port Planning Study and Ultimate Development Plan

Update 2007

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Appendices

A DRAWINGS
1. INTRODUCTION

In August 2003, the Port Hedland Port Authority completed its Port Planning Study (Reference 1) and released its Ultimate Development Plan (2003 UDP). The Port Authority had identified the need to implement a planning strategy to ensure its important role of facilitating trade through the Port of Port Hedland was secured into the future. That objective continues to have relevance today and fits well with the Port Authority’s current Vision and Mission Statements which are:

**Vision**
To be the “Port of Choice” for trade to and from the Pilbara and be the world’s leading bulk commodities port.

**Mission**
to promote, facilitate and expand trade through the Port, via the provision of safe and efficient services, and timely infrastructure development, whilst fulfilling our social and environmental responsibilities.

The economic success of the Pilbara region is driven by resource and oil and gas based export industries. Although recent trends indicate the trade through Port Hedland will be dominated by the export of bulk minerals well into the future, the future potential for oil and gas based industries to develop at Port Hedland cannot be overlooked. The Port Authority’s success in achieving its trade facilitation role will largely depend on a port development plan that maximizes the port’s capacity for efficient bulk export infrastructure whilst maintaining options for expansion into other more diverse trades, particularly those based on oil and gas industries.

The 2003 UDP included a recommendation that the UDP be reviewed within 5-7 years. It also included a recommendation that the Strategic Development Plan (SDP) that represented a 15-20 year time horizon sub-set of the UDP should be reviewed within 1-2 years. There have been significant factors impacting on future plans for the port since 2003 that make it timely to undertake a review and update of the plan in 2007. Some of those factors are outlined briefly below.

During the preparation of the 2003 UDP, the start of what is now recognised as a resources boom had not been identified. Trade projections included in the 2003 UDP were buoyant but did not anticipate total port throughput exceeding 200 million tones per annum (Mtpa) early in the next decade. Many analysts predict the strength of the demand from China that is fuelling the resources boom will continue for years, perhaps decades, to come. Accommodating the consequent demand for export capacity puts pressure on the plans for port development set out in the 2003 UDP.

In 2004, the Western Australian Government entered into an Agreement with the Fortescue Metals Group subsidiary, The Pilbara Infrastructure Pty Ltd (TPI), to construct a railway to, and port facilities at Port Hedland for the export of iron ore. The TPI project is now under construction with exports expected to commence in 2008. In June 2005, Hancock Prospecting Pty Ltd entered into an arrangement with Rio Tinto Iron Ore to develop the Hope Downs project and export ore from that
mine through the Port of Dampier. Accordingly, plans for the construction of a railway to, and port facilities at Port Hedland for the export of iron ore from the Hope Downs project were not executed. These changes in plans from proponents representing significant quantities of ore have had a significant impact on the future port structure as outlined in the 2003 UDP.

The 2003 UDP had dealt with the land based capacity of the port as determined at that time. It was recognised that the marine capacity of the port needed separate investigation. Several studies were commissioned in 2005 to assess the marine capacity of the port and to determine what potential there might be to increase that. Some results from those studies are now available and have a significant bearing on how the port should be developed.

In June 2004, the Environmental Protection Authority (EPA) promulgated its Guidance Statement Number 29 (Reference 2) on Benthic Primary Producer Habitat Protection. This policy document makes a significant difference, by comparison to the policy applicable during the preparation of the 2003 UDP, to the need to manage the treatment of mangrove communities within the port. A review of the 2003 UDP structure plan is necessary as a consequence of the new policy.

The impact of industry on the community, particularly the community in the West end of Port Hedland, has also gained more prominence in the time since 2003. Wind blown dust from minerals stockpiled in the port impacts on the amenity of residents in the West end and the possible health implications for people exposed, in the long term, to high levels of fine dust has raised consciousness about the desirability of taking actions to reduce the incidence of dust exposure in residential areas. The increased frequency of heavy road trains into the port area at the West end of Port Hedland carrying bulk materials for export has been identified as potentially increasing the risk of traffic accidents with non-commercial traffic; it would be desirable to plan for the diversion of these heavy road trains away from the town area.

The primary deliverable of this review is an updated Ultimate Development Plan (UDP) for the Port. The UDP is to represent the best assessment of the ultimate sustainable capacity of the port matched to resources, land availability, transport infrastructure and industrial capacity. The updated UDP will need to include provision for adequate export capacity and suitable linkages to both the Boodarie Industrial Estate and the resource rich hinterland. A strong emphasis through this planning process is also to be placed on environmental and social considerations so that the benefits of port development and trade growth through the port are enjoyed in more than just an economic sense.

The SDP considers the next 15-20 years and the likely requirements during that time. The SDP is a subset of the UDP as it represents a particular stage along the way and is aligned intimately with the ultimate development of the Port, and matches the current best estimates of trade development over the next 15-20 years. The SDP of 2003 is to be reviewed as part of this update of the 2003 UDP.
2. TRADE DEVELOPMENT

2.1 Short Term Trade Projections

The Port Hedland Port Authority has prepared, in consultation with industry, detailed projections of trade over the next 5 years. A summary of these trade projections is given in Table 2-1.

2.1.1 Iron Ore

The figures for iron ore exports given in Table 2-1 represent the combined volumes of ore to be shipped by BHP Billiton, Fortescue Metals Group and several junior miners hoping to commence operations at Port Hedland in the next few years.

Two of the new junior miners are Atlas Iron and Aurox Resources. Atlas Iron has plans to develop its haematite deposits initially at 3 Mtpa from 2009 road hauled to the port, thereafter to develop its magnetite deposits and pump it in slurry form to the port. It is projecting export quantities of up to 10 Mtpa from early 2011. Aurox Resources plans to export 6 Mtpa of titanomagnetite concentrate from late 2009. This product contains high concentrations of Vanadium, significantly increasing its value. Aurox is also considering piping its product to the port.

Other junior miners include Polaris Metals, Iron Ore Holdings, FerrAus, BC Iron and Yilgarn Mining.

2.1.2 New Trades

Some new or growth opportunities that have been identified are discussed here.

Concentrates

The resources boom has also provided the impetus for the development of new trades such as zinc concentrates and molybdenum as well as significant increases in copper concentrate exports. The new shippers that have emerged are CBH Resources, Straits Resources, Moly Mines, Prairie Downs and Kagara Zinc. There may also be demand in the future for new trade in lead concentrates.

The molybdenum exporter, Moly Mines, plans to export around 20,000 tonnes concentrate per annum. However, it is a very high value product and rather than being loaded over the shiploader, it will be shipped in drums packed in TEUs (containers).

It is possible that ilmenite a by product of the titanomagnetite operations may be developed commercially and exported through the port in due course.
Scrap steel

With the demolition of the HBI plant, there will be a short term boost in exports of scrap steel. However, scrap steel exporters envisage a sustainable trade of up to 60,000 tonnes per annum.

Fuel Imports

Fuel imports are expected to more than double in the next 5 years from 0.5 Mtpa to 1.2 Mtpa. Apart from impacting on berth occupancy and congestion, the issue of fuel storage and distribution needs to be considered. A large proportion of the fuel is consumed by mining companies, particularly the iron ore miners. The transport of fuel oils required for mining and railway operations would be best by rail. Additional storage required in the short term should be located such that, into the future, fuel can be piped to the rail loading point; this will reduce the trucks on the road. There is more discussion on this later in the report.

Explosives

Two companies have expressed an interest in importing Ammonium Nitrate through the port. Ideally the companies would like to land the ammonium nitrate in shipments of around 4,000 tonnes monthly. A risk analysis will be required to identify a berth location suitable for quantities of this magnitude to be handled.

Servicing FPSO's

Woodside's “Cossack Pioneer” Floating Production and Storage Offshore (FPSO) vessel has been serviced at the No 1 Berth twice this decade. This is a trade the Port Authority would like to pursue. This is a “clean” activity that require the support of heavy lift cranes, workshops etc, and the existing public berths (1, 2 & 3) on the town centre side of the harbour are well suited to these requirements. There are a total of ten FPSO's operating on the North West Shelf at present requiring port calls every 5 years. Significant multiplier benefits can be generated for the Pilbara and local service industries in attracting this trade in lieu of this being lost to overseas service destinations such as Singapore.

2nd Hand Mining & Earthmoving Equipment

Equipment of this type imported to Australia as well as containers require wash down and fumigation facilities that meet AQIS requirements. With Fremantle unable to keep up with the demand for the clean down of plant and suffering backlogs of over 6 months, the Port Authority sees an opportunity to establish a full wash down and fumigation facility and promote Port Hedland as the port of preference for both import and potential re-export of containers, 2nd hand earthmoving and mining equipment. The establishment of bonded storage areas within the port for storage of 2nd hand equipment for possible resale is an opportunity that is being considered.
To demonstrate the size of the change in trade projections since 2003, the estimate in 2003 was that total trade would reach 123 Mtpa by 2010 with iron ore exports representing 93% of the total. By comparison, Table 2-1 indicates a total trade of 209 Mtpa by 2010 of which 96% will be iron ore exports. Table 2-1 further indicates that total trade will reach 303 Mtpa by 2012 of which 97% would be iron ore, yet the 2003 projections only envisaged total trade reaching 144 Mtpa by 2020 with iron ore exports amounting to the smaller percentage of 94%.

Table 2-1 also demonstrates the huge economic benefits promised by these trade forecasts. The gross estimated value of the commodities passing through Port Hedland could grow from around $8 billion in 2007 to around $29 billion within 4 years. The immediate challenge for the Port Hedland Port Authority is to help industry to take advantage of this massive economic opportunity by providing for booming exports of bulk minerals in a way that also allows it to meet its social and environmental objectives.

The above projections exclude the possible trade that could eventuate should:

1. an Outer Harbour be developed as detailed in section 5 which could come on stream as early as 2012,
2. additional cape size berths be developed within the inner harbour with sailing restrictions (class B berths) in the interim. Currently under investigation.
## Table 2-1 5 Year Trade Forecast and Economic Value Summary

<table>
<thead>
<tr>
<th></th>
<th>2005/06 Tonnes-'000</th>
<th>2006/07 Tonnes-'000</th>
<th>2007/08 Tonnes-'000</th>
<th>2008/09 Tonnes-'000</th>
<th>2009/10 Tonnes-'000</th>
<th>2010/11 Tonnes-'000</th>
<th>2011/12 Tonnes-'000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
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<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Iron Ore</td>
<td>105,106</td>
<td>106,617</td>
<td>125,800</td>
<td>173,550</td>
<td>212,700</td>
<td>269,000</td>
<td>310,000</td>
</tr>
<tr>
<td>HBI Exports</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Salt</td>
<td>3,346</td>
<td>2,669</td>
<td>2,400</td>
<td>2,800</td>
<td>3,200</td>
<td>4,000</td>
<td>4,200</td>
</tr>
<tr>
<td>Manganese</td>
<td>1,059</td>
<td>1,185</td>
<td>1,420</td>
<td>1,520</td>
<td>1,520</td>
<td>1,520</td>
<td>1,520</td>
</tr>
<tr>
<td>Feldspar</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chromite</td>
<td>259</td>
<td>219</td>
<td>250</td>
<td>250</td>
<td>150</td>
<td>100</td>
<td>50</td>
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<tr>
<td>Copper Concentrate</td>
<td>170</td>
<td>250</td>
<td>312</td>
<td>444</td>
<td>558</td>
<td>558</td>
<td>592</td>
</tr>
<tr>
<td>Zinc Concentrate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>42</td>
<td>118</td>
<td>193</td>
<td>402</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>16</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>Container Exports</td>
<td>18</td>
<td>2</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
<td>General Cargo Exports</td>
<td>5</td>
<td>49</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total Exports</strong></td>
<td>109,995</td>
<td>110,997</td>
<td>130,233</td>
<td>178,666</td>
<td>218,323</td>
<td>275,453</td>
<td>316,865</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil &amp; Bitumen</td>
<td>438</td>
<td>531</td>
<td>515</td>
<td>711</td>
<td>871</td>
<td>1,100</td>
<td>1,267</td>
</tr>
<tr>
<td>Acid</td>
<td>148</td>
<td>145</td>
<td>165</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Container Imports</td>
<td>10</td>
<td>5</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>General Cargo Imports</td>
<td>33</td>
<td>131</td>
<td>140</td>
<td>160</td>
<td>180</td>
<td>190</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total Imports</strong></td>
<td>629</td>
<td>812</td>
<td>840</td>
<td>991</td>
<td>1,171</td>
<td>1,410</td>
<td>1,587</td>
</tr>
<tr>
<td><strong>Total Trade (Tonnes '000)</strong></td>
<td>110,624</td>
<td>111,810</td>
<td>131,073</td>
<td>179,657</td>
<td>219,494</td>
<td>276,863</td>
<td>318,452</td>
</tr>
<tr>
<td><strong>Total Trade Value $M</strong></td>
<td>7,131</td>
<td>7,909</td>
<td>9,879</td>
<td>14,891</td>
<td>19,354</td>
<td>24,470</td>
<td>29,496</td>
</tr>
</tbody>
</table>
2.2 Medium Term Trade Projections

For the purposes of this report, medium term refers to a time period of 15-20 years and is consistent with the timeframe associated with the SDP.

2.2.1 Iron Ore

Recognising the rapid growth in demand for iron ore from Western Australia and responding to some concern about the potential capacities of the three existing iron ore ports in the Pilbara, the Western Australian Government through the Department for Planning and Infrastructure, commissioned WorleyParsons Services Pty Ltd in 2006 to conduct a preliminary study into the need for, and the possible location of, a new port (or ports) in the Pilbara suitable for development to accommodate any export tonnages that may exceed the capacities of the existing ports. The report titled *Port and Related Infrastructure Requirements to Meet the Expected Increases in Iron Ore Exports from the Pilbara* (Pilbara Ports Study, Reference 3) was completed in February 2007. Although the assessment included in the Pilbara Ports Study of the capacity of the Port of Port Hedland would appear to be understated based on more recent work conducted by the Port Hedland Port Authority, the projections of the demand for iron ore exports from the Pilbara are still relevant. This report provides an insight into the 15-20 year trade projections for iron ore exports. Table 2-2 has been developed from information provided in the Pilbara Ports Study. In 2005, the three existing Pilbara ports, Port Hedland, Dampier and Port Walcott, exported respectively 45%, 32% and 23% of the total iron ore shipments from the Pilbara. These are recorded in Column 1 of Table 2-2.

The Pilbara Ports Study predicts that iron ore exports from the Pilbara will grow to a low estimate (based on Australia enjoying 40% share of the dominant Chinese market) of 564 Mtpa by 2025 and a high estimate (based on Australia enjoying 60% market share) of 893 Mtpa by 2025. Assuming that each of the three Pilbara ports will accommodate the same percentage of total exports as was the case in 2005, the shipments from each port in 2025 could be expected to be those figures shown in Columns 2 and 3 of Table 2-2. Port Hedland would accommodate between 254 and 402 Mtpa.

High and low assessments of the potential capacities of each of the three Pilbara ports were included in the Pilbara Ports Study and those assessments are recorded in Columns 4 and 5 of Table 2-2. The totals of Columns 2 and 3 are well above those of Columns 4 and 5. It was this assessment of sales demand versus port capacity that led to the conclusion in the Pilbara Ports Study that a new port would be required in the Pilbara within 6-10 years to accommodate iron ore exports by 2025 of between 107 and 356 Mtpa. It was noted that a port in the East Pilbara would be closer to the new deposits that would be opened to meet the growth in demand for iron ore.

Later in this report we discuss the potential for port capacity expansion at Port Hedland that is well in excess of the figure quoted in Column 5 of Table 2-2. It is also understood that the combined capacities for Dampier and Port Walcott have been reassessed since completion of the Pilbara Ports Study and the aim is to develop a combined capacity at these two ports of about 320 Mtpa. If the Port

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of Port Hedland can be expanded to accommodate significantly larger exports of iron ore, then the exports through Port Hedland by 2025 could be in the range of 335 to 574 Mtpa as shown in Columns 6 and 7 of Table 2-2.

<table>
<thead>
<tr>
<th></th>
<th>2025 Exports</th>
<th>Capacity</th>
<th>2025 Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Based on %</td>
<td>Mtpa</td>
<td>Mtpa</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Port Hedland</td>
<td>45</td>
<td>254</td>
<td>402</td>
</tr>
<tr>
<td>Dampier / Port Walcott</td>
<td>55</td>
<td>310</td>
<td>491</td>
</tr>
<tr>
<td>Totals (Mtpa)</td>
<td>100</td>
<td>564</td>
<td>893</td>
</tr>
</tbody>
</table>

The exports of iron ore through Port Hedland may not capture the upper limit of 574 Mtpa by 2025 for a number of reasons. This high figure is based on Australia’s share of the Chinese market reaching 60%. Australia’s market share today is only of the order of 40% and, although the precedent for mature economies like Taiwan and Japan is 60%, the Pilbara Ports Study suggested 50% was a realistic target. The current dynamics however of significant freight premiums on supplies from Brazil, could impact positively on Australia’s future share of the increased demand, especially should Australian suppliers develop berths capable of accepting the larger ships, which would afford Asian buyers significant long term savings. Example: As at Mar 2007 the difference between long term (15 year) supply contracts Australia to China using dedicated tonnage between 170,000T to 250,000T ships was a saving of US$2.80/tonne (source Braemar Seascope). Future Australian supplies to Asia could possibly attain the 60%. Securing of long term market share in the coming years will be greatly dependent on who can get capacity on stream soonest. It is evident that the projections made at the time of conducting the Pilbara Ports study were of the correct order and magnitude, however current feedback is that the growth that was expected to occur by 2025 could occur as early as 2015.

Apart from Dampier and Walcott, the proposal to develop a port at Cape Preston west of Dampier could accommodate some of the growth in iron ore exports, particularly those from deposits located closer to the West Pilbara. Making allowance for these factors leads to our judgement that a planning figure for iron ore exports through Port Hedland in 2025 of 525 Mtpa would be appropriate, albeit this capacity could come on stream as early as 2015.
2.2.2 Salt

Less than 3 Mt was shipped from Port Hedland in 2006/07. The 5 year projections show salt exports increasing to 4.2 Mtpa. An increase to 5 Mtpa has been used for predictions within the strategic timeline.

2.2.3 Other Dry Bulk Cargoes

The makeup of the dry bulk group is changing. Exports of manganese are expected to maintain good export throughput levels into the future. Feldspar exports have ceased with the exhaustion of the high grade deposit at Pippingara.

The market for chromite is understood to be volatile, for which Consolidated Minerals predict reduced export levels over the next 5 years. The extent of chromite reserves at Coobina is not known but, for the purpose of predicting trade levels to 2025, it is estimated that exports of chromite will remain at 250,000 tonnes annually.

Exports of copper concentrates from existing customers are predicted to settle but the introduction of new miners will see total exports of this commodity grow to around 600,000 tonnes annually. Other concentrates such as zinc are expected to grow to around 400,000 tonnes. Ilmenite could grow to around 400,000 tonnes.

For planning purposes, it is estimated that the total other dry bulk exports in 2025 (i.e. excluding iron ore and salt) will grow from around 2,589,000 tonnes projected for 2012, to around 3 Mtpa. 1 Mtpa of copper and zinc concentrates to be handled over No.1 berth & 2 Mtpa of Manganese, Chromite & Ilmenite over the new Utah Point berth.

2.2.4 Fuel Imports

The growth in fuel imports over the past six years has been closely aligned with the growth in iron ore exports. Extrapolating this out to 2025 when iron ore exports could be 525 Mtpa, fuel imports could grow to 2.12 Mtpa.

The points made in section 2.1.2 about storage and distribution of fuel become even more important when growth of the order contemplated here is considered. There will be a need to consider alternative discharge berth locations, tank storage sites and distribution options for volumes of this order.

2.2.5 General Cargo, Container and Acid Trades

Much of the containerised cargo, general cargo and acid trades is aligned with the dry bulk trade, particularly the concentrates. The cargo projections for these trades have been increased by about 7% over the projections for 2012 which reflects the increase over the same period in projected Dry
Bulk throughput. The increase in containerised exports, however, represents increased quantities of molybdenum.

The rapid growth in the predicted throughput of general cargo and containers over the five years to 2012 and beyond is based on attracting direct shipments of raw process materials from South East Asia, in particular. To date, the volumes of these cargoes have been too small to attract direct shipments and most imports have reached the Pilbara via Fremantle and road transport. Quantities of 250,000 tonnes per annum should be sufficient to attract direct shipments.

Some of the general cargo opportunities and related businesses that have been the subject of enquiries and could constitute part of the medium term “General Cargo, Container and Acid Trades” volumes are described below.

**Tyre Recycling**

With the number of large rubber tyres that require disposal from Pilbara mining operations, an opportunity has been identified for a tyre recycling plant in Port Hedland. The tyres would be crumbed at the plant and, in that form, the rubber is in demand for purposes such as road bases, footpaths, synthetic sports surfacing, bollards, street furniture and playground undersurfacing. Part of the product would be exported through the port.

**Drilling Fluids**

Drilling muds used in the offshore industry were, until about 2000, produced in a shed in the port area behind No 3 Berth. That industry relocated to Dampier, closer to the customer base. Another enquiry has been received recently regarding the import of drilling fluids, storage tanks and then export to customers either by road tanker or directly over the wharf onto tender vessels. This is the type of trade for which provision should be made, certainly in the medium term, as it is a service that will be required by the oil and gas industry that this plan anticipates will offer significant development opportunities in the longer term. A trade in the order of 5 – 10,000 tonnes per annum could be anticipated.

**Bunkering.**

Interest has been expressed in offering bunkering at the port, particularly in support of the drill support vessels operating off the NW Shelf. A trade in the order of 5 – 10,000 tonnes per annum could be anticipated. The possibility of establishing a bunker barge service to supply calling ships at anchor is to be investigated.
Biodiesel Plant

With pressure to reduce the use of carbon producing fuels, there could be a future for biodiesel blended with mineral diesel as a means of reducing total carbon emissions from the trains and other heavy equipment used by mining companies in the region. As this would be a partial substitute product, it is not anticipated that total trade projections through the port would be affected because reduced imports of mineral diesel would be replaced by canola / palm oil feedstocks.

A number of companies have been in discussions with the Port, some with a view to import feedstock and export biodiesel. The plants will need to be established within piping distance of berths, potentially on Port Authority land and will provide additional employment opportunities within Port Hedland.
2.2.6 Predicted Throughput for 2025

Table 2-3 summarises the trade projections for 2025. It is to be noted that a good portion of the iron ore growth could be experienced by 2015, should market forces continue as at present.

Table 2-3 2025 Trade Forecast

<table>
<thead>
<tr>
<th></th>
<th>2012 Tonnes ('000)</th>
<th>2025 Tonnes ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron Ore</td>
<td>310,000</td>
<td>525,000</td>
</tr>
<tr>
<td>Salt</td>
<td>4,200</td>
<td>5,000</td>
</tr>
<tr>
<td>Dry Bulk</td>
<td>2,589</td>
<td>3,000</td>
</tr>
<tr>
<td>Livestock</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Container Exports</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>General Cargo Exports</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td><strong>Total Exports</strong></td>
<td>316,865</td>
<td>533,091</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil &amp; Bitumen</td>
<td>1,206</td>
<td>2,120</td>
</tr>
<tr>
<td>Acid</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Container Imports</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>General Cargo Imports</td>
<td>200</td>
<td>214</td>
</tr>
<tr>
<td><strong>Total Imports</strong></td>
<td>1,587</td>
<td>2,477</td>
</tr>
<tr>
<td><strong>Total Trade</strong></td>
<td>318,452</td>
<td>535,568</td>
</tr>
</tbody>
</table>

2.3 Longer Term Trade Opportunities

Estimating the growth in existing trades and identifying new trade opportunities beyond 2025 is speculative. Development planning for the port in the long term will need to be based largely on a sensible judgement as to the extent of resources available in the region, the opportunities to develop efficient transport corridors from the hinterland to the port, the opportunities for new value adding industrial developments, the opportunities to develop efficient transport and service corridors within the port and between the port and adjoining industrial areas, the land available for stockpiles and cargo storage within and close to the port, and the capacity of the port to handle the shipping movements associated with the projected trade.

Nevertheless, it is important to recognise a number of prospective trades in the port plan. These are discussed below.
2.3.1 Boodarie Industrial Estate – Value Adding Industries

The Boodarie Industrial Estate adjoins the southern boundary of the port. It has been designated for strategic industry with appropriate buffer zones in place to allow heavy industry to establish within it.

There is an opportunity to establish industries here based on oil and gas developments in the region. There is an existing gas pipeline to Port Hedland from Dampier, the capacity of which can be expanded if necessary, to power downstream processing industries of both local mineral resources or imported minerals such as bauxite.

There is also the potential for future development of new oil and gas fields in the offshore Northern Carnarvon and Roebuck basins or onshore in the Canning Basin. Port Hedland is well located to provide support base infrastructure for the exploration, development and operation of the new fields and Boodarie offers an excellent industrial area for LNG plants. Exports of LNG, LPG and crude will require an “Outer Harbour” terminal to achieve the required exclusion zones from the loading point of these hazardous cargoes.

The Boodarie Industrial Estate presently includes BHPB’s HBI plant, iron ore beneficiation infrastructure and a gas driven power station. The HBI plant has been decommissioned and is being dismantled, albeit the iron ore beneficiation infrastructure and gas plant will remain. Until an alternative use for this area of the industrial estate is decided, the conceptual layout for the estate provided in Figure 2-1 continues to include the HBI plant. Over the past decade, there has been interest from several parties interested in establishing ferroalloy plants, there has been interest from downstream liquids industries, and there has been interest in alumina refineries and aluminium smelters using imported bauxite.

In order to make an informed assessment of the likely port infrastructure required to support the Boodarie Industrial Estate, a development model was prepared and described in the 2003 UDP. The model was based on previous scoping and approvals work for the industrial estate as contained in the BHP Engineering (Reference 4) and Woodward-Clyde (Reference 5) reports.

The initial planning studies identified three main classes of industry that would likely define the makeup of the estate:

1. Downstream Iron Ore Processing.

   eg. Metals processing, pigment production, smelters.

   eg. Methanol, Ammonia, Urea, Petrochemical plants.
The likely distribution within the estate was suggested, based on proximity to the raw materials and the required corridors. Essentially this included the Downstream Iron Ore industries to the north, Power Intensive industries in the central region and Downstream Petroleum Processing to the south.

The Boodarie Industrial Estate covers an area of 8km x 4km. Of this total, some 3,000ha is developable. The suggested aerial split determined for the three main classes of industry was approximately 20%, 25% and 55% respectively.

In order to develop a guideline environmental and risk assessment, Woodward-Clyde proposed an industrial scheme for Boodarie that included an oil refinery, ammonia/urea plant, petrochemical plant and a range of other industries, including LPG production. Minor risk issues were associated with corridors, and risk was generally manageable within the estate. Using small numbers of hazardous cargo shipments (below those expected from a fully developed Boodarie) an unacceptable risk radius of 1.3km was determined. The proximity of the west end of Port Hedland therefore constrains the location of any such export facility, leading Woodward-Clyde to recommend the development of a dedicated hazardous cargo jetty outside the inner harbour.

To develop a model for use in predicting the requirements of the Port, we have assumed development on the full area of Boodarie, using the industry specific areas presented above. These equate to approximately:

- 600ha for Downstream Iron Ore processing
- 800ha for Power Intensive industries
- 1200ha for Downstream Petroleum processing.

A possible model for such a development was presented in the following block diagram (Figure 2-1). The BHPB HBI plant has been decommissioned and is being dismantled. This plan does not propose a replacement plant for this site; it is more likely that the area will be utilised for iron ore stockpiles, iron ore beneficiation and possible rail loops and rail car unloaders in support of the Port Authority’s plans for an Outer Harbour.

The block diagram shown in Figure 2-1 is not seen as inconsistent with the Town of Port Hedland’s Land Use Master Plan (LUMP, Reference 6) which propose that general and noxious industry be located in the southern part of the Boodarie Industrial Estate.
Figure 2-1  Schematic block diagram showing possible future industry break-up for Boodarie Industrial Estate. Based on Woodward-Clyde (1996).
2.3.2 Break Bulk and Containerised Trade

Regional Resource Developments – Project and Process Materials

We have seen in the short term trade projections and in those for the strategic timeframe, a predicted growth in general and containerised cargoes. Imports of project materials for construction of resource developments and of raw materials to be used in the operation of mineral concentrate processes being developed in the region are reasonable expectations. Exports through Port Hedland by sea of low volume high value processed minerals (eg molybdenum), perhaps in containers that would otherwise be shipped empty also becomes a reasonable expectation.

To date, the transport economies have been in favour of overseas imports of raw process materials through Fremantle with road transport to the Pilbara. Existing processed cargoes from the region such as copper cathode and tantalum are presently trucked from the Pilbara. With quantities of regional imports from, and exports to, South East Asia increasing in the short term, the total transport economies of shipping direct from / to South East Asia through Port Hedland will become competitive.

The growth in direct shipments to and from Port Hedland of project cargoes and raw materials to be used in the Pilbara can be expected to continue as the region continues to develop and as both economic and environmental issues encourage a shift from road transport to and from Fremantle to movements through Port Hedland.

Project Iron Boomerang

Project Iron Boomerang is a concept that involves a railway across Australia carrying iron ore from west to east and coal from east to west with steel smelters at each end. Steel smelter parks would be established at each end; at Abbott Point in Queensland and at Newman in Western Australia. Gas would be used to power the blast furnaces.

The promoter of the project, East West Line Parks Pty Ltd, believes the minimum economic development would create an export quantity of 7.3 Mtpa of slab steel exported from the Pilbara but the number of smelters could increase this figure to 21.9 Mtpa. Port Hedland would be the logical port from which to export this type of cargo produced in Newman.

An alternative to constructing the railway across Australia with its high capital investment requirement would be to ship the coal and iron ore between the States (with balanced return cargoes improving freight efficiency) and establish the smelters in coastal industrial areas at each end. The Boodarie Industrial Estate would be a logical site for such a steel mill.

Whether a steel mill were to be established at Newman or Port Hedland, the export of steel slab through the port would be another break bulk trade requiring berths suitable for panamax sized vessels. If the production point was at Newman, the steel slab could be transported to Port Hedland by rail and offloaded on a siding close to the Port. If the smelter is located on the Boodarie Industrial Estate, transport would be by road along a well defined corridor (linkage) to berths in the port.

The WorleyParsons Group
Whilst a recent presentation by East West Line Parks Pty Ltd on this project envisaged production commencing in 2012, a longer time frame is considered more likely. The closure of the Newcastle steel works and the more recent de-commissioning of the HBI plant in Port Hedland indicate that the economies of Australian based steel manufacturing enterprises are, at best, marginal today. Circumstances may well change in the future to give Australia a competitive advantage in steel making, particularly with the environmental benefits of a shift from coal to gas as an energy source, so it is worth recognising this project as presenting a future trade opportunity.

An Alternative Container Port with Rail Land Bridging

The idea that Port Hedland could become another point of entry for containers into Australia has been suggested previously and requires discussion. The view is that another container port in Western Australia could relieve some of the road congestion that is associated with the existing container trade through Fremantle’s Outer Harbour. It has also been suggested that Port Hedland’s relative proximity to the key South East Asian container hub ports of Singapore, Surabaya (Indonesia) and Klang (Malaysia) would make it attractive to those trading into Australia.

For the proposal to work effectively, a railway linking Port Hedland with say Kalgoorlie would be required. This would be a major capital investment.

There are several reasons why this report does not believe this is a feasible opportunity in the foreseeable future. International shipping lines generally try to offer a “liner service”; that is they seek to complete a circumnavigation of the globe servicing established ports in a minimum time frame. Frequent calls at key ports and the rapid delivery of containers to key ports of discharge is the service sought by shippers. Deviating from a direct route or increasing the number of ports will increase the duration of the circuit and cost the shipping line custom. Large container vessels from Europe that pass around the Cape of Good Hope, across the southern coastline of Australia and then on to North America will not want to deviate north of Fremantle and make an extra stop. In fact, it is understood that major shipping lines will, from time to time, review the need to stop even at Fremantle; a direct route passing south of Cape Leeuwin making Melbourne the only port of call in Australia would have some time savings for the shipping lines. It is difficult to envisage that Port Hedland, located 1,600 km north of Fremantle, would be seen as an attractive alternative west coast port for these shipping lines.

It was only in recent years that the railway line joining Darwin and South Australia was completed. Darwin is close to Australia’s Asian trading partners. Even with the new railway, attractive pricing policies, and vigorous marketing by the Northern Territory Government, there has not been a significant increase in containers entering Australia through Darwin. Port Hedland is unlikely to be any more attractive as a point of entry than Darwin.

Although this report does not recommend planning for separate and additional infrastructure for a future container trade of this type, a future container trade could be accommodated if circumstances change and the demand exists for Port Hedland to be a point of entry to Australia. The infrastructure required to support the breakbulk and container trades associated with project and raw process materials is the same. In particular, the berths would suit the size of ships serving a container trade, the cargo laydown areas behind the berth would have similar specifications and any shore based cranes would be compatible with the needs of a container trade.

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2.4 Vessel Numbers

2.4.1 Projected Vessel Numbers for SDP

Based on the projected cargo throughput for 2025, vessel numbers for that year are estimated based on average cargo payloads for each type of commodity. Table 2-4 provides the projected vessel numbers for 2025.

For iron ore handled within the inner harbour, the average payload has trended upwards to 170,000 tonnes on ships of an average of 180,000 tonnes deadweight. It has been assumed it will remain at that figure.

For salt, the average payload assumed of 60,000 tonnes is higher than the current average of around 48,000T, but this is trending higher with ships of up to 77,000 DWT handled at No.3 berth. This higher figure will likely be reached in the coming years, also by 2025, it is presumed that the salt trade will have been shifted to a new loading facility capable of accepting smaller cape sized vessels, in which case average payload size may well be higher.

To maximise port capacity the Port authority shall encourage proponents to utilise larger vessels wherever possible.

Dry bulk cargoes comprise the high value concentrates and other products such as manganese and chromite. The concentrates are generally shipped in smaller parcels, but with expansion of this trade, average parcel size is expected to grow from 15,000 to 20,000T. Manganese and chromite, on the other hand, are often loaded into panamax sized vessels with payloads currently averaging 48,000T. With plans (discussed later) to relocate the manganese and chrome to a new berth at Utah Point, there will be an opportunity to load larger parcels onto smaller cape sized vessels with a trend towards 65,000T payloads. Balancing these factors and the relevant proportions of concentrate vs other products in the total cargo projected, an average parcel size of 35,000 tonnes was determined.

For livestock exports, the payload figure varies markedly. The figure of 900 tonnes adopted in Table 2-5 is the average for the previous five years.

The economic parcel size for general and containerised cargoes is about 2,000 tonnes. Some payloads will be higher than this minimum so a figure of 3,000 tonnes has been adopted for containers. For general cargoes, the average payload has been based on the figure over 2006/07, namely 5,200 tonnes. It is likely that a number of the 57 general and containerised vessel calls shown for imports may also be used to handle the exports for which a further 18 vessel calls are calculated. The overall projected vessel estimates for general cargo and container traffic are considered to be of the right order and magnitude.

The average shipment sizes for acid are the average shipment sizes of recent years. For fuel imports the current average size of ships calling is 45,000 DWT although the parcel size averages only
19,000 tonnes. In the future, assuming significant tankage is developed, the average payload size is expected to trend upwards to 35,000 tonnes.

Table 2-4  2025 Vessel Numbers

<table>
<thead>
<tr>
<th>Cargo</th>
<th>Avg Shipment Tonnes</th>
<th>Vessel Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron Ore</td>
<td>525,000</td>
<td>170,000</td>
</tr>
<tr>
<td>Salt</td>
<td>5,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Dry Bulk</td>
<td>3,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Livestock</td>
<td>10</td>
<td>900</td>
</tr>
<tr>
<td>Container Exports</td>
<td>16</td>
<td>3,000</td>
</tr>
<tr>
<td>General Cargo Exports</td>
<td>65</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total Exports</strong></td>
<td>533,091</td>
<td></td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil &amp; Bitumen</td>
<td>2,120</td>
<td>35,000</td>
</tr>
<tr>
<td>Acid</td>
<td>100</td>
<td>8,000</td>
</tr>
<tr>
<td>Container Imports</td>
<td>43</td>
<td>3,000</td>
</tr>
<tr>
<td>General Cargo Imports</td>
<td>214</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total Imports</strong></td>
<td>2,477</td>
<td></td>
</tr>
<tr>
<td><strong>Total Trade</strong></td>
<td>535,568</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** This projection of 3,417 vessels in 2025 compares with a figure of 888 in 2007. Iron ore tonnages shown would be handled from both the inner & outer harbours.

### 2.4.2 Projected Vessel Numbers for UDP

No attempt has been made to assess the number of vessels applicable to the Ultimate Development case. Much will depend on whether future development includes exploitation of value adding industries on the Boodarie Industrial Estate or whether it is substantially oriented to an expansion of bulk commodity (iron ore) exports.

The vessel numbers associated with a fully developed Boodarie Industrial Estate are summarised in Table 2-5. The model predicts a requirement to service an additional 1490 vessels, 80% for exports.
Table 2-5  Vessel Numbers Generated by Boodarie Industrial Estate

<table>
<thead>
<tr>
<th>Industry</th>
<th>Import Vessels</th>
<th>Export Vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOWNSTREAM IRON ORE PROCESSING</td>
<td>90</td>
<td>280</td>
</tr>
<tr>
<td>POWER INTENSIVE INDUSTRIES</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>DOWNSTREAM PETROLEUM PROCESSING</td>
<td>-</td>
<td>480</td>
</tr>
<tr>
<td>DOWNSTREAM PETROLEUM PROCESSING - BULK HAZARDOUS LIQUIDS</td>
<td>50</td>
<td>390</td>
</tr>
<tr>
<td>TOTALS</td>
<td>240</td>
<td>1250</td>
</tr>
</tbody>
</table>

2.5  Berth Numbers

2.5.1  Projected Berth Numbers for SDP

The cargo projections of Table 2-4 are used as the basis of assessing the number of Berths that will be required in 2025.

The number of iron ore berths comes from considerable capacity modelling work undertaken by the Port Authority over the last 2 years. That work is described in Section 3. Applying the results of that work indicates that the number of berths required for throughput of 525 Mtpa depends on the mix of loading streams.

A two berth, single shiploader loading stream is rated as having a capacity of 50 Mtpa and a three berth, twin shiploader loading stream is rated as having an annual throughput capacity of 95 Mtpa. The number of iron ore berths will, therefore, range from 17 (3 berths, 2 shiploader stream) to 21 (2 berths, 1 shiploader stream). This is a simplistic approach and will be reviewed more critically when the individual berths need to be identified in a later section. The 2 cape size berth served by a single travelling shiploader combination is a good benchmark loading stream as this ties in broadly with the capacity of a typical rail car dumper at 50 to 55Mtpa.

Assuming that the salt trade is relocated to a new loading facility with a shiploader that operates at up to 5,000 tphr, salt loading operations will consume 20% of one berth's total occupancy. This is derived as follows:

- Gross Loading Rate (GLR) of 75% of 5,000 tphr assumed; ie 3,750 tphr.
- Time to load 5 Mtpa = 5,000,000 / 3,750 = 1,333 hrs pa.
- Time for ship movements = 83 shipments @ 5 hours = 415 hrs pa
- Total occupancy for salt = 1,748 hrs pa or 20%.
The total efficient occupancy of a berth shared between products, particularly given that salt has State Agreement rights to absolute priority over the berth, will be much less than 100% and even considerably less than for a berth allocated to a single user with a single product (e.g., iron ore). Total reasonable berth occupancy for other products may only be around 70% in this case. This allows other cargoes to take up somewhere between 50 and 70% of this berth’s occupancy.

Of the dry bulk, it is assumed that manganese and chromite will be relocated to a new berth on Utah Point with a stockyard maximum outload capacity of 5,000 tphr (albeit the shiploader will be rated to 7500 tphr). Applying similar methodology as that for salt yields a berth occupancy of 7%.

Concentrates are likely to remain at No 1 Berth where the existing shiploader has a restricted loading rate and are expected to consume 23% of that berth’s occupancy. In addition, the nature of concentrate products creates a need to spend time cleaning down the equipment to avoid cross contamination and avoid losses to the environment. To recognise this, the occupancy of 23% should be increased to about 30%.

Applying loading or discharge rates (as appropriate) for cattle at 100 tphr, general and container cargoes at 200 tphr, and bulk liquids at 400 tphr yields the berth occupancy / berth requirements summarised in Table 2-6.

### Table 2-6  Berth Requirements in 2025

<table>
<thead>
<tr>
<th>Cargo Type</th>
<th>Cargo Tonnes ('000)</th>
<th>GLR tphr</th>
<th>Berth Numbers / Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Ore</td>
<td>525,000</td>
<td>N/A</td>
<td>17 to 21</td>
</tr>
<tr>
<td>Salt</td>
<td>5,000</td>
<td>3,750</td>
<td>20%</td>
</tr>
<tr>
<td>Manganese, Chromite and Ilmenite</td>
<td>2,000</td>
<td>3,750</td>
<td>8%</td>
</tr>
<tr>
<td>Concentrates</td>
<td>1,000</td>
<td>400</td>
<td>40%</td>
</tr>
<tr>
<td>Livestock</td>
<td>10</td>
<td>50</td>
<td>3%</td>
</tr>
<tr>
<td>Container</td>
<td>59</td>
<td>200</td>
<td>5%</td>
</tr>
<tr>
<td>General Cargo</td>
<td>279</td>
<td>200</td>
<td>21%</td>
</tr>
<tr>
<td>Oil &amp; Bitumen</td>
<td>2,120</td>
<td>400</td>
<td>64%</td>
</tr>
<tr>
<td>Acid</td>
<td>100</td>
<td>400</td>
<td>3%</td>
</tr>
</tbody>
</table>

A possible mix of berths could be:

- Petroleum @ 64% and Acid @ 11%; total 75%  
  1 Berth (No 3 Berth)
- Concentrates @ 30%, Livestock @ 3%, Containers @ 5% and General Cargo @ 18%; total 56%  
  1 Berth (No 1 Berth)
Salt @ 5 Mtpa and Iron Ore (magnetite) at 20 Mtpa (separate shiploaders) 1 Berth (New)

Manganese & Chromite @7% and
Iron Ore at say 20 Mtpa 1 Berth (Utah Point)

Iron Ore exports of 525 Mtpa less 40 Mtpa already accommodated above = 485 Mtpa still to be accommodated. How the number of berths required for this throughput may be achieved will be discussed later in the report.

2.5.2 Projected Berth Numbers for UDP

No separate estimate is made of the additional berths required to accommodate growth in those trades listed in Table 2-6, but an estimate is offered for the berths required to service the trades associated with a fully developed Boodarie Industrial Estate. Table 2-7 sets out berth numbers for these trades. The Outer Harbour Berths could be single point moorings.

Table 2-7  UDP Berth Requirements for Boodarie Industrial Estate

<table>
<thead>
<tr>
<th></th>
<th>Inner Harbour Berths</th>
<th>Outer Harbour Berths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downstream Iron Ore Processing</td>
<td>2 bulk, 1.5 land-back</td>
<td></td>
</tr>
<tr>
<td>Power Intensive Industries</td>
<td>1.5 land-back</td>
<td></td>
</tr>
<tr>
<td>Downstream Petroleum Processing</td>
<td>1 bulk liquid, 0.1 bulk</td>
<td></td>
</tr>
<tr>
<td>Downstream Petroleum Processing - Bulk Hazardous Liquids</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>2 bulk, 3 land-back, 1 bulk liquid</td>
<td>4</td>
</tr>
</tbody>
</table>
3. MARINE CAPACITY

This Section considers the marine capacity associated with what we will term the Inner Harbour. A later Section in this report considers the potential for additional capacity achievable through development of an Outer Harbour.

3.1 Previous Work and Recommendations

The 2003 UDP discussed the Channel and Harbour Capacity. It considered predicted vessel movements and earlier modelling of the channel capacity. The earlier modelling work did not provide good guidance on capacity as it was limited in scope.

The 2003 UDP concluded that there is likely to be a constraint placed on the Port’s capacity by the channel at some stage in the future. The report identified a series of trigger points where expansion works may be required such as:

- Purchase of new tugs, change-out of smaller tugs,
- Deepening of departure slots and partial deepening of the shipping channel,
- Development of passing lanes in the shipping channel, and
- Upgrades of ship loaders/unloaders and materials handling systems.

The report went on to recommend the development of a detailed Port Simulation model to look at the ability of the channel to support the Ultimate Development Plan and to properly assess these likely trigger points. As a complementary exercise, the report recommended a ship handling study to verify the basin extents, and particularly any issues with the approach channel and approaches to the South West Creek berths at Anderson and Stanley Points.

The Port Authority commissioned these studies in 2005 and preliminary findings have been made available to WorleyParsons in order to prepare this 2007 UDP Update.

3.2 Capacity Modelling

In the GHD report to the Port Authority titled “Report for Vessel Simulation Modelling – October 2007”, issued in draft form in November 2006, the benefits of establishing loading stream configurations of 2 berths, 1 shiploader and 3 berths, 2 shiploaders were identified. The additional berth in these loading streams allows switching of loading between ships at the berths and provides an effective buffer against channel congestion and deballasting delays. Loading can proceed on a 24/7 basis. This optimises port capacity.

The key findings from this simulation modelling were:

The WorleyParsons Group
• Investigations into large cape size iron ore loading capacity concluded that a port layout that incorporates five loading streams with 12 berths and 7 loaders can handle up to 320 Mtpa at an acceptable vessel handling performance.

• The performance penalty for channel congestion does not become excessive for tonnages of up to 320 Mtpa.

• The average vessel queue time is an acceptable 48 to 72 hours.

• Vessel movement spacings used in the model were conservatively assessed at 1 hour for both inward and outward sailings.

• The tug fleet will only need to grow to about 10 tugs as throughput grows from 100 to 320 Mtpa. The operating hours of each tug will increase. This would necessitate a total of 11 tugs allowing for 1 spare for repairs and maintenance.

• The capacity of a 2 berth, 2 (x 10,000 tphr) shiploader stream is modelled at 68 Mtpa when total port throughput is at 100 Mtpa but reduces to 60 Mtpa as total port throughput increases to 320 Mtpa.

Further modelling is currently underway to further refine the findings above, namely:

• Investigate the potential for the port to accommodate a number of smaller cape size berths, handling vessels up to 150,000 DWT with restricted sailing rights outside of the main high tide sailing windows. Modelling to also include all berths and all shipping movements.

• Outward vessel movement spacings reduced to 45 minutes on average with 30 minute spacings possible.

• Modelling shall assume two turning basins operating concurrently with ships entering in pairs 45 minutes apart, the first turning at the rear of the harbour (Burgess / Anderson Point) with the second in the middle of the harbour (Harriet Point), followed by a 1 hour separation before the next pair (more for ships berthing at Finucane Island). Dredging of additional berths within the inner harbour shall effectively create 3 x 600m diameter turning basins.

• Modelling of ships reversing up South West Creek and associated risk assessment.

Investigations are also underway:

• To develop a refuge berth at Hunt point, designated points of refuge along the channel length but clear of the channel and alternative emergency navigation routes, in addition to the possibility of providing extended tug escorts. Reduced spacing of vessels will introduce additional risks which may be mitigated by these measures.

• To optimise channel profile from a Dynamic Under Keel Clearance perspective, with selective dredging of high spots, to enhance sailing drafts and augment sailing windows.
3.3 **Channel Dredging**

Dredging of the channel to deepen and / or widen it has been mooted in the past. Deepening will widen the window allowing more ships to depart on each tide. Widening would allow two way movement of vessels, particularly in the inner half of the channel, reduce the time between a ship departing a berth and the incoming ship berthing.

Recently, the Port Authority undertook dredging of a berth pocket at Utah Point in preparation for the construction of a new berth. From the significant delays experienced during that exercise, in having to halt dredging for vessel movements in the channel, the Port Authority is of the view that once the next step up in throughput occurs, the cost of delays will make significant dredging uneconomic. Only selective dredging of high spots is still under consideration.

The channel and berth pockets are subject to siltation of around 250,000 m³ per year as a result of a west to east littoral drift depositing sand into the channel and erosion of the creek systems depositing silt into the berthing pockets. Presently maintenance dredging is carried out 3 yearly, resulting in a accumulated loss of draft of around 0.3 metres over this term. PHPA is presently investigating undertaking dredging annually, with the possibility of a dedicated dredger for Port Hedland. This will afford increased sailing drafts, reduction of short loaded vessels particularly on neap tides and a gain of capacity estimated to be in excess of 2 Mtpa on average. Siltation of the channel causes build up of silt on the edges of the channel which effectively reduces the navigable width of the channel, thereby reducing margins of safety; more regular dredging will reducing the risk of mishap.

3.4 **Vessel Spacing**

Current port protocols stipulate the time spacing between ships in the channel as 1 hour. At a spacing of 1 hour, 3 ships can depart on each tide on average year round. On spring tides sometimes just 2 ships can depart whereas on neap tides upwards of 4. If the time can be reduced to say 45 minutes, 4 ships could depart on the tide and port capacity significantly enhanced.

Reduced spacing will augment available sailing drafts.

3.5 **Influence of Average Size of Cape Vessels**

The GHD modelling has been based on the historical record of ships visiting Port Hedland. Very recently, the size of cape sized ships has increased from an average of 171,000 DWT (161,000T average cargo) to a sustained average of around 178,000 DWT (168,000T average cargo). For cape sized vessels that are tidally constrained, vessel numbers rather than size is the major limiting factor to capacity. For an increase in average size such as that experienced recently, if sustained, capacity could increase from 320 Mtpa to about 334 Mtpa.
3.6 **Capacity of Smaller Vessels not Constrained**

The modelled capacity of the port relates to iron ore only. That is, the reasonable capacity of the port to export iron ore in large cape vessels is about 320 Mtpa. The throughput associated with trades using small capes (120,000T deadweight), panamax and smaller vessels that are not tidally constrained, is not part of the 320 Mtpa. A substantial number of these smaller vessels can be handled so the total capacity of the port can be significantly more than the 320 Mtpa limit for iron ore. A further study by GHD is currently underway modelling all future vessel movements including vessels that are not tidally constrained.

3.7 **Shipping Protocols**

To maximise channel utilisation and trade facilitation the Port Authority has developed shipping protocols for the port, that factor in order of arrival but maximise available sailing drafts. High tide windows are prioritised for departing large draft capes.

3.8 **Allocation of Berths for 320 Mtpa – Class A Berths**

The Port Authority has interpreted the GHD draft report and, taking into account existing arrangements, has identified one optional allocation of this capacity which could include the loading streams detailed in Table 3-1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Configuration</th>
<th>Capacity (Mtpa)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelson Point</td>
<td>2 berths, 1 loader</td>
<td>50</td>
<td>2\textsuperscript{nd} loader retained as spare</td>
</tr>
<tr>
<td>Burgess Point</td>
<td>2 berths, 1 loader</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Finucane Island</td>
<td>2 berths, 1 loader</td>
<td>50</td>
<td>2\textsuperscript{nd} loader retained as spare</td>
</tr>
<tr>
<td>Harriet Point</td>
<td>2 berths, 1 loader</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Anderson Point (North side)</td>
<td>3 berths, 2 loaders</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Anderson Point (West side – in SW Creek)</td>
<td>1 berth, 1 loader</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12 berths, 9 loaders</td>
<td><strong>320</strong></td>
<td></td>
</tr>
</tbody>
</table>
Whilst the Nelson Point and Finucane berths will retain their second shiploaders, these berths will be treated as though they only have 1 shiploader in operation for berthing priority allocation.

3.9 Prioritisation of Ship Departures – Class B Berths

For iron ore, the figure of 320 Mtpa is an economic capacity. Trying to move more large vessels on the tide than is associated with a throughput of 320 Mtpa would likely incur significant additional demurrage costs. It may be possible, however, to prioritise ship departures ensuring that those ships that are given priority on the tide are the berths identified as contributing to the 320 Mtpa capacity (Class A berths). Ships calling at these berths will generally be the larger cape size vessels primarily in the range of 160,000 to 220,000 DWT and drawing the largest draft. High tide sailing windows shall be prioritised for departing Class A berth ships.

Small cape vessels averaging 120,000 DWT will draw approximately 15 metres when fully loaded. Vessels of this size could depart on most tides. If the objective is to maximise the tonnage of iron ore exported from the port, additional berths could be allocated that allow iron ore loading of vessels to a draft of 15 metres without impacting on the 320 Mtpa capacity above. Ten percent of the cape size ships currently calling at Port Hedland are around 150,000 DWT, which if required to short load to depart ahead of the main high tide sailing windows so as not to impact on the Class A berth vessel sailings, could permit significant additional quantities of iron ore exports. The premium on the cost of freight as a result of the short loading is of the order of $3 to $5/T which is unlikely to be an impediment at times of shortage of supply. In any event, iron ore exporters would not incur this expense as invariably it is the purchaser that pays the freight. Additional modelling studies are currently underway to assess the viability of accommodating an additional 100Mtpa capacity in Class B priority export berths. Currently around 15% of the large capes short load, particularly around neap tides with charter contracts structured to allow for this.

The Port Authority envisages that non tidally restricted Class B berths could be developed within the Inner Harbour to meet the immediate iron ore export demands, with the potential for this production to move offshore to the Outer Harbour in due course once developed. The redirecting of this export capacity to the Outer Harbour would be commercially driven as the market firms and freight efficiencies sought from the steel mills. The Outer Harbour will likely cater for vessels in the 250,000 to 320,000 DWT range with significant freight advantages, countering moves by the Brazilians to lower their costs of freight. This capacity could be brought on stream relatively quickly, such that facilitating this trade in the short term will enable Australian producers to secure global market share and then to sustain this long term when production shifts to the Outer Harbour.

With the class B cape size berths developed within the Inner Harbour primarily in South West Creek, there will be the potential for these berths to be converted in due course, to be developed as berths to service trade from the Boodarie Industrial Estate. Having deepwater berths built with adequate service corridors and Project Ready Industrial Land at Boodarie will be a major draw card and catalyst to get Boodarie off the ground. Conditions imposed on the developers of the berths in SW Creek by the Port Authority would be that upon ceasing of use as iron ore export berths, the Port Authority would be that upon ceasing of use as iron ore export berths, the Port Authority
would have the option to lease back these berths on pre agreed commercial terms to enable the Port Authority to then take the Inner harbour to its next phase of growth. Alternatively the Port Authority would support plans from proponents that are prepared to redevelop and actively facilitate alternative trades across these berths.

To assess the additional capacity of the port achieved by allocating Class B berths with lesser priority on high tide departure slots to Class A berths, Tables 3-2(a) and 3-2(b) have been prepared.

**Table 3-2 (a) Possible Allocation of Capacity to Class B Loading Streams (150,000 DWT)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Configuration</th>
<th>Capacity (Mtpa)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson Point (West side – in SW Creek &amp; linked to berth noted in Table 3-1)</td>
<td>2 berth, 1 loader</td>
<td>65</td>
<td>This would then be a triple berth, served by 2 travelling shiploaders.</td>
</tr>
<tr>
<td>Stanley Point (up SW Creek)</td>
<td>2 berths, 1 loader</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Burgess Point</td>
<td>1 berth, 1 loader</td>
<td>45</td>
<td>Combined with the 2 berth 1 loader table 3-1, would make this a triple berth.</td>
</tr>
</tbody>
</table>
| **Total** | **5 berths, 3 loaders** | **160** | |}

**Table 3-2 (b) Other non tidally restricted new Bulk Minerals Berths (120,000 DWT)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Configuration</th>
<th>Capacity (Mtpa)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson Point (North side – east end, share with salt)</td>
<td>1 berth, 1 salt &amp; 1 iron ore loader</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Utah Point (multiple product)</td>
<td>1 berth, 1 loader</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
| **Total** | **2 berths, 3 loaders** | **40** | |}

The combined iron ore throughput capacities achievable from both Class A and Class B priority berths is 480 Mtpa. Further modeling is currently underway to confirm whether or not the channel can accommodate part or all of this additional throughput. However, if proven correct, the Inner Harbour could accommodate the iron ore trade forecasts for the 20 year time frame. As a matter of comparison the combined berth numbers taken from Tables 3-1, 3-2(a) and 3-2(b) of 19 compare favourably with the number of 17 to 21 estimated for iron ore in Table 2-7.
One point that needs to be recognised however is that should the Inner Harbour berth sites be fully exploited in the short term for iron ore in this manner leaves very little opportunity for trade associated with value added industries on the Boodarie Industrial Estate, until such time as an Outer harbour is developed and capacity shifted across. Two development scenarios are considered later, one that assumes the port is dominated by bulk mineral exports in the long term and the other that assumes there is balance between bulk mineral exports and commodities to and from value adding industries on the Boodarie Industrial Estate. The second option effectively equates to the scenario where the bulk commodities exported over the Class B berths in the short to medium term are replaced with trade in support of the Boodarie Industrial Estate.

The proposal that iron ore exports associated with Class B Berths in South West Creek would be diverted to the Outer Harbour at some future time to make way for break bulk trade from the Boodarie Industrial Estate is appealing because it would facilitate the early development of iron ore export capacity. However, there will be a high capital cost to the iron ore exporter in surrendering its berths in South West Creek and developing new berths in the Outer Harbour, particularly if the need for that comes not too many years after the South West Creek berths are commissioned. There will also be an operational cost to the iron ore exporter as it redirects its materials handling systems. Furthermore, an industry looking to develop on Boodarie is likely to experience a delay in its development program while waiting for final agreement, planning and construction for the relocation of the iron ore industry to the Outer Harbour; such a delay may be a significant disincentive to attracting industry to Boodarie. It is recommended, therefore, that the Port Authority conducts an economic analysis of the costs and benefits to both the iron ore industry and other prospective Boodarie Industrial Estate industries as well as the schedule implications for new industries before committing to this approach.

Ships handled at the Class B berths shown in Table 3-2(a) would be granted secondary sailing rights on the available high tides to Class A berth ships Table 3-1. These ships would likely depart ahead of the high tide sailing windows on the flooding tide, but may well on a majority of occasions load to drafts in excess of 15m and thus not have to sail short loaded. The Port Authority would manage the shipping protocols and Dynamic Under Keel Clearance to ensure optimal loading rates of Class B berth ships as with Class A berth ships, to minimise any short loading. All such efficiencies will result in lesser shipping movements year round and even higher capacity.

The berths shown in Table 3-2(b) are non tidally constrained berths designed to accept small capes, up to 120,000 DWT. Vessels calling at these berths as with the existing Port Authority berths 1, 2 & 3 may berth and depart at substantially all tide conditions.

### 3.10 Pilotage

The Port Authority’s Pilots have been trialing new electronic positioning equipment that represents an advanced aid to navigation. Portable Pilotage Units (PPU) include a computer and DGPS positioning receivers that are carried on board by the Pilot. The DGPS receivers allow the position and direction of the ship to be shown in real time on a chart of the port displayed on the computer screen. This display of position will give Pilots more confidence in some of the more challenging manoeuvres,
particularly during night hours, or during rare occasions of impaired vision due to fog or mist, when it is easy to get an incorrect perception of distances to berths etc around the turning basin. Being confident about these manoeuvres will introduce some time savings in berthing and departing ships.

Another benefit of carrying the computer on board is that the Pilot can access the Port Authority’s DUKC system and get a real time update on the progress of the transit. This improves safety because the control over under keel clearance is improved and this in turn is likely to lead to some greater efficiency and capacity. It is difficult to quantify either of these benefits at this stage.

3.11 Suction Mooring System

The Port Authority intends to incorporate the ‘Cavotec’ suction mooring system to its new berth at Utah Point, which it believes will afford significant enhancements, namely:

- Reduce interaction with ships passing in the channel, negating the need for the shiploader to boom up for passing ships.

- Attenuates against effects of long swell and resultant oscillation, which may be of particular interest to the open sea Outer Harbour berths.

- Reduced risk of mooring lines parting, removing a hazard, increased safety.

- No need for line boats for tie up and release of ships. Operational cost saving.

- Rapid tie up and release of ships, estimated at 20 minutes per berthing and 20 minutes per release. This will augment capacity of berths and improve gross loading rates, ‘first line to last line’.

- The instant tie up of the ships this system offers will permit significantly enhanced performance of the tugs, to attend to the next ship, impacting on reduced separation times between ships and thus indirectly on port capacity and improved sailing drafts. Once locked in the ship is fully secure, enhancing the safety of the port.

- No need for ships crews to tend to lines (7m tide variation), with risks of ships parting as in the case of the ‘Creciente Incident’. Mooring system automatically adjusts for the variation in tide. From a safety and security perspective of the port the berth operator is in control of the ships moorings and is not dependent on crews who may not be attending to the ship lines as they should.

- No need for end mooring dolphins, allowing reduced berth to berth separation and reduced berth construction costs.

- Significant in built redundancy and fail safe mechanisms.
Whilst the Cavotec system is new technology, it is rapidly proving itself and for the reasons above the Port Authority is convinced of its merits and that it will revolutionise mooring practices in the near future.

3.12 Tugs

The number of tugs required to service the increased Inner Harbour vessel traffic will not grow in proportion to vessel traffic. The tugs that are used within the port will be required to be on duty more consistently; more crews will be required. The number of tugs required within the Inner Harbour is unlikely to grow past about 12 (+ 1 spare to cover for routine maintenance outages). Simulation of tug requirements indicates the opportunity to reduce tug numbers for certain sized ships based on current shipping levels. As vessel movements increase and vessel separation times reduce, to ensure optimum maneuvering, tie up and escort functions at minimal risk the number of tugs may well revert to current levels. The need for extended tug escort shall require further investigation.
4. INNER HARBOUR DEVELOPMENT – STRATEGIC PLAN

4.1 Introduction

This Section will consider development of the Inner Harbour in both the short term (5 years) and medium or strategic time frame (20 years). It is assumed that there will not be any significant development of the Boodarie industrial Estate before 2025. Development of the Boodarie Industrial Estate and how the port accommodates that will be considered in a later Section titled “Ultimate Development Plan”.

Environmental issues and the interrelationship of the development of the port with the community are discussed in subsequent Sections but the plans discussed here take those other issues into account.

Figure 4-1 Existing Status of Port Development
Figure 4-1 shows the existing state of development. TPI’s two berths at Anderson Point (with single travelling shiploader able to load over either berth) are considered existing and included in the plan. These berths and the supporting stockpile area are approved, they are under construction, and they are scheduled to commence operations in 2008. Some of the other developments that are discussed later but not shown as existing may be well advanced in the planning stages but do not yet have formal approval from the Port Authority.

Other berth facilities that have been in operation for several years include BHPB’s two iron ore loading berths at Nelson Point, BHPB’s two iron ore loading berths at Finucane Island, and the Port Authority’s three public berths on the east side of the port entrance.

### 4.2 Land to Support Port Activities

In the 2003 UDP, a number of areas were identified that could be improved with reclamation and used for cargo storage or associated industry. These areas have been reviewed and modified where appropriate to provide land closer to future berths and to minimise, as far as is possible, impacts on mangroves. These areas referred to as Areas A to G and other areas that both exist or can be developed to support port activities are described in Figure 4-2.

#### 4.2.1 Existing Developed Areas

Existing areas include those parcels of land at Nelson Point and on Finucane Island occupied by BHPB under State Agreements for its iron ore export operations.

The Port Authority controls an area behind its existing No 1, No 2 and No 3 berths which is largely developed in support of its activities at those three berths. The Port Authority has commissioned a study into the potential for containerised and general cargo trade over these berths. This plan is expected to describe the redevelopment of this area to reflect the changes that will follow the relocation of the chrome and manganese trades to Utah Point, that will follow the relocation of the salt trade to a new berth at Anderson Point, the construction of infill decking behind No. 2 Berth facilitate efficient general cargo and container handling, and the development of additional bulk concentrate storage facilities.

Half of the area marked as Area A on Figure 4-2 has been leased to The Pilbara Infrastructure Pty Ltd (a subsidiary of Fortescue Metals Limited) and is being developed for stockpiles to support the operations of the two iron ore loading berths under construction at Anderson Point. The area leased and optioned provides sufficient room for stockpiles to support an expansion of FMG’s presently approved export limit to 95 Mtpa.
Figure 4-2  Land Areas to Support Port Activities
4.2.2 Areas Marked A to K

**Area A**

Area A is approximately 220 Ha within the existing port boundary. This area is set aside for bulk mineral stockpiles. An area of this size has the capacity to support total iron ore exports of approximately 180 Mtpa (including that ore to be exported by FMG).

**Area B**

Area B is approximately 170 Ha within the existing port boundary. This area is set aside for future expansion of bulk mineral stockpiles. It has the capacity to support iron ore exports of approximately a further 140 Mtpa. This area may also support the heavy industries that will develop in future within the Boodarie Industrial Estate.

**Area C**

Area C is to be allocated for light industry, engineering businesses and other support industries including scrap metal merchants and construction laydown areas. Businesses in this large 290 Ha area can support the heavy industries that will develop in future within the Boodarie Industrial Estate. They can also support a future offshore industry with supply and rig tender vessels operating out of Port Hedland (drill mud, refuelling, drill casings etc) as well as the possibility of offshore fabrication or assembly of components manufactured elsewhere. Imported Pre Assembled Modules can be received from heavy lift ships berthing at Lumsden Point, with units ranging up to 3000T, 30m wide, 45m high and 60m long, to service new developments in the port and the mines. A similar facility has been commissioned in Dampier to facilitate Woodside’s train 5 construction. This area may also be used for magnetite dewatering and storage (pumped to the port by slurry pipeline) or alternative salt storage. An access corridor will link Area C to the fourth Anderson Point berth, by way of either a rock lined access Jetty or piled and concrete deck structures. This to include a 500m long berth face on the eastern side for shallow draft vessels (dredged to 6m), to include construction barges, bunker barges, commercial fishing vessels, navy craft, future Port Authority maintenance dredger and passing super yachts. Provision for additional tug pens will be made. This area will also act as a safe haven area for small craft and barges with cyclone moorings provided. A slipway is envisaged for the maintenance of tugs and small craft. A further activity in this area is the storage and load out of rock onto barges for the lining of pipelines ins upport of the oil and gas industry in both the north west and the Browse basin.

Within area C will be a permanent settling basin, to pump contaminated silt from the maintenance dredging of berth pockets, for subsequent drying out and removal.

**Area D**

Area D is approximately 80 Ha in area. It could be used for various purposes such as temporary construction laydown areas, 2nd hand earthmoving and mining equipment storage, cattle yards, other light industry or transport related uses compatible with those uses planned in the Town of Port

The WorleyParsons Group
Hedland's Land Use Master Plan (LUMP, Reference 6) for the area immediately east of Wedgefield and adjoining the Port Authority's southern boundary.

Area E

This area will be set aside for port related light industrial uses such as a biodiesel plant, which requires reasonable proximity to the berths to pump imported oils and export biodiesel (or use locally).

Area F

Area F is located on high ground on Smith Point. This smallish area of about 17 Ha is intended for a future salt stockpile in the event that salt loading is relocated from No 3 Berth to a new berth east of Anderson Point. Salt may then be transported from the salt pond area to the berth by conveyor removing a significant amount of road train traffic through Port Hedland. This land is part of BHPB’s State Agreement lease area; BHPB will need to agree with this proposal or other arrangements will need to be made for salt if it is to be relocated from No 3 Berth.

Area G

The geometry of this area restricts its potential for iron ore stockpiles. This area may be more suitable for bulk liquids storage and general cargo laydown. This area of approximately 130 Ha is readily accessible from the Boodarie Industrial Estate and is close to future berths on either side of South West Creek.

Area H

Area H is approximately 85 Ha in area and would be suitable for iron ore stockpiles. Area H provides sufficient stockpile and rail car unloader space to support an annual export trade of approximately 80 Mtpa. A rail could access area H without the need to cross other railways. Given the difficulties that have become evident in constructing workable rail crossings into the port area, this area H may be a suitable alternative stockpile and rail car dumper area to that originally planned by Hope Downs on the east side of BHPB’s Finucane Island access corridor.

In light of plans for the Outer Harbour this area may then be required for an enlarged service corridor for the conveyor runs feeding the Outer harbour from Area I below.

Area I

This area is set aside for iron ore stockpiles in support of the outer harbour bulk mineral export facility. Most of Area I is outside the Port Area and forms part of the Boodarie Pastoral Lease which is presently held by BHPB.

Area J

This in an area set aside for mangrove repopagation.
Area K

BHPB proposes to reclaim the area behind Finucane Island C berth with dredge spoil to support its operations at C and D Berths and future expansions. The proposal incorporates a vegetated environmental berm and noise barrier behind the berths to reduce the impacts of BHPB’s operations on the town.

4.2.3 Additional Port Operational Areas

West Creek

There is an opportunity to reclaim the central portion of West Creek to provide an area of land of approximately 30 Ha in support of future berths at Stanley Point in South West Creek. This creek has been gradually silting up since the causeway to Finucane island was built. The design of the reclamation works shall ensure that the fill enhances the mangrove communities that line both sides of West Creek, by propagating additional mangroves. The design shall include maintaining water exchange to the mangroves on either side of West Creek over time and thus ensure the sustainability of the mangroves. The rock lining to the fill shall be designed to accommodate mangroves. If the future berths on the west side of South West Creek are to be used for break bulk and project cargoes associated with industries on the Boodarie Industrial Estate, there will be a need for some land close behind the berths to support the cargo stockpiling and handling activities at those berths. The land reclamation in West Creek would be the minimum requirement. An area to the south of the land reclaimed has been shown as dredged to 6m as an additional safe haven (during cyclones) for low freeboard vessels such as construction barges, commercial fishing vessels, tugs and line boats as an alternative to the small boat harbour and jetty proposed off area C. The extent of creek bed to be reclaimed is offset by the reduction of creek bed reclamation from the Anderson Point hub as envisaged in the 2003 UDP.

Anderson Point Hub

If the future berths on the west side of Anderson Point in South West Creek are to be used for break bulk and project cargoes associated with industries on the Boodarie Industrial Estate, there will be a need for some reclamation on Anderson Point to support the cargo stockpiling and handling activities at those berths. This reclamation has been designed to minimise the impact on mangrove communities on Anderson Point whilst ensuring sufficient (minimum) space for operational effectiveness. The area at Anderson Point now included in this update of the UDP is considerably less than that proposed in the 2003 UDP.

UCL West of Wedgefield

There is a triangular area of Unallocated Crown Land (UCL) immediately to the west of Wedgefield and between the southern boundary of the Port Area and the BHPB railway and road access corridor to Finucane Island. The Port Authority has formally requested the allocation of this piece of land from the Department for Planning and Infrastructure. It is understood that the inclusion of this piece of UCL in the Port Area would represent a change of purpose; this invokes a number of processes that need
to be completed before vesting of the land is confirmed. Although these processes can take time, it is understood there is broad community agreement with this proposal and so this plan takes this land into account. This triangular piece of land forms a southern extension of Areas A and B described above. The southern part of Area B in particular could be used for fuel storage (as an alternative to Area G); it is close to road access and to both BHPB and FMG railway lines which will facilitate the loading of road tankers and rail car tankers. It is estimated that future fuel tank storage of between 160 mega litres and 210 mega litres will be required by 2025 to match the nearly threefold increase in fuel imports. Locating the storage adjacent to land transport loading points away from town will reduce the extent of heavy traffic on Wilson Street.

In the medium term the Port Authority envisages fuel ships continuing to berth at the No. 1,2 & 3 public berths with the development of an interconnecting pipeline from the existing berths beneath the harbour and along the Anderson Point service corridor to the storage tanks mentioned above.

4.3 Short Term Development Plan

Figure 4-3 shows the development expected in the next 5 years.

4.3.1 Additional Berths

The plan projects 5 new berths will be constructed in this time frame. They are:

Utah Point

The Port Authority’s plans for a new berth at Utah Point are well advanced. Figure 4-4 shows the plan for the berth at Utah Point and the stockpile area to be developed behind Harriet Point. It is intended that this new berth will handle some 15 to 18 Mtpa of iron ore product from 3 or 4 miners and a total of approximately 1.6 Mtpa of manganese and chrome.

The berth will be designed to accommodate small cape vessels of up to 120,000 DWT. The berth pocket, which was dredged to 14.2 m earlier in 2007, may be deepened at a later stage to 14.7 m to accommodate a fully loaded vessel of 120,000 DWT at all tide conditions. It may be possible to deepen the pocket using a trailer suction dredger during maintenance dredging activities. The Port Authority is also aware that, with the upgrade of the Panama canal, a new fleet of “Super Panamax” or small cape vessels are being constructed with 175 on order for delivery within the next 5 years. These small cape vessels range in size up to 116,000 DWT. Planning the Utah Point berth to accommodate small cape vessels up to 120,000 DWT will also allow exporters to charter the new type of vessel and enjoy the reduced freight rates that will flow from that.
Figure 4-3  Short Term (5 year) Development Plan
Figure 4-4  Proposed Berth at Utah Point and Stockpile Area

A shiploader with a peak loading rate of 7,500 tphr is proposed. This loader will have the capacity to load in excess of the 18 Mtpa of bulk minerals projected and it will mean individual cape ships will be loaded in a reasonable time. The stockyard facilities for road hauled product will have a capacity to load out at a nameplate capacity of 5,000 tphr, however provision has been made within the facility to accommodate a future rail link with separate stockyard and reclaim facility, which would be designed to match the 7500 tphr shiploader loading rate.

In this part of the entrance channel, vessel surge caused by passing ships has resulted in broken mooring lines at existing berths and it is common practice to stop shiploading as a precaution during ship transits. The Port Authority plans to use the new Cavotec suction mooring system which will negate the use of mooring lines, it will lead to savings by obviating the need for fore and aft mooring.
dolphins, it will prevent vessel movement at the berth and it will overcome the need to stop shiploading due to passing ship traffic.

A small boat harbour has been dredged to the rear of the berth for small craft and barges to moor with a berth length of some 120m.

**Harriet Point**

A two berth, single shiploader loading stream is proposed at Harriet Point dedicated to iron ore export.

**Burgess Point**

A two berth, single shiploader loading stream is proposed at Burgess Point dedicated to iron ore export. These berths will be built at an angle to the existing two Nelson Point berths. It will be possible to extend these berths in due course to a three berth, two shiploader loading stream.

**Anderson Point**

Expansion to fill in the skeleton structure of the (existing) layby berth at Anderson Point is already underway which shall raise capacity to between 50 to 55 Mtpa. Constructing a third berth by an easterly extension and installing a second shiploader will create a 3 berth, two shiploader loading stream. It is expected, given the capacity of the shiploaders proposed for Anderson Point, that this loading stream will have a capacity to load 95 Mtpa of iron ore.

### 4.3.2 Other Developments in the Short Term

**Redevelopment of Land Behind Nos 1, 2 and 3 Berths**

As noted in Section 4.2.1, the relocation of the manganese and chrome trades to Utah Point, which will occur in the short term, will provide an opportunity to re-configure and re-allocate the land behind the Nos 1, 2 and 3 Berths. It is expected that this will be complete by 2012.

**Reclamation of West Creek**

Subject to the availability of fill material and environmental approval, the reclamation of West Creek discussed earlier in this Section could proceed opportunistically within 3 to 5 years. This reclamation will be undertaken when fill material is available from the dredging of South West Creek.

**Light Industry at North Wedgefield**

The Port Authority proposes to establish light industry in the port immediately to the north of Wedgefield. In the short term, scrap steel and sand blasting businesses are likely to be established in this area.

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New Access / Service Roads

The main initiative here will be a new road to Finucane Island shown in Figure 4-5. It will be designed to highway standards to accommodate heavy vehicular traffic (road trains) taking material to the stockpile area on Stanley Point for shipment over the new berth at Utah Point. It will also be open to the public who wish to access the recreational area and opportunities on Finucane Island. There will be a new road intersection at Finucane Island connecting with the existing crossing over BHPB’s rail to facilitate community access to Finucane Island. The existing Finucane Island Road will revert to a rail service road exclusively for BHPB’s use, whilst providing additional area for future services.

Figure 4-5  New Finucane Island Road and other Internal Port Access Road
The internal port service road running east west to the north side of Wedgefield may be the alignment of the new reconfigured Great Northern Highway (refer Land Use Master Plan) currently under investigation by Main Roads as part of the Auslink road network. Should this occur with grade separated crossings at all main intersections, this will better service road train traffic into the port from both the north and south as well as through traffic, significantly decongesting traffic on the existing local Port Hedland / South Hedland / Wedgefield road network.

4.4 Strategic Development Plan

The 2003 UDP introduced the concept of two development scenarios as the full development capacity of the port is reached. Scenario A provided a development hub at Anderson Point with land backed berths suitable for a large trade in break bulk product; it assumed the Boodarie Industrial Estate would be fully developed and that there would, in addition to that, be additional heavy processing industry at Port Hedland. Scenario B assumed that the predominance of bulk mineral exports would continue and a greater emphasis was placed on provision for bulk loading berths with stockpile areas set further back.

The trade projections for 2025 are set out in Table 2-3. The total berth requirements to accommodate this trade throughput in 2025 are summarised in Table 2-7.

4.4.1 Strategic Development Plan – Scenario A

The trade projections for 2025 assume that iron ore exports will reach 525 Mtpa and require between 17 and 21 berths. Table 3-1 identifies 12 berths that could be allocated for loading iron ore in large capes fully loaded (Class A - 1st priority loading streams); these berths would provide capacity to export 320 Mtpa of iron ore. If say 3 of the 2nd priority Class B loading berths nominated in Table 3-2 (a) are also constructed, namely 2 on the Anderson Point side of South West Creek and 1 additional berth at Burgess Point, the capacity to load iron ore could be as high as about 430 Mtpa. There would still be a shortfall in iron ore loading capacity of about 95 Mtpa by 2025.

If the 15 Inner Harbour iron ore berths referred to above (excluding Utah Point and Anderson Point 4th berth table 3-2 (b)) are constructed, this would leave the opportunity to construct up to 3 berths in South West Creek for other cargoes associated with future development at the Boodarie Industrial Estate. In the event that the Outer harbour is developed and the Class B berth exports are transferred to the Outer Harbour this would free up 3 berths in SW Creek that could be utilised to service the trade requirements of the Boodarie Industrial Estate. This matches with the berth requirements for Inner Harbour berths nominated in Table 2-8 which suggests that 6 berths will be required. The reduction of iron ore cape size shipping through the inner harbour back to 320 Mtpa will allow for the larger number of ships associated with the Boodarie Industrial Estate trade. Assuming that any spare capacity at the No 1, 2 and 3 berths by 2025 (refer Table 2-7 assuming salt, manganese and chrome trades are relocated) is taken up by the growth in fuel trade, the Inner Harbour cargo berth needs of a fully developed Boodarie Industrial Estate can be satisfied. [The interconnection of fuel pipelines between the existing public berths, the South West Creek berths and

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the tanks on the town side and back of harbour, will enable trade growth to be optimally accommodated through the various steps of berth development with maximum berth utilisation, as fuel ships can be received at any berths with nominal additional infrastructure.]

The Strategic Plan - Scenario A for the Inner Harbour is shown in Figure 4-6. It describes the projected development in 2025 assuming that berths with a capacity to load approximately 320 Mtpa of iron ore are developed and it assumes that there are berths with capacity to fully support the trades projected in 2025 other than iron ore. The plan reserves six berth sites in South West Creek for future trades associated with the Boodarie Industrial Estate which is unlikely to be developed earlier than 2025.

As mentioned above the South West Creek berths could be developed as Class B berths to support the burgeoning iron ore trade in the coming years, so that these may be substantially paid for in the short term, provided that these revert to berths supporting the Boodarie Industrial Estate in due course, with the class B iron ore export capacity transferred to the Outer Harbour. If an Outer Harbour is not forthcoming or such undertakings to relocate are not forthcoming, then consideration should be given to reserve the South West Creek berths to service the future Boodarie Industrial Estate trade.

The 205 Mtpa of iron ore for which this Inner Harbour Scenario A does not provide long term capacity would need to be accommodated elsewhere. The Port Authority has commenced an investigation into the feasibility of an Outer Harbour with a capacity to load large iron ore vessels. This is dealt with in Section 5. If this Scenario A is adopted and 6 berth sites are reserved for general cargo in South West Creek, it is likely that an Outer Harbour, or a new port in the Pilbara, will be required well before 2025.

4.4.2 Strategic Development Plan – Scenario B

This Scenario assumes that the development of inner berths for loading iron ore is maximised and matches the projected throughput of iron ore for 2025. Other trades projected for 2025 are also accommodated in this plan. The berths described in Figure 4-7 include those set out in Tables 3-1 and 3-2, which accommodate iron ore, salt, manganese and chromite. In addition, the existing Port Authority berths numbered 1, 2 and 3 carry the remaining trades.

If Scenario B is adopted, the Inner Harbour will be fully developed by 2025. If Scenario B is adopted and an Outer Harbour cannot be developed for some reason, there will be no opportunity to develop berths to accommodate the break bulk trade from the Boodarie Industrial Estate and, this Strategic Plan – Scenario B will effectively become the Ultimate Development Plan for the Inner Harbour.
Figure 4-6 Strategic Development Plan – Scenario A
Figure 4-7   Strategic Development Plan – Scenario B
4.4.3 Associated Developments in the Strategic Plan

Boodarie Access and Service Corridors

Although the Boodarie Industrial Estate is unlikely to be developed in the Strategic time frame, provision for the access and service corridors linking the Industrial Estate to Anderson Point, Stanley Point and the Outer Harbour (for single point moorings), should be preserved. Although most of the discussion on these corridors is included under the section on the Ultimate Development Plan, the Strategic Plan should include these access and service corridors.

Wedgefield to Anderson Point Access and Service Corridor

A corridor linking Wedgefield to the easternmost berth at Anderson Point is planned. A future salt conveyor from the area of Smith Point can be linked up with this service corridor to access the proposed shared berth at the eastern end of Anderson Point. In addition, vehicle traffic and other services for the commercial craft activities along this service jetty (see discussion below) will be facilitated by this corridor / service berth. It is envisaged that 6m draft shall be available at this berth over all tide conditions (this happens to be the minimum depth that a cutter suction dredger can effectively dredge). This corridor will need to take the form of a jetty structure suitable for heavy vehicular loads or reclaimed land (sheet piled on the eastern berthing face).

Third Party Rail Siding to Support Utah Point

The Western Australian Government is negotiating third party access arrangements to the railways of BHPB Iron Ore and Pilbara Iron. Figure 4-8 describes the preferred arrangement for a siding off BHPB’s Finucane Island railway with rail car discharge hopper near to Utah Point. Any small miners that may gain access in the future to BHPB’s railway will be able to develop and use the siding and rail car dumper to deliver their ore to the stockpiles on Stanley Point prior to shiploading at Utah Point, subject to availability of capacity, or transfer of capacity from road hauled to rail hauled.

Second Port Authority Bulk Minerals 150,000 DWT berth at Stanley Point in South West Creek

In light of the successful private / public development of the Utah Point berth ($120M funded by the Port Authority and $105M funded by the private sector), and the rapid take up of capacity, potential exists for the development of a second multi user Cape size Port Authority Class B berth (up to 150,000 DWT) up South West Creek with contributions from foundation customers. Such a berth could be serviced from the Port Authority’s bulk minerals hub at Stanley Point with sufficient stockyard area to service rail hauled or pumped product (magnetite). This would offer interchangeability of product feed to either the Utah or Stanley Point berths. This berth would be built as per the existing Port Authority berths and Utah Point berth of concrete slab construction with the versatility to handle all future trades including Boodarie Industrial Estate trades in due course.
Figure 4-8  Rail Siding and Rail Car Dumper at Utah Point
Small Commercial Craft Moorings

An area in West Creek sheltered behind and between the reclamation area in West Creek and the mangroves on Stanley Point is to be dredged and set aside for safe moorings for commercial fishing vessels, barges and construction vessels. Figure 4-9 looks more closely at the area in question.

Figure 4-9  Small Craft Mooring Area in West Creek

Provision is also being made for additional commercial craft and Navy vessel activity at the east end of Anderson Point. Any requirement for additional tug moorings would also be accommodated here. The planned access corridor (discussed above) between Wedgefield and the easternmost berth on Anderson Point will offer a support structure for these activities. The jetty will be sufficiently wide to provide an adequate service area and berthing support for rig tenders, construction barges, and Navy vessels. This service corridor structure could also provide the support needed for a floating landing platform to allow for roll-on roll-off cargoes to barges if there is a need for that type of activity. Figure 4-10 looks more closely at the area for these commercial craft activities.
Occasional moorings and a small craft launching ramp can also be located in the small dredged pocket behind the northern end of the proposed Utah Point berth. This pocket can access the main shipping channel through the gap between the Utah Point berth and the Finucane Island C Berth.

**Rail Service Corridor from Hinterland**

New iron ore exporters will want to access stockpile areas, as FMG has done, on the south and west sides of the harbour. New railways will need to approach the port from the south and to the west of South Hedland. It may be advisable for any new railways to be closely aligned as they cross the Great Northern Highway. This will make a future bridging of the highway over the railways simpler because it will involve only one bridge. These areas are outside the Port Authority’s jurisdiction but it is in the interests of the port that the Port Authority consult with the relevant Government and Local Government Agencies to plan and reserve a railway access corridor of sufficient width to accommodate the needs of at least three operators. The planned corridor should extend from the port to a distance of say 10 km south of South Hedland. Figure 4-11 shows the suggested corridor through the Boodarie area.
It is suggested that the main road servicing the Boodarie Industrial area be located to the south of the PEPL power station to avoid crossing the rail and SW Creek. The existing road to the BHPB HBI site to be realigned slightly and maintained for access to the infrastructure remaining after the removal of the HBI plant as well as rail loop access. This to remain as an at grade crossing of the future rail lines.

**Figure 4-11  Railway Access Corridor to South and West Sides of Port**

Realignment of South West Creek Floodway

In extreme flood events caused by heavy rainfall, the culverts under the Finucane Island Road and railway draining the South West Creek into the harbour are inadequate to handle the volume of water. A floodway to bypass a portion of this water to the west of the port and into the mangroves already exists. With the proposal to build the railway access corridor described above, we recommend that the existing floodway be realigned to run parallel and to the south and west of the proposed railway.
access corridor. Culverts constructed under any new railways equivalent to those existing under the Finucane Island Road and railway will ensure that normal high tide inundation of the upper reaches of South West Creek will be maintained. The realigned floodway is identified in Figure 4-11 above.

The rail line crossing South West Creek to the HBI plant rail loop site is to be designed to withstand the South West Creek flood waters.
5. OUTER HARBOUR DEVELOPMENT OPPORTUNITY

5.1 A Preliminary Concept

The Port Authority has conceived the concept of a multi-user Outer Harbour located to the north of Finucane Island. This has arisen out of the demand for capacity to load greater volumes of iron ore than can be accommodated within the Inner Harbour. Although dredging of the existing channel could create additional capacity for the Inner Harbour, the Port Authority’s experience with dredge standby costs associated with shipping movements early in 2007 with a small dredging exercise suggests that deepening and widening the existing channel is not a viable option.

Reference 3 discussed the demand for iron ore from the Pilbara and projected export levels to 2025. These are discussed in Section 2. With a waning of interest from the major ore exporters in the possible new port site at Ronsard, there is greater interest in expanding capacity at Port Hedland.

The concept shown in this Section is simply that, a concept, and it should not be interpreted as a proposal. The Port Authority, in conjunction with industry and the State Government has begun a process of identifying the issues associated with such a plan and considering alternative arrangements that overcome the shortcomings of this very preliminary starting concept.

Although this is a preliminary concept, there are good reasons to pursue it vigorously. Some of the benefits of this proposal are:

- An Outer Harbour and the increased throughput that it would support will create additional employment in Port Hedland and the additional population will be able to support an improved array of services and amenities,
- Consolidating exports at an existing town rather than constructing a new port such as that mooted at Ronsard Island will save the need for creating a new set of public infrastructure with the high costs associated with that,
- A new and separate channel will reduce the risks associated for large companies like BHPB in having all of its exports reliant on a single channel. An incident causing a ship to sink and block the channel, possibly for months, will do enormous harm to an exporter. Not only will the exporter’s income stream be stopped until the channel is reopened but also there will be long lasting damage to confidence from international customers who rely on a steady supply of ore,
- The Outer Harbour proposed will be able to handle larger ships and there are considerable freight cost advantages to be achieved with the larger vessels. To optimise the capacity of the Inner Harbour, berths providing capacity beyond 320 Mtpa will be restricted to ships having a loaded draft generally not much greater than 15 metres. The freight rate savings of the large ships that will be able to load at the Outer Harbour will be even greater when compared to
vessels with a restricted draft. Economics will drive the Class B berth export capacity moving to the Outer Harbour when that comes on stream,

- The environmental impact associated with developing a second port at Port Hedland shall be substantially less than developing a new port along the coast,
- Providing for growth in exports of iron ore from Port Hedland through an Outer Harbour will allow for berths within the Inner Harbour to support the development of the Boodarie Industrial Estate, and
- It is more likely that a proposal such as this can be developed more rapidly than an entirely new port on an isolated part of the coast. Given the rapid growth in demand for supply, this may be the best way to create the export capacity required in the time available.

5.2 Capacity Objectives

The aim is to develop a viable and sustainable concept for an Outer Harbour that has a minimum throughput capacity of 400 Mtpa of iron ore.

Recognising that there are considerable freight rate savings to be achieved to shippers using very large bulk cargo vessels, the Outer Harbour concept will be tested for a design vessel having the following dimensions:

**Design Vessel**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length between perpendiculares</td>
<td>325 metres</td>
</tr>
<tr>
<td>Breadth – Moulded</td>
<td>60 metres</td>
</tr>
<tr>
<td>Depth – Moulded</td>
<td>28.15 metres</td>
</tr>
<tr>
<td>Draft – Loaded</td>
<td>18.10 to 21.0 metres</td>
</tr>
<tr>
<td>DWT</td>
<td>270,000 to 323,200 tonnes</td>
</tr>
</tbody>
</table>

Vessels of this design can be accommodated within the Inner Harbour but cannot be fully loaded. With the assistance of very high spring tides, a loaded draft of 19.0 metres is the maximum possible and 18.5 is more normal.

5.3 Elements of this Initial Concept

In the 2003 UDP an “Outer Harbour Development” was detailed on the plans off Finucane Island, intended for crude oil imports, methanol, LNG, LPG, and ammonia. The need to provide berths for these products in the long term is still applicable as discussed in Section 2. Section 8 discusses provision for these types of Outer Harbour terminals. The “Outer Harbour” of the 2003 UDP did not conceive an alternative offshore iron ore loading facility.
The concept described in Figure 5-1 is for a multi-user iron ore loading terminal. The intention is that individual companies would be able to build and operate their own railways, stockpiles and shiploading facilities with significant common user elements such as the channel, turning and berthing basins being shared by the companies.

The concept shows a new channel, which, although totally separate in Figure 5-1, may join the existing channel in deep water. This would be dredged to a depth suitable to the nominated design vessel. Four loading streams, each of 3 berths and 2 shiploaders, and each with a capacity of 100 Mtpa have been indicated, although 4 berth / 2 shiploader loading streams will also be investigated.

Consideration will be given to using some of the spoil to reclaim an area off the north shore of Finucane Island for possible use as surge stockpiles. The reclaimed area would need to be above high tide and be surrounded by a perimeter bund that is sufficiently high and well armoured that it will hold out storm surge and extreme cyclonic waves.

Another possible stockpiling arrangement envisages a very large reclamation area on the north shore of Finucane Island to support the main iron ore stockpiles. Of the options for delivering ore to the stockpiles, one would be for rail loops surrounding the stockpiles on the reclaimed area. Any option that involves large open stockpiles in the vicinity of Finucane Island would have serious environmental dust implications; this would need modeling before being seriously contemplated.

The concept of Figure 5-1 envisages the location of the main stockpiles further to the south in Areas A, B, G, H or I with the product conveyed from there to smaller surge stockpiles or bins closer to the loading berths. In this circumstance any reclaimed area would be small if required at all and the issue of creating access for railways onto and across Finucane Island is removed.

5.4 Considerations and Further Studies

The concept of Figure 5-1 raises a number of serious considerations that require further study before an optimum Outer Harbour option can be determined. These considerations and further studies include:

- Detailed wave, tide and current measurement and analysis,
- Assessment of the exposed conditions (to swell) on vessel moorings and berth operability,
- A computerised simulation of the port to confirm its capacity,
- Geotechnical investigations to determine the ground conditions for dredging and berth construction,
- An assessment of dredging volumes and spoil disposal options,
- An assessment of reclamation methods and the availability of armour material,
- The engineering issues associated with rail access to the reclamation area and of constructing rail car dump hoppers,
- The cumulative impact of wind blown dust from the stockpiles and handling operations on Port Hedland and South Hedland should be modelled,
- Environmental implications of a development of this scale including the significant dredging of a new channel, spoil disposal at sea (if required), reclamation on the reef foreshore, impact on marine species (eg turtles), and disturbance to mangroves,
- The cost of developing the concept, and
- Opportunities to expand the Outer Harbour if required, including the ability to accommodate bulk hazardous liquids as set out in sections 2.3.1 and 2.5.2.

Studies have begun to assess these issues and to identify options to mitigate any areas of concern to acceptable standards.

Figure 5-1 Outer Harbour Concept
6. ENVIRONMENTAL SUSTAINABILITY

The 2003 UDP identified three major issues that might create a constraint to development of the port. Those three issues are mangroves, dust and noise. A number of other issues which were seen to be less likely to be the cause of a constraint to development were also identified. This Section discusses each of these issues and their relationship with the UDP.

6.1 Mangroves

6.1.1 EPA Guidelines

As noted in Section 1, Introduction, The EPA issued its Guidance Statement No 29 (Reference 2) in 2004, after completion of the 2003 UDP. The main reference applied in preparing the 2003 UDP was EPA Guidance Statement No 1 (Reference 8) titled Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline.

The application of Guidance Statement 29 to the 2005 assessment of the FMG proposal for an iron ore export facility located on Anderson Point identified the extent of mangrove disturbance that had taken place within the harbour since 1960. It also identified the areas of mangroves to be disturbed under the approved proposals for both the Hope Downs and FMG proposals. The implication was that, beyond the Hope Downs and FMG developments as proposed at that time, other developments proposed in the 2003 UDP may not have received EPA approval.

Guidance Statement 29 limits the area of benthic primary producer habitats disturbed to 10% in a nominated management unit.

6.1.2 Area of Mangroves Disturbed

In 1960, the total area of mangroves existing within the Port Hedland management unit, as defined under Guidance Statement 29, was 2,676 Ha. Since 1960, 253 Ha of mangroves have been disturbed.

Further approved mangrove disturbances are 89 Ha for the Hope Downs project and 15 Ha for the FMG project. This brings the total for the Port Hedland management unit to 357 Ha which represents a 13.3% cumulative loss of mangroves since 1960. This was the situation in mid 2005.

It is now apparent that the Hope Downs project as proposed will not proceed. If the 89 Ha that would have been disturbed are deducted from the approved cumulative loss, the total losses associated with existing developments, including FMG, is reduced to 268 Ha. This equates to the maximum allowable of 10%.

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Additional areas of mangroves that will be disturbed if the Ultimate Development Plan, as described in Section 8, is fully developed will amount to 48.5 Ha. This represents a further 2% loss of the mangroves within the management unit. Without offsets, this is unlikely to be acceptable within a strict application of Guidance Statement 29 without offsets of some form.

### 6.1.3 Offsets and Mangrove Repropagation

The Port Authority has employed the V & C Semeniuk Research Group (VCSRG) to study mangroves in the harbour and the potential for their repropagation. The VCSRG has submitted a draft report titled *Port Hedland Mangrove Study – Mangrove Habitat Offsets and Trade-Offs*.

EPA draft Guidance Statement No 19 deals with the subject of *Environmental Offsets* (Reference 9). The VCSRG report notes there are two approaches to providing offsets for any loss of mangrove areas which are in essence:

1. A trade-off where a given existing wetland area elsewhere is set aside as a conservation reserve in place of an area of loss, and
2. The creation of an area that attempts to re-create the functions of the mangrove area that will be disturbed.

The Port Authority wishes to pursue the option of repropagation to re-create the functions of the mangrove areas that will be disturbed. Figure 6-1 identifies an area that the Port Authority proposes to set aside for mangrove repropagation.

The area shown can support a tidal creek and mangrove area of at least 80 Ha (Total of Area J is 146 Ha). This will offset, in terms of area, the mangrove areas that will eventually be disturbed under the plan outlined in this report.

The aim of repropagation is not just to replace the area of mangrove lost but is, as far as is possible, to replicate the habitat, vegetation structure, vegetation composition, and ecological composition of the mangrove communities disturbed. The VCSRG report analyses the potential for replication of inner harbour mangrove habitats and their usefulness. The report goes on to identify a number of the more important (i.e., highly productive ecologically) habitats that can be cost effectively replicated.

The conclusion that is drawn from the VCSRG report is that by carefully locating the tidal creek systems intended as replicates of those disturbed, the ecological productivity of the Port Hedland harbour area could be increased.
6.2 Offshore Reef Areas

Development of the Inner Harbour in accordance with this plan will not cause further disturbance to the offshore reef systems. The development of an Outer Harbour as discussed in Section 5 will, however, involve dredging and perhaps reclamation of areas of offshore reef. The implications of that disturbance will need to be considered in more detail as part of the planning and investigation process for the Outer Harbour.

6.3 Fauna - Turtles

Of marine fauna, the most sensitive to developments is the turtle. Turtles are known to return to the same beach where they were hatched to hatch their own young. The loss of a beach through development will break the breeding cycle and put the reproduction of turtles at risk.

There are no known hatching beaches used by turtles within the Inner Harbour so most of the developments discussed in this plan do not pose a risk to turtles. No research has been undertaken into the use by turtles of the northern foreshore of Finucane Island. If an Outer Harbour such as that

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discussed in Section 5 is to be developed, a study into what, if any, impact on turtles may result from the proposed development will be an important element in the consideration of the proposal.

6.4 Marine Water Quality

6.4.1 Industrial Waste Discharge

The discharge of industrial wastes into port waters is not an issue today. In the longer term, with developments at Boodarie and with an expansion of Wedgefield, vigilance will be required to ensure that this remains the case.

6.4.2 Product Spillage During Loading

Product spillage during cargo handling has occasionally been of concern. This is particularly so for the concentrates and heavy metals loaded at No 1 Berth. The relocation of chrome and manganese to the new berth at Utah Point will leave only the concentrates being loaded over the shiploader at No 1 Berth. The handling characteristics of the concentrates are considerably different to those of the other minerals loaded; the relocation of other than concentrates (i.e. dry bulk minerals) will allow the Port Authority to make changes to the shiploader at No 1 Berth which should overcome any ongoing problems.

6.4.3 Dredging

Dredging is an essential part of developing, and maintaining depth in, the port. Cutter suction and trailer suction dredgers typically create a plume of suspended sediments around the cutter or trailer head respectively. These plumes are of short duration as the dredge will not operate continuously during any campaign, and often a campaign will only take a matter of months. There is no recorded deleterious affect to the marine environment from the operation of dredging equipment.

The reclamation of land using dredge spoil, typically produced from a cutter suction dredge, can be carried out in a manner such that water from the reclamation area is retained sufficiently long that all sediments settle in the reclamation area and any waste water flowing back into the harbour is clear.

In light of the projected increase in shipping and the likelihood of a second channel to be maintained the Port Authority envisages reducing the frequency of channel maintenance dredging from 3 years to annually. This will reduce the sediment accumulation within the channel, afford increased sailing drafts, lesser short loading of ships, greater port capacity and profitability of the iron ore producers. More frequent dredging of berth pockets will avoid contaminant levels building up and permit continued disposal at sea. Notwithstanding this the Port Authority shall seek to develop settling ponds within development area C to dispose of any contaminated silt from the berth pockets that may occur in the future.
The benefits to Western Australian Ports in having a shared maintenance dredger, which shall likely be shared with Bunbury and Geraldton are significant. In recent times the costs to undertake dredging have escalated more than three fold, as well as a lack of availability. High costs of mobilisation and demobilisation are a major constraining factor including the requirement to drydock dredgers prior to entering Australia as a requirement of the Australian Quarantine Inspection Service (AQIS) and the doubling up of crews during maintenance campaigns.

6.4.4 Oil Spillage

Oil spillage into the harbour from commercial shipping is a rare event. Disposal of contaminated bilge liquids into the harbour is prohibited and the incidence of accidental discharge is rare.

The occasional accidental spillage of petroleum products from dredgers, small commercial craft such as fishing vessels, and from recreational craft has been experienced. On one occasion, the escape of lubricating greases from the submerged moving parts of a dredger required action. The bunkering and servicing of small craft in the port also represents a risk.

The risk of spillage is managed through regulated procedures overseen by the Port Authority. If a spillage does occur, the Port Authority has the equipment and trained personnel to contain and clean up spills of moderate size. In the unlikely event of a major oil spill incident, State and National Plans can be implemented with equipment and personnel being mobilised from other centres.

6.4.5 Ballast Water Discharge

The discharge of ballast water in ports is governed by international policy and Australian legislation. The discharge of ballast water is permitted in Australian ports provided certain protocols have been satisfied. Ships are required to exchange their ballast with clean seawater during transit from one port to the next. The Australian Quarantine Inspection Service (AQIS) is responsible for ensuring that ships comply with the protocol.

In a bulk loading port such as Port Hedland, the discharge of large quantities of ballast water is essential during the loading of a ship. Alternatives to discharge into harbours have been considered including pumping to onshore tanks for treatment and chemical treatment onboard the ship. No viable alternative has yet been identified so the mid-ocean exchange protocol remains the approved treatment of ballast water; this mid-ocean exchange does provide some protection against the introduction of foreign marine pests.

There is a common misperception that ballast water is linked to bilge water; the latter is often contaminated with oils and other toxic liquids. The key issue with ballast water is the possibility that it may contain foreign marine species that may be destructive to indigenous species. It is worth noting that commercial shipping has not been responsible for those incidents of introduced foreign marine pests in Australia; the transport medium has been identified in these cases as either small commercial or recreational boats.
The Port Authority has undertaken in depth base line studies of the port of Port Hedland and has a continuing involvement in the monitoring of marine pests in ports as part of a Western Australian Port Authorities Association collaboration with the department of Fisheries.

6.4.6 Anti Fouling Paints

Anti-fouling paints containing organotins (e.g. Tributyltin or TBT) have been a source contaminants detected in berth pocket sediments. It was not uncommon for older paint treatments to flake and fall to the sea bed; during shiploading operations this meant that the flakes were trapped in the berth pocket sediments. The extent of these contaminants in Port Hedland harbour waters was very small and quite manageable.

In 1997 the Australian and New Zealand Environment and Conservation Council (ANZECC) issued a Code of Practice for all commercial vessels in Australian waters. It prohibits in-water removal of fouling with an exception for emergency conditions. Before sea chests or propellers can be cleaned the administering authority must be given 5 days notice, including details of the collection process and disposal of removed material. The Port Hedland Port Authority prohibits any in-water removal of fouling which may cause the introduction of foreign marine pests or cause harmful anti-fouling paints to fall into the water.

The IMO’s *International Convention on the Control of Harmful Anti-fouling Systems on Ships* (AFS 2001) requires that from January 2008 no ship shall have anti-fouling systems containing organotins (e.g. TBT). These harmful anti-fouling paints shall not be present on the hull with old TBT either to be removed or sealed by applying a coating that prevents leaching into the water. Australia was the first signatory to the Convention.

6.5 Dust

6.5.1 Wind Roses

Airborne dust is dispersed according to wind direction and strength. An understanding of the likely areas to be impacted by dust and of the extent of impact can be gained by a review of wind roses for Port Hedland.

Wind roses have been generated for the 1998-2004 time series, and in monthly intervals. The overall wind rose is shown in Figure 6-2.

Figure 6-2 indicates the wind is either from the North-West (most dominant) or the South-East. Monthly wind roses indicate the north-westerly winds are most prevalent from September-February, and the south-easterly winds generally occur from March-August.
These prevailing winds cross the western end of Port Hedland from the existing bulk mineral operations in the port and this coincides with the high TSP concentrations monitored at the Harbour Monitoring location.

Figure 6-2  Wind Rose for the dataset 1998-2004

6.5.2 Dust Dispersion Modelling

There have long been concerns about the level of dust in Port Hedland. Ambient levels of total particulates are known to exceed the National Environmental Pollution Measure (NEPM) criteria on a number of occasions each year. The large volumes of mineral products held in stockpile and loaded onto ships at Nelson Point, at the Port Authority berths and at Finucane Island are sources of dust that, when added to the ambient levels, create dust levels that regularly exceed the NEPM criteria in the western part of Port Hedland.

An important question that arises for the implementation of this Ultimate Development Plan is how the new developments proposed in this plan will impact on dust levels, not only in Port Hedland, but also in other receptor areas such as Wedgefield and South Hedland. Detailed modelling to predict dust levels is beyond the scope of this report. However, some guidance can be taken from the recent modelling carried out by Sinclair Knight Merz Pty Ltd (SKM) on behalf of the Port Authority. WorleyParsons has been given access to a draft report prepared by SKM relating to the proposed Utah Point berth development.
The SKM work modelled the current operation based on 2004/05 data and compared it with a development scenario that includes the Utah Point Berth handling 9 Mtpa of product, BHPB’s facilities at Nelson Point and Finucane Island exporting a combined 152 Mtpa of iron ore, and FMG exporting 45 Mtpa of iron ore from Anderson Point. The most publicly available up to date dust levels were used, taken from the Port Hedland Harbour Dust monitor, Port Hedland Hospital Dust Monitor, South Hedland Dust Monitor and Wedgefield.

For dust particles of the size of 10 microns or less (PM$_{10}$), the NEPM criteria stipulates that the maximum concentration, averaged over a 24 hour period, should not exceed 50 µg/m$^3$ on more than 5 occasions per year. The SKM study also compared the results of its modelling to the limit of 150 µg/m$^3$ for residential areas stipulated in the Kwinana Environmental Protection Policy (EPP) (EPA 1999) to assess the potential amenity impacts. The results of the modelling are summarised in Table 6-1.

### Table 6-1  Comparison of Predicted PM$_{10}$ concentrations in Port Hedland

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Maximum 24-hour Average (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Operation</td>
</tr>
<tr>
<td>Harbour Monitoring Location</td>
<td>97</td>
</tr>
<tr>
<td>Hospital Monitoring Location</td>
<td>109</td>
</tr>
<tr>
<td>South Hedland High School</td>
<td>8</td>
</tr>
<tr>
<td>Wedgefield</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Proposed Utah Point Development</td>
</tr>
<tr>
<td>Harbour Monitoring Location</td>
<td>87</td>
</tr>
<tr>
<td>Hospital Monitoring Location</td>
<td>69</td>
</tr>
<tr>
<td>South Hedland High School</td>
<td>12</td>
</tr>
<tr>
<td>Wedgefield</td>
<td>24</td>
</tr>
</tbody>
</table>

The predicted decrease in PM$_{10}$ concentrations at the Harbour and Hospital Monitoring locations is due to a combination of causes including:

- All crushing and screening operations at the BHPBlO Nelson Point operations will cease;
- Certain stackers/reclaimers and transfer stations at Nelson Point will be decommissioned; and
- PHPA will be relocating high dust emitting operations to Utah Point.

Although the SKM report did not identify the specific cause of the predicted increases in concentrations at South Hedland and at Wedgefield, it is likely that the proximity of the iron ore operation on Anderson Point commencing in 2008 will be a substantial contributor. Modelling was based on a scenario that proposes stockpiles on Area A and berths on Anderson Point handling 45 Mtpa.

Area A has capacity to support an export operation in excess of 200 Mtpa which equates to the capacity of all future berths on Anderson Point, assuming they are all dedicated to iron ore exports. Even ignoring the use of Area B for stockpiling bulk mineral products, an increase in stockpiles in

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Area A alone of 4 to 5 times that modelled could cause the dust concentrations in Wedgefield to exceed the NEPM criteria. This crude assumption is based on a linear extrapolation of the increase in predicted concentrations proportional to the increase in iron ore throughput.

A further growth in throughput of mineral products beyond that modelled is likely to create a further increase in dust levels in South Hedland. Beyond that, it is difficult to make an assessment of the quantum of the increase based on the data available.

Dust in Port Hedland is a factor of significant concern to the Port Authority. The Port Authority shall endeavour to minimise the impacts of dust from future developments.

It is recommended that further modelling of dust be carried out to determine the likely impact of developments on a scale commensurate with those foreshadowed by this plan. Where modelling indicates unacceptable dust concentrations, mitigation options will need to be considered.

6.6 Noise

Noise levels in the western end of Port Hedland are known to exceed the levels that are acceptable according to the Environmental Protection (Noise) Regulations 1997 (Noise Regulations). Given the nature of industrial port activity that causes the high noise levels has been carried out for some forty years, the primary focus is not to prohibit the existing noise sources but to manage the cumulative noise levels. This means that particular efforts are required to mitigate the noise from new developments so that the cumulative level in the western end of Port Hedland is not increased and is, preferably, reduced.

Unlike dust for which the NEPM criteria are guidelines, acceptable noise levels are regulated and new developments must demonstrate that they satisfy those regulated noise limits. As with dust, detailed modelling to predict noise levels is beyond the scope of this report. Nevertheless, the relevant question that needs to be answered in considering the implementation of this plan is to what extent the developments proposed in this plan will be constrained by noise levels.

Whilst it is recognised that future developments will generate additional noise, further modelling of noise is to be carried out progressively as expansions and new infrastructure are brought on line, with measures taken to minimise the impacts of noise from such developments. Where modelling indicates noise levels in excess of those limits nominated in the Noise Regulations, mitigation options will need to be implemented.
6.7 Storm Surge

6.7.1 Storm Surge Studies

PORT HEDLAND STORM SURGE INUNDATION STUDY, 1995
BUREAU OF METEOROLOGY/GEMS

This study (Reference 10) was commissioned by BHP DRI to develop site levels for the then proposed HBI plant. The study involved the modelling of storm surge using a nested hydrodynamic model accounting for cyclone induced flooding. The fine grid model of the Port Hedland area was comprised of 100m grid cells and included some of the special features such as levee banks and roads.

Port Hedland is extremely vulnerable to the effects of storm surge causing inundation during the tropical cyclone season. Most of the Port and town are below six metres Australian Height Datum (AHD). Consequently, the aim of the study was to establish the level of inundation expected at the subject site during 1 in 50 and 1 in 100 year events.

The study resulted in the revising downwards of earlier storm surge estimates generated by the Bureau of Meteorology due to the use of a more representative modelling approach. The resultant storm surge levels at Finucane Island were +5.1m AHD for the 50-year event, and +5.9m for the 100-year event. It should be noted that although the uncertainty and possible errors of the analysis were discussed, these were not included in the storm surge estimate. This is particularly relevant to the estimation of the wave-setup component, which was not modelled.

The Study Area was defined by eleven tag points at which storm surge inundation modelling was undertaken. The study indicated that for both the 1 in 50 and 1 in 100 year events: ‘inundation occurs more quickly to the west of Downes Island and through the harbour entrance. The rail/road acts as an effective barrier to the flow of water and contains the flood to the east of the (HBI) plant site. Because Finucane Island and the sand bars to its immediate south west act as a barrier, flow into the region on the western side of the road/rail embankment is restricted.’

GREATER PORT HEDLAND STORM SURGE STUDY, 2000
BUREAU OF METEOROLOGY/GEMS

This study represented an update of the earlier work, and was commissioned by the Town of Port Hedland, DRD and the Ministry for Planning. The work included the effects of catchment flooding to derive new estimates for the 50 and 100 year events. Although the scale of work conducted was large, there was little detail presented in the report to enable a thorough review of the methodology, particularly in the way the catchment modelling results were included in the general inundation model.

The results were not presented in tabular form for any of the previously assessed locations, however a CD database was provided for reference. It is understood that work was to be undertaken to render...
the results into a more usable format but the results of that work, if complete, were not available for consideration as part of this study. Although a 100m resolution was used, actual flooding and inundation response may be determined by finer scale features, such as drainage channels, natural levee banks etc. Another consideration that may be important is localised flooding in the townsite due to wave overtopping during extreme events.

The results show that flood levels vary considerably through the region, with a portion of Wedgefield lying within the 50-year flooding limit.

### 6.7.2 Storm Surge Implications for Development Plan

Reclamation levels equivalent to, or higher than, the 1:100 year event are recommended. A level of 5.9 m AHD is equivalent to 9.8 m CD, which is consistent with other port reclamation levels.

The reclamation of development areas A, B and C to a level of 5.9 m AHD should provide additional protection to Wedgefield as the fill will slow inundation. In addition, the new internal port road running across the north side of Wedgefield (refer Section 4.3.2) will provide further protection to Wedgefield from storm surge flooding.

### 6.8 Potable Water Supplies

The suppression of dust from stockpiles is typically performed by the application of water via sprinklers. Fresh or potable water must be used for watering stockpiles because higher salinity levels will introduce impurities that will adversely affect steel making in blast furnaces.

Some extension of the existing underground water supplies is possible and some additional underground water sources have been identified. These will provide for some expansion of industrial and port activity in Port Hedland but are unlikely to have sufficient capacity to cope with the scale of developments and demand for water foreshadowed by this plan. It is reasonable to assume that desalination will be required, as it has in Denham, Perth and Dampier, to provide the quantities that will be required for industrial purposes in the longer term.

Aurox Resources envisage the export of their titanomagnetite concentrate from Balla Balla by way of a slurry pipeline to the Port Authority berth at Utah Point where the product is dewatered and the water pumped back to Balla Balla in a closed circuit. This is a very efficient means of transporting the product 120kms to the port without impact on the road network.

The Port Authority believes, however, that potential exists to utilise this significant volume of water in Port Hedland for dust suppression purposes, the very low salinity of the Balla Balla bore water may be suited for dust suppression even if diluted with existing water supplies, failing which the costs to desalinate would be significantly less than sea water. The energy savings in not having to pump the water back to Balla Balla would also be significant. Other magnetite projects planned may also offer additional water supply options.
6.9 Power Supplies

The port and its associated industries are a very significant consumer of power. Conveyors, stacker / reclaimers and shiploaders are all high energy users. With the trade growth projected through this study, demand for power will grow to be several times greater than it is at present.

Port Hedland is connected to the Pilbara grid which is supplied by power stations at Dampier, Wickham and Port Hedland. The Port Hedland power station is driven by gas delivered by pipeline from Dampier. The gas pipeline from Dampier has considerable capacity so expansion of power generation at Port Hedland is not likely to be difficult in the short term.

In the longer term, it is likely that power generation beyond that which can be supported by the existing gas pipeline will be required. Given the close proximity of the North West Shelf gas resources and the efficiency of gas as an energy source for power production, upgrading of the piping capacity from Dampier and further gas fired power generators at Port Hedland would be an appropriate means of expanding power generation capacity to meet the projected growth in demand.
7. **SOCIAL SUSTAINABILITY**

The Port Authority recognises the importance of supporting community projects and actively participating in improving the Town.

7.1 **Key Features of the Plan**

This plan looks to optimise the economic development of the Port of Port Hedland consistent with the sustainable development of the Town of Port Hedland and its services. This plan is consistent with the Town of Port Hedland’s Land Use Master Plan 2007 and it offers the following features that support the sustainability of Port Hedland’s community:

- Significant trade and industrial development well into the future that will bring with it additional jobs and continued prosperity for the residents and businesses in Port Hedland,
- Recognition of existing land uses and communities and the establishment of on-site and off-site buffers to avoid conflicting land uses,
- Recognition of sites of heritage value,
- Support for industrial and eco-tourism opportunities at Smith Point and adjacent to Marapikurinya Park,
- Support for recreational boating facilities; specifically through support for a marina located on the Spoil Bank and by developing improved road access to the boat launching facility at Finucane Island,
- Reduction in the number of heavy road trains accessing the Port along Wilson Street,
- Reduction in some types of mineral dust in the west end of the Town by the relocation of some trades to the west side of the harbour,
- Support for a single enlarged rail corridor for future railway lines to access the west side of the harbour, and
- Support the realignment of the Great Northern Highway to the rear of Wedgefield to also act as a storm surge barrier should this be deemed the preferred solution.

7.2 **Economic Benefits**

In Section 2 it was pointed out that flowing from the projected increase in trade in the next 5 years alone the gross estimated value of the commodities passing through Port Hedland could grow from about $9 billion in 2007 to nearly $29 billion by 2012. Putting aside consideration of the work opportunities that construction of new infrastructure will create, the operational phase of the increased trade environment will create additional long term jobs in Port Hedland.
In addition to the direct employment opportunities that will flow from this growth in trade, additional jobs will be required in related service industries. It would not be unrealistic to anticipate a total growth in long term job opportunities of 2,000 over this period with a population growth in Port Hedland of 4,000 to 5,000 people.

With further development of the port in the medium and long term, further increases in working and residential populations can be expected. These are likely to increase further once value adding industries start to be established on Boodarie.

A growth in population will provide the demand for improved quality and choice in medical and education services. It will support improvements in recreational facilities and both retail and commercial services. Economic activity and population growth will assist the sustainability of this regional town.

Developing a greenfield efficient high throughput Outer Harbour, capable of servicing the larger and more economic vessels that are evolving to service the Brazil trade, shall ensure that Australia continues to benefit from the significant freight differential and enhances its market share well into the future. This evolution will mitigate against any down turn in export volumes through Port Hedland. With the enhanced services, amenities, and critical mass in Port Hedland, significant economies of scale for proponents using Port Hedland will be achieved, greatly enhancing the long term sustainability of the town and port.

7.3 Buffers and Compatible Development

This plan proposes that a 500 metre on-site buffer be established to the north and west of Wedgefield. This buffer is described in Figure 7-1. Buffers should be established formally in accordance with the State Industrial Buffer Policy (Reference 7). The buffer to the west of Wedgefield can only be requested by the Port Authority following vesting of the triangular piece of Unallocated Crown Land to the west of Wedgefield.

Development within these on-site buffers will be limited to low impact uses such as light industry. The Port Authority is planning a light industrial development in the buffer area immediately to the north of Wedgefield. This development in itself will offer some additional protection to Wedgefield from storm surge water levels. The proposed buffer will allow the existing land use at Wedgefield to continue.

Low impact development is also proposed in the vicinity of the residential community at Redbank. As an example, the area described in blue in Figure 7-4 is within the port area, it is adjacent to the Redbank residential community and has been the subject of a proposal to develop a bio-diesel plant; a low impact and environmentally beneficial industry.

The LUMP recognises that, in the vicinity of the west end of the port town, it is not feasible to establish on-site or off-site buffers. The challenge of managing the impact of dust in particular on the...
neighbouring community will continue. The Port Authority supports the management measures recommended in the LUMP.

Where possible, 500 metre wide off-site buffers should be established to minimise the risk of incompatible developments occurring adjacent to the port in future. Figure 7-2 identifies areas adjacent to the port’s boundary where an off-site buffer can be established.

Figure 7-1  On-Site Buffers at Wedgefield

Figure 7-2  Off-Site Buffers on Port’s Southern Boundary
7.4 Aboriginal Heritage

Research undertaken at the Department of Indigenous Affairs confirms that numerous archaeological sites (of potential significance) exist within the Port Authority Reserve. The known or documented archaeological sites, in the main, comprise of midden and tool fragment deposits throughout the limestone ridge country. Other archaeological findings include shell and stone artefacts and limestone engravings. While these sites are numerous, it could be considered they are representative of similar sites in the hinterland.

In response to the Aboriginal Heritage Act, it is important to assess the likelihood of potential Aboriginal Heritage significance relative to the progressive expansion of the Port and undertake appropriate action. It is appropriate for the Port Hedland Port Authority to make application to the Department of Indigenous Affairs’ Aboriginal Cultural Material Committee, pursuant to Section 18 of the Act, to notify the Committee that progressive development of the Port will eventually lead to the damage of known sites. Therefore it is appropriate to liaise with the Department of Indigenous Affairs and those custodians responsible for known sites of significance and formally notify those parties of the likelihood of the damage to known sites. This will then trigger the Aboriginal Cultural and Materials Committee and the custodians to form an opinion as to whether the evaluated sites are of significance. The Port’s notification will then warrant a response from the Minister to either consent or decline the ability to damage the sites.

It is therefore evident that additional Aboriginal ethnographic and archaeological assessment is warranted, including consultation with the Aboriginal Cultural Material Committee and Aboriginal custodians. The associated notification is warranted to conclude the decisions of Aboriginal Heritage.

Given the timeframe for the Strategic and Ultimate Development Plan, this process is not considered to be preventative of progressive assessments and developments of the Port in accordance with the Aboriginal Heritage Act.

7.5 Industrial and Eco-Tourism Opportunities

7.5.1 Marapikurinya Park

The Port Authority has identified an industrial tourism opportunity at Marapikurinya Park. The Marapikurinya park development will have a coffee shop / restaurant and board walk, marine interpretive centre, and gallery with a link to the relocated airport control tower where the general public will be able to enjoy a view of the northern end of the port and inner harbour operations. In front of the development, moorings for small boats to tie up are proposed. Figure 7-3 includes architect schematics of the proposed development.

An Emergency Response Centre and possible offices as part of the Marapikurinya Park Development is also contemplated. It would be located behind the centre looking over the port and tug pens, possibly with a link to the old airport control tower.

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7.5.2 Smith Point Lookout and Mangrove Walk

This proposal will offer the public an opportunity to view the majority of the inner harbour and berths and to observe ships manoeuvring and berthing. Initially, the port proposes to establish a narrow limestone track (shown in white in Figure 7-4) following the limestone ridge wherever possible. This elevated alignment will give a good outlook. The track would be single lane with occasional passing bays to minimise the impact on the environment and to add to the appreciation of the port environs.

Subsequently, the Port Authority proposes to progress the development of a boardwalk structure through the mangroves (shown in green in Figure 7-4) to a lookout point on the mudflats on Smith Point. The Authority will construct the boardwalk in stages as its budget permits and it may seek outside contributions to expedite this development. It is from the lookout on Smith Point that an uninterrupted view of the inner basin will be enjoyed.

The proposed bio-diesel plant on the old power station site would be a development that is not only compatible with the existing residential occupancy of Redbank but would also be consistent with the
industrial / eco tourism theme of the Smith Point development. Lease revenue from the bio-diesel plant may also present the Authority with a means of part funding the track and mangrove boardwalk over time. The development of a board walk to Smith Point is in line with the feedback of the community as part of the Land Use Master Plan process.

Figure 7-4  Smith Point Lookout and Mangrove Walk

7.5.3 Hunt Point Access Track, Viewing Point and Beach

Figure 7-5 provides an aerial perspective of the alignment of the proposed track to Hunt Point (shown in red). The track would be aligned within the Port Authority's boundary and above the high water mark. It would be a limestone track with occasional passing bays and finishing at a graded parking area at Hunt Point. The route of the track will be winding and it will follow the contours to minimise impact on the existing ground. The public will have an opportunity to view the port from the western side of its entrance and will more easily be able to access the protected beach area at Finucane Island where the Port Authority proposes to establish some shaded areas. Access to Hunt Point will offer the public a third point from which to observe activities in the port.
7.5.4 Finucane Island Boat Ramp & Look Out to Outer harbour and Salmon Creek

As part of the Port Authority’s Utah Point berth development, it shall construct a new road to Finucane Island which shall ensure the general public continued access to the Finucane island boat ramp. In due course the Port Authority envisages the development of a low key track access up onto the limestone high ground outcrop including parking and picnic area to oversee the Outer Harbour development as well as the Salmon Creek pristine mangrove habitat.

7.6 Recreational Boating

7.6.1 Marina at Spoil Bank

Port Hedland has long needed protected moorings for recreational vessels. Recreational boating is restricted to trailerable sized vessels. Yachting in particular is very limited; shallow drafted trailer-sailer craft that can be launched at the existing boat launching ramp provide the only class of yacht that can be regularly used.

A marina concept was developed approximately 10 years ago. It was to be co-located with what is now the Town Boat Ramp on Richardson Street. This was the preferred site at that time but the disadvantages of the location have become more apparent over the last decade. Attention has returned to the idea of a marina at the Spoil Bank. Figure 7-6 shows the marina concept for the Spoil Bank site.
The Port Authority supports the development of a marina at the Spoil Bank through its continued participation as a member of the Spoil Bank Development Committee. The Port Authority has also pledged a sum of $100,000 towards the development of a boat launching ramp at the Spoil Bank which is likely to be incorporated in any future marina.

Figure 7-6  Possible Marina at Spoil Bank

The Main Street jetty shall continue to service the needs of small craft and local fishermen and shall be available for berthing the Leeuwin and even visiting super yachts.

7.6.2  Safe Haven for Small Commercial Vessels

There is a need for secure moorings for small commercial vessels that offer protection in bad weather. It has generally been possible to make adequate arrangements for those small craft that are associated with the port such as construction barges, work boats and, of course, the tugs. However, the opportunities for other commercial craft such as fishing vessels, charter boats and other tourist related vessels are very limited. These latter vessels offer the Port Hedland community diversity and additional opportunities for service industries.

As part of its proposal to fill West Creek, the Port Authority intends to dredge a narrow mooring area between the mangroves and reclamation area. This small anchorage will offer this type of small craft a safe haven and it will be a less risky proposition for these activities to be based in Port Hedland.

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7.7 Heavy Traffic on Wilson Street

The number of road trains accessing the port along Wilson Street is increasing. The road trains share this main artery into Town with not only commercial traffic but also with local domestic and tourist traffic. Risk of an accident involving a heavy truck and a light vehicle increases as the number of road trains increases.

The Port Authority proposal is to relocate the manganese and chrome trades to its Utah Point berth in the short term. In addition, it will pursue opportunities to relocate salt exports to Anderson Point and fuel trade to the rear of the harbour in the medium term. These moves will substantially reduce the heavy traffic on Wilson Street.

The present tonnages of these four products is 5.2 Mtpa and this is predicted to grow to 6.3 Mtpa by 2011/12. These tonnages represent average truck movements of about 270 and 350 respectively per day or one every 6 minutes reducing to one every 4 minutes.

7.8 Mineral Dust Reduction

Wind blown dust migrating over residential areas, particularly in the west end of the Town, have an impact on amenity and potentially on health for some long term residents. The LUMP proposes dealing with these issues by reducing the growth in density of long term residential units west of the Hospital and by promoting opportunities for short stay tourist related developments.

There are standards for levels of suspended particulate matter in the atmosphere and the existing exporters of mineral products are engaged in programs to reduce their contribution to the dust loads. Each new development is required to address dust issues as a part of its environmental approval process.

The Port Authority shall relocate both manganese and chromite exports in the short term from No 1 Berth to a new berth proposed to be constructed at Utah Point on the west side of the harbour. This will bring an immediate benefit to those living in the west end of the Town. In addition, in the medium term, the Port Authority will work with Dampier Salt with a view to relocating salt exports from No 3 Berth to a future berth to be constructed to the east of Anderson Point. This will bring some further benefit to those in the west end of the Town.

7.9 Rail Access Corridor

Rail access to the port has become a problem in recent years with the growth in trade, rail congestion and with a second major exporter, FMG, preparing to commence operations in 2008. The movement of trains creates noise issues in residential areas and level crossings at major road intersections is starting to cause delays and disruption to the smooth flow of road traffic. These issues could be exacerbated in years to come without planning for growth now.
The Port Authority proposes to work with Government to establish a single wide rail corridor to the west side of the harbour. Future growth in iron ore exports will be more to the west and south sides of the harbour. The major resources of iron ore exist in the East Pilbara and railways carrying product to the port will approach Port Hedland from the South East.

Figure 7-7  Proposed Rail Corridor to West Side of Harbour

The Port Authority has identified FMG’s railway alignment as one that could form the basis for an expanded corridor serving other companies and other railways. Such a corridor is shown in Figure 7-7.

A corridor on this alignment will allow trains to pass well to the west of South Hedland following flat gradients and large radius curves; these things will minimise the noise impact on South Hedland. Co-
locating the crossing of multiple railways across the Great Northern Highway will facilitate a single future road bridge over the railways.

Trains feeding product to Finucane Island from the Newman hub currently travel to the east and then north of South Hedland. In the future, it would be best if this rail traffic were directed to the west of South Hedland entering the port as part of the future western rail corridor. This would minimise the noise impacts on South Hedland but also significantly reduce the interaction with road traffic. The current spur at the Boodarie siding could be extended southwards to connect with the western rail corridor to service the Finucane Island rail traffic, negating the need for continued use of the Goldsworthy rail line between Wedgefield and South Hedland which would greatly simplifying the road network upgrades in this area. The rail could remain but its use would be significantly curtailed. This change would save around 3km on the haulage distance.
8. ULTIMATE DEVELOPMENT SCENARIOS

As with the Strategic Plans for the port, two scenarios are contemplated in putting together the Ultimate Development Plan. Scenario A envisages the Boodarie Industrial Estate fully developed with most of the remaining area of the Inner Harbour developed for the export of iron ore. Salt and the other smaller volume trades envisaged are also accommodated within the Inner Harbour as part of Scenario A. Scenario B envisages that the potential for iron ore exports through the Inner Harbour is maximised whilst also accommodating salt exports and the other smaller volume trades that do not rely on processing through the Boodarie Industrial Estate.

Scenario A envisages some “Outer Harbour” or offshore terminals for products from the Boodarie Industrial Estate requiring a greater “exclusion zone” than can be achieved within the Inner Harbour. However, the concept of an Outer Harbour for the export of far greater volumes of iron ore (see Section 5) is not included here. Assuming that the concept of an Outer Harbour for enhanced iron ore exports is proven over the next few months, the Ultimate Development Plan Scenarios could easily be adjusted to accommodate it.

8.1 Scenario A – Boodarie Industrial Estate Developed

8.1.1 Berths

The Ultimate Development Plan for Scenario A is at Appendix B. The UDP shows the berths described in the Strategic Development Plan for Scenario A and, in addition, it provides for 5 Berths in South West Creek and 4 offshore loading terminals to cater for imports and exports associated with the Boodarie Industrial Estate. The offshore bulk liquids terminals could simply be single point moorings with pipe connections.

In total, Scenario A provides for 23 Inner Harbour berths and 4 offshore bulk liquids terminals. Any berths for further iron ore exports constructed as part of an Outer Harbour (see Section 5) would be in addition to this number.

8.1.2 Inner Harbour Development Areas

The Inner Harbour development areas are described in Section 4.2 and included in the UDP.

8.1.3 Boodarie Access and Service Corridors

Service corridors linking the Boodarie Industrial Estate with the South West Creek berths off Anderson Point and Stanley Point respectively and the offshore terminals are described in Section 4.4.3 of this report.
The corridor linking the Boodarie Industrial Estate directly with Anderson Point is intended only for pipelines and conveyors. The alignment of this corridor crosses the FMG railway loop, BHPB’s Boodarie Siding and the Finucane Island road. The construction of at least two bridges, one with a significant span, for a heavy traffic fly-over would be a substantial and costly exercise. The bridging of conveyors and pipelines, on the other hand, can be achieved at a more affordable cost and the direct route will save conveyor transfer points and reduce operational costs compared to other alignments.

The other corridor running north out of the Boodarie Industrial Estate towards Finucane Island includes corridors for services, conveyors and liquid products. Road access from Boodarie Industrial Estate into the port is best handled via the Great Northern Highway, with high volume grade separated crossings to efficiently manage road traffic feeding either the Anderson Point or Stanley Point berths.

Pipelines out of Boodarie with product for berths at Stanley Point in the Inner Harbour or for offshore terminals will leave Boodarie and will continue north in a 100 metre wide corridor adjoining the west side of BHPB’s Finucane Island rail and road access corridor. Product piped to or from the South West Creek berths will need to be bridged over or tunnelled under BHPB’s corridor and the new Finucane Island Road with its associated services.

8.2 Scenario B – Bulk Mineral Exports Predominate

8.2.1 Berths

The Ultimate Development Plan for Scenario B is at Appendix B. As described in Section 4.4.2, the Inner Harbour berths of the Strategic Development Plan for Scenario B are the same as for this Ultimate Development Plan. Once again the number of berths total 23 with all but 3 berths dominated by iron ore exports.

Under this scenario, there is no space within the Inner Harbour to develop berths to take break bulk cargoes associated with the development of industries on the Boodarie Industrial Estate, unless the Outer Harbour is developed and the Class B iron ore capacity is transferred at that time to the Outer harbour. However, downstream petroleum processing plants could be developed on Boodarie with their associated requirement for four offshore hazardous liquids terminals.

8.2.2 Inner Harbour Development Areas

The Inner Harbour development areas described in Section 4.2 are equally applicable to Scenario B and are included in the UDP.
8.2.3 Boodarie Access and Service Corridors

No service corridor connecting the Boodarie Industrial Area and Anderson Point is required under Scenario B. Similarly, there is no requirement for pipelines from the Industrial Estate to the berths at Stanley Point.

However, a pipeline service corridor connecting the Industrial Estate to the offshore terminals and a road access corridor connecting the Industrial Estate with the port will be required. These would be similar to that described for Scenario A.
9. CONCLUSIONS & RECOMMENDATIONS

9.1 Summary

This document has presented an overview of the rationale used to guide the formation of an Ultimate Development Plan for the Port of Port Hedland. The result is a model for the Ultimate Development of the Port, together with a proposed Strategic Development Plan which projects development by 2025. This UDP will allow the Port Authority to manage the progressive development of strategic infrastructure without compromising the Ultimate Development Plan.

The Ultimate Development Plan is intended to ensure that the options and directions of future development at the Port are secured and can be integrated within the long-term planning of greater Port Hedland. The development of available land areas in Boodarie and within the Port Area will provide a potential level of throughput many times the existing levels of trade. These new trades will require a variety of vessel sizes and berth specifications which make the development of a flexible concept a necessity. The proposed development plans offer that flexibility and retain solid linkages to existing and future industrial areas. Implicitly, the Port should aim to be able to service not only the needs of a buoyant minerals export industry but also the requirements of a fully developed Boodarie Industrial Estate.

Consideration has been given to:

- Port planning objectives, including basin and berth geometries, and balancing marine and land support area capacities.
- Future tug and small craft requirements.
- Storm surge and drainage issues.
- Environmental issues, such as dust and the preservation of mangrove areas where possible.
- Planning issues, particularly in relation to the proximity of existing residential areas, and the need for adequate planning by the Port and Town to ensure no further encroachment of activities that will restrict the development potential of the Port.

The following sections summarise the proposed development plans as presented and discuss the future actions and studies required.
9.2 Trade Forecasts

Assessments of future trade show that iron ore exports will continue to be the predominant trade through the port, particularly in terms of volume. Other dry bulk mineral and mineral concentrate exports will also grow into the future. Other associated trades such as fuel imports and containerised / break bulk / project cargoes will grow substantially as exports of minerals from the area grow.

Demand for iron ore exports from Port Hedland could be as high as 525 Mtpa by 2025. Projections beyond 2025 are difficult to make with any confidence. Exports of 525 Mtpa are likely to require between 17 and 21 berths.

Provision needs to be made for export and import trades associated with value adding industries on the Boodarie Industrial Estate. When fully developed, it is expected that 6 berths would be required within the Inner Harbour and 4 terminals in the Outer Harbour. The Outer Harbour terminals would serve hazardous bulk liquid cargoes such as LNG and LPG.

9.3 Port Capacity

It has been assessed that the Inner Harbour has the marine capacity to serve iron ore exports in large cape sized vessels (at Class A – 1st priority loading streams) of 320 Mtpa. Additional export capacity could be achieved in ships of restricted draft (at Class B – 2nd priority loading streams) but this will involve developing berths within South West Creek for iron ore exports that will eventually be needed for trades associated with industries on the Boodarie Industrial Estate.

The report records the possibility of developing an Outer Harbour facility, in addition to the hazardous bulk liquids terminals discussed above, with separate channel with the capacity to support iron ore exports of 400 Mtpa. This is a preliminary concept only and is the subject of separate studies.

9.4 An Ultimate Development Plan

The Ultimate Development Plan has been developed on the basis of two industrial scenarios. Scenario A provides a more industrial development focus, with berth sites set aside and developed for break bulk and liquids trades associated with value adding industries on the Boodarie Industrial Estate, together with significant bulk mineral exports. Scenario B provides for the export of bulk minerals as the predominant use of the port. The future requirements of the Port will be preserved by planning for these two options because, within these options, there is flexibility to support a wide range of port activities, some of which may not be foreseeable today.

The plans for both Scenarios are consistent with the Town of Port Hedland’s Land Use Master Plan and appropriate buffers are provided to ensure that the likelihood of conflict between land uses is minimised. Environmental issues such as mangrove conservation and dust levels are managed under each option.

The WorleyParsons Group
The Ultimate Development Plan provides for:

- Up to 23 Inner Harbour berths, 4 offshore bulk liquids terminals, and a possible iron ore export facility as a new Outer Harbour with a capacity of up to 400 Mtpa.

- Under Scenario A, the provision of 6 general purpose berths in South West Creek with the capacity to service trades associated with future value adding industries on Boodarie Industrial Estate.

- Allowance for future development of an additional berth off Anderson Point to be shared for salt exports and iron ore (magnetite exports).

- A future location for tugs, a MOF/Supply Base wharf and Pre Assembled Modules receive berth at Lumsden Point. Another small commercial craft anchorage is proposed in South West Creek.

- Efficient road traffic corridors linking the East side of the port with the West side and linking the MOF facility on Lumsden Point in the north with the Great Northern Highway in the South are proposed. Conveyor and pipeline corridors linking Boodarie with Stanley and Anderson Points are also proposed.

- Relocation of dusty bulk handling from No 1 and No 3 berths to Utah Point, with the existing Port area retained for concentrates, general cargo, container traffic and fuel.

9.5 A Strategic Development Plan

A Strategic Development Plan is proposed based on the trade forecasts for 2025. A Scenario A and Scenario B Strategic Plans are provided. The Scenario A Strategic Plan does not provide sufficient berths within the Inner Harbour to meet the project iron ore volumes.

The Scenario B Strategic Plan maximises the development of the Inner Harbour to achieve the project demand for exports of iron ore; this Scenario B Strategic Plan is essentially the same as the Ultimate Development Plan Scenario B.

9.6 Actions, Further Studies and Recommendations

The report identifies a number of actions and further studies which will be progressed by either the Port Authority or proponents ahead of future developments proceeding, namely:

1. Cumulative dust modelling and assessment based on the Ultimate Development Plan to determine if development Areas A and B can be fully exploited for bulk mineral stockpiles.

2. An economic assessment of the costs and benefits of the concept of developing some of the berths in South West Creek on a temporary basis for the export of iron ore loading. Iron ore loading would continue from these berths pending development of an Outer Harbour, the relocation of the iron ore exports from South West Creek to the Outer Harbour, and the
redevelopment of the berths in South West Creek to service value adding industries established on Boodarie Industrial Estate.

3. The critical factor for the Port in achieving the Ultimate Development Potential is related to the delivery of gas to Boodarie (or the Port). This could either be from an offshore field or via land from Dampier, as with the existing PEPL pipeline. Strategies for future gas capacity expansion at Port Hedland need to be put in place. The Port offers strategic advantages for development over other similarly zoned industrial areas in the region, which could be marketed effectively by both the Port Authority and Government.

4. A feasibility study for an “Outer Harbour” hazardous cargo terminal should be undertaken, with the aim of providing safe, practical and economic options for the export of hazardous cargoes such as LNG, LPG and crude. [Port Hedland could be an alternative location for Browse basin LNG plants.]

5. The current feasibility study into an Outer Harbour development with a capacity to load 400 Mtpa of iron ore should be pursued and incorporated into this Ultimate Development Plan when complete.

6. A risk model for the Port should be developed, including present and future proposed industry and risk scenario profiles.

7. A database of all existing baseline environmental, hydrographic and geological information should be established by the Port, to ensure the efficient collation of all information for future development proposals.

Finally, the Port should seek endorsement for the proposed Ultimate and Strategic Development Plans from the WAPC, and seek advice from the EPA under Section 16 of the Act. These two actions will lead to the adoption of a robust planning tool and a clear map for future industrial and Port development.
10. REFERENCES


2. Environmental Protection Authority, Guidance Statement No. 29, Benthic Primary Producer Habitat Protection for Western Australia’s Marine Environment, June 2004.

3. WorleyParsons Services Pty Ltd, Port and Related Infrastructure Requirements to Meet the Expected Increases in Iron Ore Exports from the Pilbara, prepared for the Department for Planning and Infrastructure, February 2007.


6. Port Hedland Land Use Master Plan Steering Committee (assisted by Urban design Centre of Western Australia, Sustainable Consulting and EPCAD Consultants (Australia) P/L), Land Use Master Plan, prepared for the Town of Port Hedland, July 2007


8. Environmental Protection Authority, Guidance Statement No 1, Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline, April 2001.


APPENDIX A – DRAWINGS

Figure 4-1  Existing Infrastructure Including Approved FMG Facilities
Figure 4-3  Short Term (5 Years) Development Plan
Figure 4-6  Strategic Development Plan – Scenario A
Figure 4-7  Strategic Development Plan – Scenario B
Figure 8-1  Ultimate Development Plan – Scenario A
Figure 8-2  Ultimate Development Plan – Scenario B