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MEYRICK AND ASSOCIATES

Department for Planning & Infrastructure

Report for Kwinana Intermodal Terminal

Site Evaluation & Planning Study

December 2007

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Introduction

The Western Australian Planning Commission has commissioned GHD Pty Ltd and Meyrick & Associates to undertake a site evaluation and planning study for a proposed intermodal freight terminal to be located in the Kwinana area.

This report describes the study methodology, consultations undertaken, and investigations carried out. It provides a conceptual design for a preferred terminal option, and makes recommendations relating to the future design and construction of the terminal, and the protection of the required land.

Image 1 Intermodal terminal in Long Beach, USA

Definitions

An intermodal freight terminal may be defined as:

> *A site dedicated to the transfer of freight from one mode of transport to another, together with all the necessary support services and activities.*

An intermodal terminal does not exist in isolation. The terminal and its adjoining lands may be grouped by function, as follows:

i. **Core terminal:** A site containing rail corridors serving the terminal, all rail and road facilities for transfer of freight, storage and handling of containers and other goods, provisioning and servicing of rolling stock, management of rail wagons, management of containers and other maintenance activities.

ii. **Terminal Support Areas:** The land subdivision adjacent to the terminal that has a structure plan and land use that supports the terminal activities. Typical uses include transport operations and warehousing.

iii. **Industry Park/Cluster Development:** Land areas that support the core transport functions as well as providing the opportunity to enhance the terminal function through associated value added uses in areas surrounding the terminal.

Previous studies

A number of studies and policy documents have identified the need for additional intermodal terminal facilities within the Perth region. An additional intermodal terminal would reduce pressure on the Kewdale / Forrestfield complex, reduce the quantity of freight carried by road in the metropolitan area, and support the proposed Fremantle outer harbour. The relevant documents include:

- **1997 Dept of Transport study**, which identified two sites in the Kwinana area for possible intermodal terminal locations. The report recommended that land should be protected for the purpose of the terminal.
- The **Fremantle-Rockingham Industrial Area Regional Strategy** identified the Fremantle-Rockingham region, focusing on the Hope Valley-Wattleup area, as the best location for the future development of industrial land within the Perth Metropolitan Region.
- The **2002 Freight Network Strategy** states *Intermodal facilities, where the exchange of freight between modes can occur, are critical to the efficient functioning of the freight network. ….* And further it recommends as an action item: *Commence planning for additional or expanded intermodal facilities at Kewdale and Kwinana*
- **Fremantle Outer Harbour** (Kwinana Quay). Work on planning for the Fremantle Outer Harbour is well developed, including preliminary analysis of potential road and rail connections to support the Outer Harbour.
- **Latitude 32** – established under the Hope Valley-Wattleup Redevelopment Act 2000, and supported by a suite of documentation including a master plan and various planning, engineering and environmental reports..
- The **Kwinana intermodal terminal study stage 1** identifies the need for additional intermodal facilities in the Perth region. The study confirms that Kwinana is a suitable location for a major intermodal terminal in the Perth Metropolitan area from a supply perspective as it meets the key locational drivers for a successful intermodal terminal. The study also sets out recommendations relating to the required size of the terminal under various economic and operational scenarios.

The freight task

It is anticipated that the Kwinana intermodal terminal will primarily service the interstate freight task, with a smaller proportion of the throughput being intrastate. The quantity of international freight passing through the terminal will vary considerably depending on the location and form of the proposed outer harbour .

Through reference to previous studies, stakeholder consultation and discussion with the steering group, the target capacity of 1.2 million TEU/annum[1] has been adopted for the Kwinana intermodal terminal.

[1] **TEU** = twenty-foot equivalent unit. Container capacity is measured in twenty-foot equivalent units (TEU), a measure of containerised cargo capacity equal to one standard 20 ft (length) × 8 ft (width) × 8ft 6inch (height) container. In metric units this is 6.10 m (length) × 2.44 m (width) × 2.59 m (height), or approximately 38.5 m³.

The site

A number of possible locations were considered for the Kwinana intermodal terminal, but proved unsuitable for various reasons. The preferred site is located within Latitude 32 (Hope Valley Wattleup redevelopment area), between Russell and Rowley Roads.

The preferred site is adjacent to the existing Midland – Kwinana railway, has suitable topography, no conflicting land uses, and minimal environmental constraints.

Planning issues

The Hope Valley-Wattleup Redevelopment Act (2000) supersedes the Metropolitan Region Scheme within the redevelopment area. Under the act, Landcorp has the responsibility of establishing and implementing a master plan and various structure plans. The proposed terminal site is largely located within land identified for the purpose of freight industry within the structure plan.

Stakeholder consultation

The WAPC has established a steering group drawn from government departments and instrumentalities, to provide guidance and input to the study team

Interviews were conducted with all members of the steering group as well as representatives of the freight industry.

Five terminal concepts were prepared and presented to a stakeholder workshop. Input from workshop participants was invaluable in formulating the preferred option for the Kwinana intermodal terminal.

Site access

The preferred site has direct access to the Midland – Kwinana railway.

Road links will be provided within the Latitude 32 development area, connecting the terminal to the regional road network at Rowley and Russell Roads.

Access to the proposed Fremantle outer harbour will be dependent on which of the harbour options is adopted. The location and layout of the preferred terminal option would be highly conducive to interaction with the port via Rowley Road. If the Ankatell Road option is adopted for the port, the interaction would be less direct, but still reasonably efficient.


384000
388000
392000
6444000
6440000
6436000
6432000
LEGEND
Hope Valley Redevelopment Area
Proposed Road Links to Outer Harbour
Major Roads
Railway
Outer Harbour Options
Option 1
Option 2
Option 3
Option 4
SCALE
1:40,000
MEYRICK AND ASSOCIATES
KWINANA INTERMODAL TERMINAL STUDY
Figure 1:
Locality Plan

Terminal options

Five terminal layout options were developed and subjected to scrutiny by stakeholders and the steering group. All options were located in the preferred site, between Russell and Rowley Roads. The preferred option (Number 5) was developed further, taking feedback into account.

The recommended layout is flexible and accommodates both 1.8 kilometre long interstate trains, as well as shorter trains for intra-metropolitan haulage and the haulage to the Fremantle ports. The layout is conducive to a range of ownership and management models, as described in section 7.9 below.

Freight village

The intermodal terminal does not exist in isolation, and forms part of a "freight village" comprising the core terminal infrastructure, terminal support areas, and an industry park / cluster development. The design of the recommended option is conducive to the integration of freight activities with adjacent industrial and commercial land uses.

Recommendations

The study team make the following recommendations in relation to the Kwinana intermodal terminal:

Recommendation 1

The Kwinana intermodal terminal should be located within the Hope Valley Wattleup Redevelopment Area (Latitude 32), and between Russell Road and Rowley Road.

Recommendation 2

The Kwinana intermodal terminal should be arranged generally as shown on Figure 11 of this report.

Recommendation 3

A planning control area should be declared under the Hope Valley Wattleup Redevelopment Area Act (2000), covering the core terminal area as shown on Figure 11.

Recommendation 4

The land adjacent to the core terminal should be designated appropriately under the Hope Valley Wattleup Redevelopment Area structure plan. It will be important to ensure that terminal-related activities such as container parks are recognised and planned accordingly.

Recommendation 5

A site grading plan should be prepared covering the whole of the terminal area. Extractive industries licenses issued within the project area should include a requirement to construct finished ground levels in accordance with the grading plan.

Recommendation 6

Environmental recommendations contained in Appendix A of this report should be implemented.

1. Introduction

The Western Australian Planning Commission, through the Department for Planning & Infrastructure, has commissioned GHD Pty Ltd and Meyrick & Associates to undertake a study of a proposed intermodal terminal to be situated in Kwinana. The study follows on from previous work undertaken over a period of years, which identified the need for a terminal in the Kwinana area, and established certain parameters relating to the terminal.

1.1 Previous studies

1.1.1 1997 Dept of Transport study

In 1997 the Department for Transport commissioned Sinclair Knight Merz and Robertson Consulting to undertake an evaluation of land requirements for road-rail intermodal freight terminal facilities in the Perth region. This study identified two sites in the Kwinana/Cockburn areas for possible terminal locations. The report then went on to recommend that –

> *"Long term planning should recognise the potential of the WA Government Railways Kwinana intermodal terminal to service a future Kwinana Intermodal Sea Port and possible future interstate trade. The terminal environment should be protected for this purpose, and Land within the Kwinana Intermodal Terminal should be zoned for railway purposes."*

1.1.2 Fremantle-Rockingham Industrial Area Regional Strategy

The *Fremantle-Rockingham Industrial Area Regional Strategy* (FRIARS) identified the Fremantle-Rockingham region, focusing on the Hope Valley-Wattleup area, as the best location for the future development of industrial land within the Perth Metropolitan Region.

FRIARS identified the area for development as being regionally significant for the future industrial and economic growth of Western Australia. This judgement was based on long-term advantages of the area, including integration with existing industry, infrastructure accessibility and strong inter-regional links.

These attributes give the area a strategic advantage as a future industrial and employment centre over alternative locations. Additionally and equally as important, the proposed site qualities apply to a location that can provide a longer-term solution, specifically the establishment of a larger, integral industrial area as opposed to piecemeal, small- area initiatives.

1.1.3 2002 Freight Network Strategy

The 2002 Freight Network Strategy (FNS) Master Plan states -

> *"Intermodal facilities, where the exchange of freight between modes can occur, are critical to the efficient functioning of the freight network. …. The growth of the role of the Kwinana area in the freight task is an important strategic planning consideration. This area represents a key convergence point for road, rail and sea freight activities and the level of activity that is likely to occur in this location in the future may generate the demand for additional intermodal facilities. Planning should commence to assess demand, land and engineering requirements and potential impacts and options for such facilities should be protected through appropriate planning processes."*

Government and the FNS process subsequently endorsed the Priority Actions listed in the FNS Master Plan. Action 7 states -

"Commence planning for additional or expanded intermodal facilities at Kewdale and Kwinana."

1.1.4 Fremantle Outer Harbour (Kwinana Quay)

Work on planning for the Fremantle Outer Harbour is well developed, including preliminary analysis of potential road and rail connections to support the Outer Harbour. This work has also identified the need to set in motion a planning process to examine the need for, and location of, an intermodal terminal or terminals in this area to support the future Outer Harbour, the Kwinana Industrial Area, Australian Marine Complex, East Rockingham Industrial Area and the Hope Valley/Wattleup Redevelopment Area.

Approval has been granted to proceed with environmental investigations of two options – one with access via Rowley Road, and one with access via Anketell Road.

1.1.5 Latitude 32

LandCorp's Hope Valley/Wattleup Redevelopment Project (Latitude 32) recognises the importance of the Kwinana Industrial Area, the future Outer Harbour and has identified transport and related industries precincts within the master plan area.

A window of opportunity currently exists in relation to the Hope Valley/Wattleup Redevelopment Project.

1.1.6 Kwinana intermodal terminal study stage 1

DPI and partner organisations commissioned in May 2006, ARRB Group, Meyrick and Associates and GHD to investigate the potential development of an intermodal freight terminal in Kwinana (referred to hereafter as the Stage 1 report). This work is an investigation of the case for the development of an intermodal terminal in Kwinana, and includes an analysis of the potential demand for the terminal in the context of freight growth, existing terminals in the Perth region and the potential role and ensuing functionality of a new terminal. The operational and physical characteristics of a number of intermodal terminal options are also investigated.

This work produced the following conclusions:

- Demand for freight services is linked to changes in economic growth with a number of major studies identifying that regional and urban freight movements are strongly correlated to economic activity;
- The demand for intermodal terminal services in Western Australia has three segments, being the demand for international, interstate, and intrastate terminal services;
- In Western Australia the Kewdale/Forrestfield area has become a focus of domestic freight activity due to its road and rail access which enables the transport and distribution of goods to local, intrastate, and interstate destinations, and to and from the port of Fremantle. The predicted supply of intermodal terminal services will not be exceeded by the demand for intermodal services until after 2030. However, there are a number of events such as terminal operational constraints and congestion on road networks which could reduce the supply of intermodal terminal services and which could bring forward the need for an intermodal terminal in another metropolitan location;
- Kwinana is a suitable location for a major intermodal terminal in the Perth Metropolitan area from a supply perspective as it meets the key locational drivers for a successful intermodal terminal;

- The size, role, and operations of a new intermodal terminal at Kwinana would be dependant on a range of factors including the:
  - overall terminal throughput;
  - mix of core road/rail exchange and other activities on the site;
  - relative share of interstate, international and intrastate rail freight – each has different and not always complementary needs;
  - number of independent terminal, warehouse, and freight forwarder operations;
  - size and frequency of trains and how the cargo is handled to and from the trains;
  - road and rail access arrangements to and from the terminal;
  - buffer zone constraints.

The Stage 1 report makes recommendations on the area of land required for an intermodal terminal. Land is required for rail operations, for handling containers to and from the rail operation, for warehouses and other ancillary purposes, and for internal roadways. A conceptual intermodal terminal model has been developed.

Land requirements identified in the report are listed in Table 1.

Table 1 Notional terminal land requirements

Terminal throughput (TEU/yr)[2]		Warehousing	Container storage	Rail areas	Circulation, car parking	Total yard area
Total	**Rail**					
200,000	160,000	10.5	3.5	12.0	6.5	33
400,000	320,000	21.0	7.0	18.0	12.9	59
600,000	480,000	31.5	10.5	18.0	15.0	75
1,200,000	960,000	42.0	14.0	36.0	23.0	115

The report *Options for Outer Harbour Logistics Strategy* (Meyrick & Associates, 2005) identified container park requirements for the proposed Fremantle outer harbour. The capacity of the container park is related to the port throughput, ranging between 0.047 and 0.055 TEU of storage per TEU of port throughput. Based on these parameters, and three scenarios for port throughput, the following capacities were derived:

[2] **TEU** = twenty-foot equivalent unit. Container capacity is measured in twenty-foot equivalent units (TEU), a measure of containerised cargo capacity equal to one standard 20 ft (length) × 8 ft (width) × 8ft 6inch (height) container. In metric units this is 6.10 m (length) × 2.44 m (width) × 2.59 m (height), or approximately 38.5 m³.

Table 2 Container storage for outer harbour scenarios

Port Throughput (TEU)	Empty container park storage capacity (hectares)	
	0.047 TEU/TEU throughput	0.055 TEU/TEU throughput
500,000	22	26
1,000,000	44	51
1,500,000	66	77

It is apparent that a substantial quantity of land will need to be set aside for port container storage. It is likely that the majority of the storage will have to be "off dock" and a logical location would be adjacent to the Kwinana intermodal terminal.

The land area required for the port's container storage has not been included in the land requirement estimates for the Kwinana intermodal terminal in this report.

Image 2 A very large container park at Port Elizabeth, New Jersey

1.2 Stage 2A (This study)

Key tasks of the current study are:

- Determine site selection criteria and undertake a site selection analysis.
- Define site options within the Hope Valley/Wattleup area.
- Assess selected sites in terms of suitability
- Identify land use planning issues

1.3 Stage 2B

Undertake detailed site analysis of the preferred site, which will allow land to be appropriately reserved or zoned or otherwise controlled under the Hope Valley Wattleup Redevelopment Area Structure Plan, and purchased when required.

1.4 Future work

Subsequent work will be required in relation to:

- Potential planning mechanisms to secure the site in the MRS or Hope Valley Wattleup Redevelopment Area Structure Plan
- Future reservation/zoning, servicing requirements and transport connections.
- Establish a Planning Control over the recommended site.

2. The freight task

2.1 Overview

An intermodal terminal is a facility which enables the receipt, transfer between transport modes, and on-forwarding of freight. Freight passing through the terminal may be:

- Intrastate – both origin and destination are within Western Australia
- Interstate – goods being transported to and from the eastern states
- International – goods that are imported or exported, specifically through the Port of Fremantle.

The terminal must provide rail corridors serving the terminal, all rail and road facilities for transfer of freight, storage and handling of containers and other goods, provisioning and servicing of rolling stock, management of rail wagons, management of containers and other maintenance activities.

Image 3 The Pacific National intermodal terminal at Kewdale

2.2 Intrastate

Growth in the intrastate freight task is likely to be predicated on continued production of commodities at Kwinana, for transport by road or rail to the south-west and goldfields. In addition, there is likely to be a shuttle of freight and empty containers between Kwinana and Kewdale / Forrestfield, and a shuttle between the Fremantle inner and outer harbours. It is possible that other freight nodes may be developed in other parts of the Perth region in future.

In addition to road/rail intermodal exchange, there is likely to be an amount of road/road exchange taking place at the terminal.

The stage 1 study[3] identified three growth scenarios (low, medium and high level) and estimated the required throughputs for each scenario, up to the year 2035.

Table 3 Intrastate container throughput ('000 TEU)

Growth scenario	2010	2015	2020	2025	2030	2035
Low level	55	61	67	74	82	91
Medium level	61	75	91	112	137	167
High level	65	85	112	146	191	249

2.3 Interstate

The stage 1 study has identified the interstate freight task as being the primary activity to be undertaken at a terminal in Kwinana. The major interstate freight movement would be the receipt of containers from the eastern states for unpacking and / or on-forwarding to the southern part of the Perth metropolitan area and the south-west of Western Australia. A smaller quantity of containers would be packed and railed to the eastern states, while there could also be a quantity of empty containers to be returned to the east.

Provision must also be made for the handling of non-containerised freight (referred to as “ugly freight”).

The stage 1 study identified three growth scenarios (low, medium and high level) and estimated the likely throughputs for each scenario, up to the year 2035.

Table 4 Interstate container throughput ('000 TEU)

Growth scenario	2010	2015	2020	2025	2030	2035
Low level	52	84	107	134	167	206
Medium level	72	115	169	236	321	413
High level	130	230	311	391	464	550

2.4 International

The proposed Fremantle outer harbour could have a significant influence on the form and size of the Kwinana intermodal terminal. The two outer harbour options being evaluated both include on-dock rail facilities. The Stage 1 study concluded that if rail is provided onto the new docks, then the proportion of international trade likely to pass through the terminal would be small. On the other hand, if the port’s rail-head was established at the intermodal terminal, then a very high proportion of the international trade would be handled by the terminal (and some have suggested that this would be a better option than having on-dock rail at the outer harbour). The Stage 1 study assessed that only in this case, would it be necessary to provide a highly efficient and flexible means of shuttling containers between the docks and the terminal. However, consultation with industry stakeholders as part of the current study would

[3] ARRB, Meyrick & Associates and GHD: *Contract Report – Final – Kwinana intermodal terminal study WC72329* November 2006

suggest that even if the Outer Harbour includes on dock rail, that it would still make sense to use a nearby intermodal terminal as a staging post for all of the rail based freight and at least some of the road based freight moving into and out of the port. In this case the intermodal terminal at Kwinana would become the port gate as the pick and up drop off point for these containers which would be shunted on 300 metre trains between the intermodal terminal and the port.

Image 4 Loading containers onto truck using a reach stacker

Among industry players, one prevailing view is that it would not be efficient to have longer trains moving into and out of the port as these would result in congestion at the busiest part of the port. This means that it would be better if the 600 metre trains that are typically used for moving imports and exports were to begin and end their journey at the intermodal terminal with the remaining link being on 300 metre trains.

The stage 1 report identified the likely international freight throughput of the Kwinana intermodal terminal for the various scenarios discussed above but the implication of the terminal having a greater role as a staging post is that the medium level estimates shown in Table 5 below may be conservative. On this basis it would be prudent to ensure that the terminal concept design accommodates an international throughput that is at least a little higher than the levels shown for the medium level (on-dock rail) scenario.

Table 5 International container throughput ('000 TEU)

Growth scenario	2010	2015	2020	2025	2030	2035
Low level	0	20	23	28	50	75
Medium level (on-dock rail)	0	20	23	28	50	75
Medium level (no on-dock rail)	0	120	135	165	300	450
High level	0	120	149	198	390	600

2.5 Target capacity for Kwinana intermodal terminal

Combining the various freight task scenarios described in the preceding sections gives a range of anticipated total throughputs as set out in Table 6. The “medium” scenario for international trade depends on the extent to which the Fremantle outer harbour utilises on-dock rail and container-handling facilities.

Table 6 Total container throughput (000 TEU) in 2035

Freight task / Growth scenario	Low	Medium	High
Intrastate	91	167	249
Interstate	206	413	550
International	75	75 - 450	600
Total	372	655 – 1,030	1,399

Following extensive consultation and discussions with the study steering group, it was determined that the target capacity for the Kwinana intermodal terminal should be between the upper end of the “medium” scenario, and the “high” scenario. Consequently a target capacity of 1.2 million TEU/anum was adopted.

3. The site

3.1 Site options

3.1.1 Overview

The brief for the study specified that the study team will need to examine the rail system and sites within, and immediately surrounding, LandCorp's Hope Valley / Wattleup Redevelopment Project Area (Latitude 32).

Latitude 32 is located at Hope Valley and Wattleup, bounded by Anketell Road to the south, Rockingham Road to the west, Fanstone Avenue to the north and Henderson Road / Power Avenue / Mandogalup Road / Abercrombie Road to the east. The site is approximately 700m from the coast and covers an area approximately 14.2km².

Accordingly, the rail system and topography were investigated in the areas described below.

3.1.2 East & west of Latitude 32

The main Midland – Kwinana railway runs generally north-south through the Latitude 32 project area. Accordingly, an intermodal terminal needing connection to the railway would require a spur which would most likely run diagonally through Latitude 32 and thus create severe constraints on development of the area.

West of the area is the Mount Brown conservation reserve, which was not considered further.

East of Latitude 32 is an area of rural residential land, which is not zoned for industrial uses and was not considered further.

3.1.3 North of Russell Road

The land north of Russell Road is constrained by extractive industries, the Cockburn Cement plant and rural / residential developments. It is more remote from the Kwinana industrial area and either of the proposed outer harbour sites.

3.1.4 Between Russell & Rowley Roads

The area between Russell and Rowley Roads has been identified in the Latitude 32 structure plan as suitable for freight-related industries. It provides a sufficient length of land with suitable topography, and with the Midland – Kwinana railway running through the site.

This area has good access to the industrial area via Rowley Road. It is also in close proximity to one of the proposed locations for the outer harbour.

3.1.5 Between Rowley and Anketell Roads

The area between Rowley and Anketell Roads is subject to Amendment 1 of the Hope Valley / Wattleup Redevelopment Area Master Plan. The amendment seeks to

- substantially increase the proportion of land devoted to general industry (rather than transport & freight),

- provides for parks and conservation areas, including preservation of the Conway Road Swamp,
- Provides for a realignment of the controlled accss highway between Anketell Road and the Rockingham Rd / Rowley Road interchange.

There is a potential site adjacent to the existing railway, running from the crossing of Rockingham Road, along Conway Road towards Rowley Road. It is likely that a terminal in this location could be configured to provide good access to either of the Fremantle outer harbour options, as well as being in close proximity to the Kwinana industrial area.

However development of this site as an intermodal terminal would be constrained by the Conway Road swamp and the controlled access highway. It would not be compatible with the land uses proposed under Amendment No 1 of the master plan.

3.1.6 South of Anketell Road

Constraints south of Anketell Road preclude the development of a full-scale intermodal terminal and associated support land uses. The constraints include major road crossings, railway junctions, an existing terminal, regional open space reservations and the East Rockingham cemetery.

3.1.7 Preferred site

On the basis of the analysis described above, the preferred site for the Kwinana intermodal terminal is within Latitude 32 (the Hope Valley / Wattleup Redevelopment Area), between Russel Road and Rowley Road. This site offers advantages including:

- Topography is suitable for development of a large, flat site;
- There is sufficient length for the terminal and associated rail spurs;
- The land is not constrained by rural, residential or other incompatible uses (however see references to the waste disposal facility);
- The land is identified as suitable for transport and freight-oriented industry within the Latitude 32 master plan.


Image 5: Overview of preferred site

3.2 Latitude 32: Site description

Latitude 32 is located at Hope Valley and Wattleup, bounded by Anketell Road to the south, Rockingham Road to the west, Fanstone Avenue to the north and Henderson Road / Power Avenue / Mandogalup Road / Abercrombie Road to the east (please refer to site plan). The site is approximately 700m from the coast and covers an area approximately 14.2km².

Topography

The whole of the site is within the Spearwood dune system and is thus undulating. A broad valley runs from the northern boundary at Russell Road to Wattelup Road. East, west and south of this valley the land rises in typical dunal formations.

Existing industry constraints

The north-western part of the site is dedicated to extractive industries (limestone) as are locations at the south end. A large proportion of the western part of the site is occupied by waste disposal land-fill sites.

3.3 Land use – existing

Land use within the study area falls into four major categories:

- Quarrying
- Refuse disposal and recycling
- Market gardens and turf farms
- Residential

3.3.1 Quarrying

Extensive limestone quarries exist at both the northern and southern ends of the site. In the vicinity of Russell Road, limestone is extracted by Cockburn Cement Pty Ltd under a state agreement.

South of Wattleup Road are old quarries which have been worked out and abandoned. These will require extensive rehabilitation to be suitable for industrial development.

Image 6: Quarrying operations

Image 7: Worked-out quarries

A large limestone quarry is currently being operated south of Wattleup Road, west of Postans Road.

Landcorp have advised that further quarrying activity will take place over a wide area of the Latitude 32 development area. Future works will need to have finished levels pre-determined to suit the industrial development of the area.

3.3.2 Refuse disposal and recycling

The Henderson landfill site is a very large refuse disposal and recycling site operated by the City of Cockburn. The site occupies a total area 67 ha, between the existing railway and Rockingham Road. 12 hectares of the site is lined for leachate recovery and treatment. A methane recovery process is in place.

The ultimate capacity of the site is approximately 3,500,000 $m^{3,}$ with an annual load of 120,000 tonnes. The site is expected to reach capacity around 2025.

Landcorp have expressed a firm desire for some or all of the landfill site to be used for container parks. However landfill sites are subject to substantial (and uneven) settlement, discharge of methane and other gases and discharge of leachate into the soil. Where a site has been well designed and managed, these difficulties are reduced, but not entirely eliminated. There are precedents for the construction of infrastructure over disused landfill sites, and the Henderson landfill may prove to be suitable for container storage and similar uses. Considerable geotechnical investigation would be required prior to any construction, and the site may need extensive preparation.

3.3.3 Market gardens and turf farms

The majority of land east of the railway between Russell Road and Rowley Road is used for market gardens and turf farms. The majority of these operations are operated by resident owners.

3.3.4 Residential

The Wattleup townsite continues to have a declining number of residences. Being within the Kwinana industrial area buffer zone, no new residences are permitted anywhere within the Latitude 32 development area. Landcorp is progressively buying up properties in the townsite.

To the east of Power Avenue there are extensive rural residential areas which are in close proximity to the Latitude 32 development area.

3.4 Environment

The intermodal terminal will form one precinct of fourteen within the proposed Hope Valley Wattleup Redevelopment Project (HVWRP). The intermodal terminal will be a central hub of importance, combining road, rail and sea freight facilities in one location, to effectively import and export materials around the state.

A number of desktop assessments including database, literature reviews and consultation with state government departments were undertaken to determine the potential environmental impacts of the proposed works. These included identification and reporting of:

- climate;
- geology and soils;
- topography and hydrology;

- vegetation i.e. clearing and presence of Declared Rare or Priority Flora (DRF), Threatened Ecological Communities and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) listed species;
- weed management;
- significant fauna;
- indigenous heritage;
- non-indigenous heritage;
- land use; and
- construction phase impacts.

The major issues identified from the desktop assessment, are summarised as follows:

- Clearing of native vegetation for the proposed terminal location, and infrastructure links to the terminal;
- Groundwater contamination, movements and use;
- Potential Acid Sulphate Soil issues from dewatering or construction activities;
- Air quality issues from activities onsite;
- Odorous or toxic materials handled through the port causing offsite impacts;
- Noise from activities at the terminal potentially impacting offsite;
- Terminal design negatively impacting to persons surrounding the terminal; and
- The requirement for a formal risk assessment for materials handled at the facility.

Additional studies and permits identified during the desktop assessment that may require further work to be undertaken are as follows;

- A clearing permit may be required for the removal of vegetation at the proposed intermodal terminal location;
- A fauna assessment may be required for areas marked for vegetation removal;
- The development of a water allocation plan for major parties onsite that require groundwater extraction;
- A groundwater monitoring plan should be developed to identify significant changes to the groundwater in the project area;
- The development of an Acid Sulphate Soil investigation and management plan;
- The development of a noise assessment report to accompany the terminal development and proposed activities at the site;
- A design development plan will need to be developed, lodged and open for public comment upon finalisation of the design location and plan; and
- Undertaking of a formal risk assessment to determine potential offsite impacts from potential activities to be undertaken at the terminal.

With the information identified in this study, it was concluded that the most suitable location for the intermodal terminal would be centrally located between Russell and Rowley Roads, requiring only minor deviance from the existing rail line location. The master plan identified precincts 4 and 7 as potentially

suitable for the location of the intermodal terminal. From the environmental constraints identified within this study, it was identified that those precincts remain as the preferred location for the facility.

3.5 Geotechnical conditions

3.5.1 Introduction

A desktop geotechnical study of the site has been undertaken. The study included a review of general geological conditions, groundwater depths, presence of wetlands, and known quarries and tip site.

The site is located on the Spearwood Dune System, which comprise of Spearwood Sand and coastal limestone known as Tamala Limestone as indicated by 1:50,000 Environmental Geology map (Fremantle)[4]. The Spearwood Sand is an eolian calcarenite deposit derived from the Tamala Limestone and comprises yellow, medium to coarse grained quartz dominant sand. Remnants of calcareous sand may be present in close proximity of calcarenite outcrops. Crossbedding, paleosols and rhizoliths are common features in this unit. The Spearwood Sand is deposited in the late Pleistocene period.

The 1:50,000 Perth & Environs (Perth-Fremantle) geological map[5] indicates the subsurface geology consists of Coastal Limestone with transitional boundaries of unlithified lime sand, calcarenite outcrop, kankar outcrop and leached quartz sand. Pockets of swamp and lacustrine deposits of peat and peaty sand are also indicated to be present.

The undulating topography of the site is characteristic of the Spearwood Dunal system.

3.5.2 Tamala Limestone

Limestones give an uneven and irregular surface configuration with development of pinnacles of hard rock, and deep sand filled cavities. This can be problematic with regards to foundations and earthworks on the site. Limestone outcrops exposed to weathering conditions will undergo hardening and produce caprock characteristics known as Calcrete. Calcretised layers have been known to cause problems with excavations and engineering pilings to lose their verticality (Gordon; 2003).

Cavities are sized variably from sinkholes and dolines to large caves. It is documented that Yanchep and areas north of Wanneroo hosts such karstic examples. Although the site is not in close proximity to these areas, karsts are found in the same geological unit as that which underlies the site, the Tamala Limestone.

Large scale cavities are also known to develop under the groundwater, beneath the coastal parts of the Spearwood Dune System. Cavities and fissures in the limestone may provide high permeable paths that may contribute to the contamination of the groundwater.

The strength of the Tamala Limestone is also highly variable and dependent on the degree of cementation. This may vary the settlement and bearing capacity of foundations.

Defects common in limestone comprise of bedding and natural joints. Natural joints are usually planar in feature and either vertically or steeply dipping, with no displacement, and usually infill by sheet calcrete. Defects in the underlying subgrade will have an effect on foundation designs.

[4] Geological Survey of Western Australia: 1:50,000 Environmental Geology map (Fremantle)

[5] Geological Survey of Western Australia: 1:50,000 Perth & Environs (Perth-Fremantle)

It is documented that karstic subsidence and collapse in limestone has been initiated by urbanisation. Loss of vegetation covers, overwatering, overfilling of stormwater sumps from heavy rainfall, and lowering of local groundwater from overpumping are some examples (Gordon; 2003).

It will be necessary to bear these factors in mind during the detailed planning and design of the intermodal terminal, especially with respect to bulk earthworks and drainage.

3.5.3 Previous Quarrying

Extensive quarries are present throughout the site, from mining of the local limestone. Depending on required land uses, these quarries may have to be rehabilitated to meet environmental guidelines. Some quarries may need to be backfilled to the design level in order to meet construction requirements. Engineered backfill material could be sourced from the local area in order to minimise construction costs.

Limestone exposed in quarries will form calcrete through the weathering process. Calcrete, hardened caprock, may provide difficult excavation conditions.

3.5.4 Wetlands

Wetlands (found between Anketell and Rowley Roads) provide unsuitable ground condition for foundations. The subsurface conditions of wetlands are mostly 'peaty' and or silty in characteristics. Peaty subgrade is unstable due to its low bearing capacity and potential for settlement of foundations. Settlement in the foundations is due to the degradation of the 'peaty' deleterious material.

The silty component of the wetlands will affect the permeability of the soils. Fines prevent water from percolating through the subgrade and promote flooding or perching of water. Subgrade with high fines content will not be suitable for stormwater drainage.

Wetlands are also categorised as high risk for Actual Acid Sulfate Soils and Potential Acid Sulfate Soils and may cause environmental and groundwater issues.

Long Swamp, located south of Rowley Road, is categorised as 'conservation' by the Department of Environment.

3.5.5 Landfill Site

Landfill sites have unstable foundations and proved to have settlement issues. Extensive environmental and geotechnical investigations will be required prior to site development. Approvals from the relevant government bodies may also be required.

3.6 Existing infrastructure

3.6.1 General

Within the Latitude 32 site, there are utility services (electricity, gas, water, telecoms) serving the existing residences and industries. The local reticulation services will necessarily be re-routed as required to service the new industrial and commercial developments.

In addition, high voltage electricity and high pressure gas pipelines traverse the site. Landcorp have advised (at the workshop on 27 September 2007) that they anticipate creating a services corridor to accommodate the gas pipelines and high voltage power lines.

3.6.2 Gas

The Dampier – Bunbury natural gas pipeline runs north-south through Latitude 32, towards the eastern side of the site. It is not anticipated that the pipeline will affect planning of the intermodal terminal.

The Parmelia gas pipeline also run north-south, generally in proximity to the Dampier – Bunbury pipeline.

Domestic gas is also reticulated throughout the area.

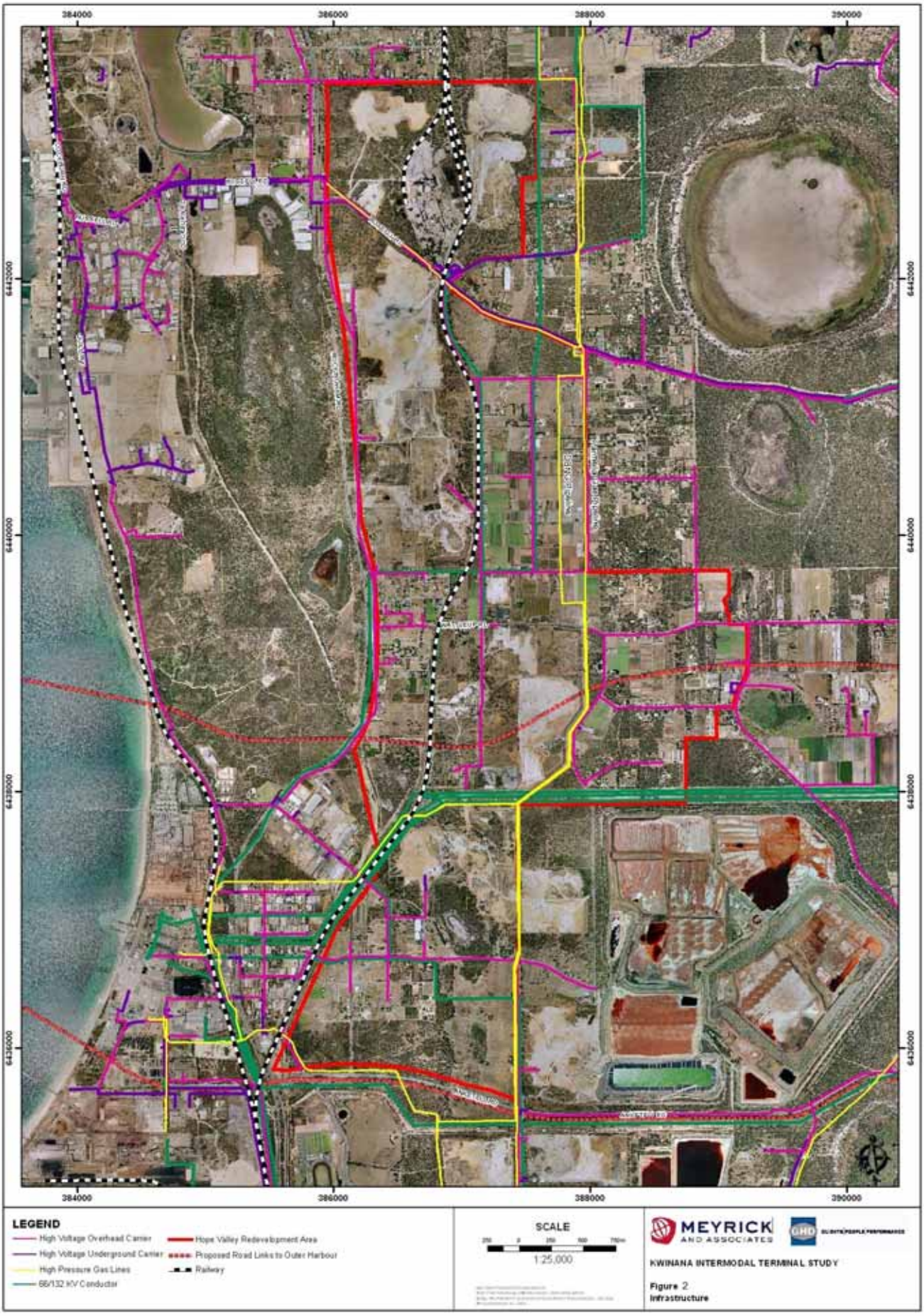
The gas demand of the intermodal terminal is expected to be low. Adjacent industries and service facilities may have higher demands, depending on the type of processes undertaken.

3.6.3 Electricity

High voltage (66kV and 132kV) power lines cross the Latitude 32 area in a number of locations. It will be necessary for these to be relocated as Latitude 32 develops, and particularly as the intermodal terminal is established. Low voltage power is reticulated throughout the site.

Electricity demands of the intermodal terminal and freight village will comprise:

- Floodlighting and street lighting;
- Rail-mounted gantry cranes, if these are used;
- Refrigerated containers (reefers);
- Administration & amenities buildings and warehouses - light, heating, air conditioning, office power, internal gantry cranes; and
- Support services and industry - light, heating, air conditioning, office power.


384000
386000
388000
390000
6442000
6440000
6438000
6436000
LEGEND
High Voltage Overhead Carrier
High Voltage Underground Carrier
High Pressure Gas Lines
66/132 kV Conductor
Hope Valley Redevelopment Area
Proposed Road Links to Outer Harbour
Railway
SCALE
1:25,000
MEYRICK AND ASSOCIATES
GHD
KWINANA INTERMODAL TERMINAL STUDY
Figure 2
Infrastructure

4. Planning issues

4.1 Planning & zoning

4.1.1 Metropolitan Region Scheme

The Metropolitan Region Scheme (MRS) is repealed under Section 23 of the Hope Valley-Wattleup Redevelopment Act 2000 in relation to the Hope Valley-Wattleup Redevelopment Area. Therefore, the MRS is not applicable to the Master Plan area. However, as key reservations such as the primary regional road reservation are still shown in the MRS, any amendments to these reservations through the Master Plan amendment process, will need to be reflected in the MRS through the relevant MRS amendment process.

4.1.2 Hope Valley Wattleup Redevelopment Act 2000

The Hope Valley-Wattleup Redevelopment Act (2000) (hereafter referred to as the Act) was established to:

> *"…provide for the development and redevelopment of certain land in the local government districts of Cockburn and Kwinana, to confer planning, development control and other functions in respect of the land, and for related purposes."*

The act provides the Western Australian Land Authority (LandCorp) with the authority to undertake, promote and coordinate development and redevelopment of the land within the redevelopment area. Any planning documentation (master plan, structure plan, design guidelines) or development proposals within the redevelopment area are to be approved by the Western Australian Planning Commission (WAPC).

Figure 2 indicates town planning scheme zoning in the area surrounding Latitude 32. Latitude 32, being excluded from the provisions of the MRS is shown uncoloured on this drawing.

4.1.3 Hope Valley / Wattleup Redevelopment Area Master Plan

The whole of the Latitude 32 – Hope Valley / Wattleup development area is subject to a master plan managed by Landcorp. Within the master plan, precincts have been identified for a range of commercial and industrial uses including:

- Transport industry
- General industry
- Eco industry and business park
- Resource recovery
- Local commercial
- Greenbelt, remnant vegetation and rural.

Discussions with Landcorp have indicated that the precinct locations and areas shown in the master plan are indicative and may be amended to accommodate the intermodal terminal and associated land uses, provided that the overall land use balance is maintained.

Landcorp have also expressed a strong preference that the intermodal terminal be located a reasonable distance from the surrounding rural residential areas to avoid creating a nuisance.

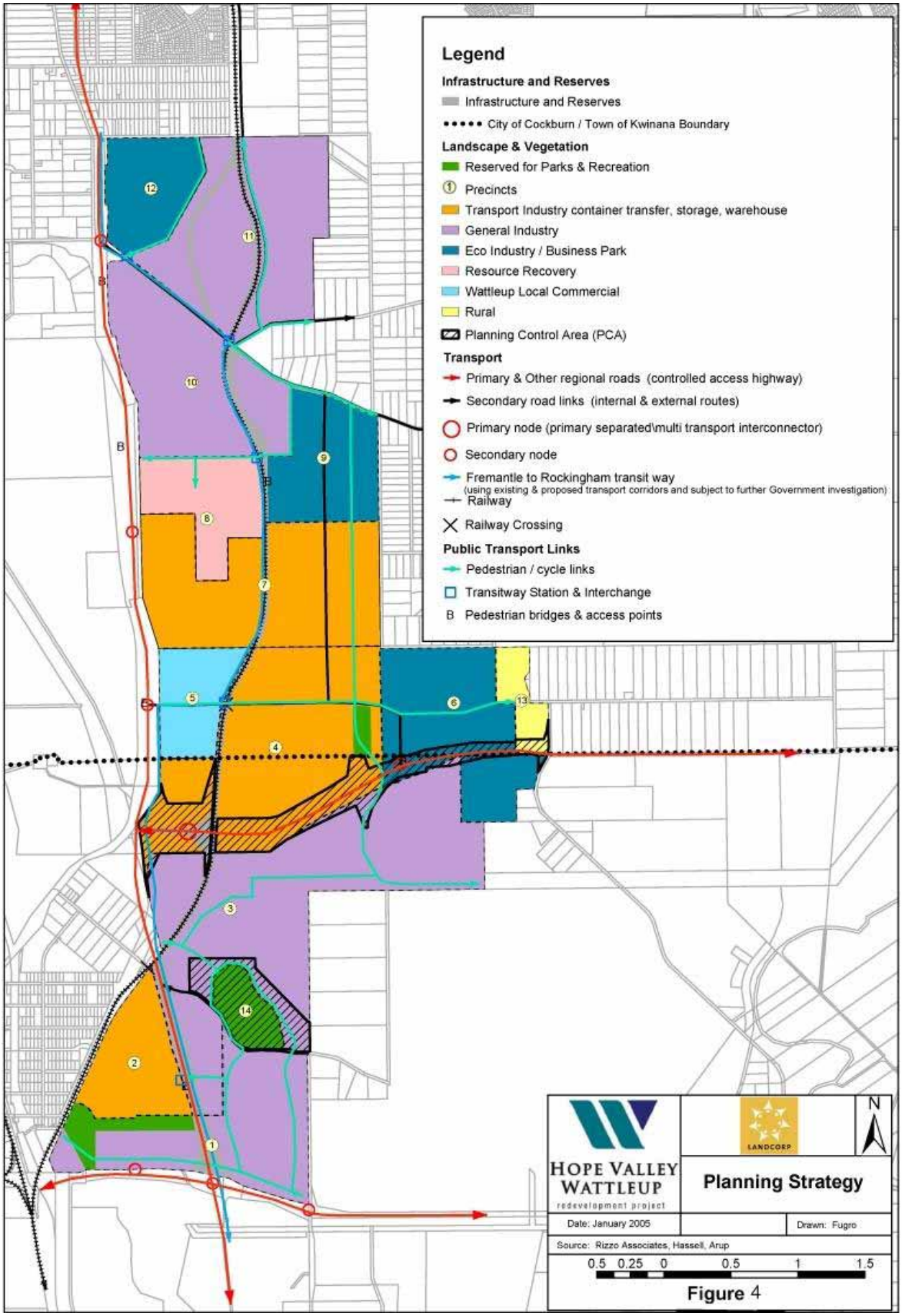
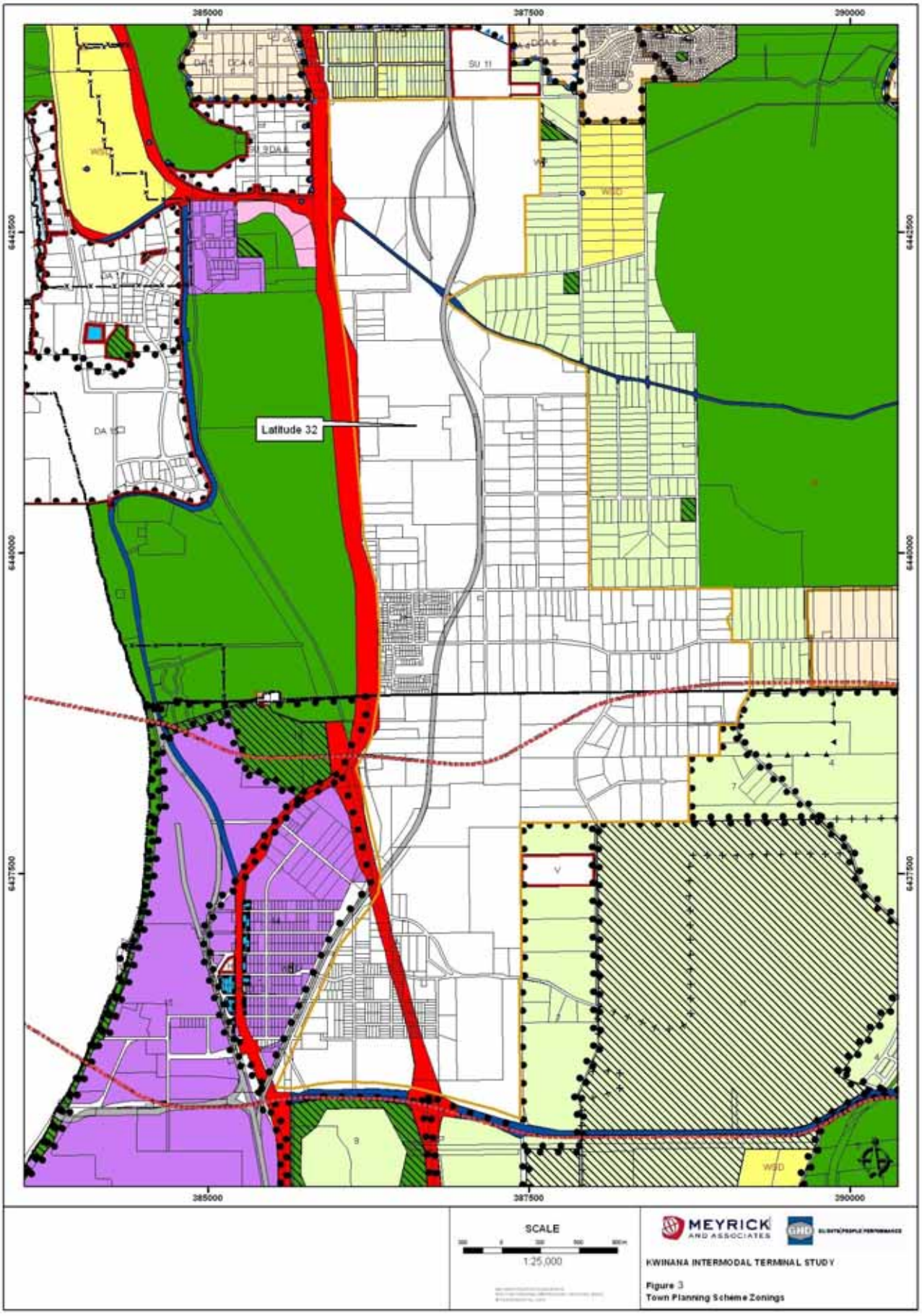

Legend
Infrastructure and Reserves
Infrastructure and Reserves
City of Cockburn / Town of Kwinana Boundary
Landscape & Vegetation
Reserved for Parks & Recreation
Precincts
Transport Industry container transfer, storage, warehouse
General Industry
Eco Industry / Business Park
Resource Recovery
Wattleup Local Commercial
Rural
Planning Control Area (PCA)
Transport
Primary & Other regional roads (controlled access highway)
Secondary road links (internal & external routes)
Primary node (primary separated\multi transport interconnector)
Secondary node
Fremantle to Rockingham transit way
(using existing & proposed transport corridors and subject to further Government investigation)
Railway
Railway Crossing
Public Transport Links
Pedestrian / cycle links
Transitway Station & Interchange
B Pedestrian bridges & access points
HOPE VALLEY WATTLEUP
redevelopment project
LANDCORP
N
Planning Strategy
Date: January 2005
Drawn: Fugro
Source: Rizzo Associates, Hassell, Arup
0.5 0.25 0 0.5 1 1.5

Figure 4

Figure 3 - Town planning scheme zoning


385000
387500
390000
6442500
6440000
6437500
Latitude 32
SU 11
DCA 6
DA 15
W3D
SCALE
1:25,000
MEYRICK AND ASSOCIATES
KWINANA INTERMODAL TERMINAL STUDY
Figure 3
Town Planning Scheme Zonings

4.2 Freight village

4.2.1 Overview

It is the intention of Government that the proposed terminal not be a stand-alone facility, but be integrated with surrounding land uses to maximise synergies and benefits arising from such co-location. One model for the integration of the freight terminal and adjacent industries is the “freight village”.

4.2.2 Definition

One definition of “freight village” is given by EuroPlatforms[6]:

> *"A freight village is a defined area within which all activities relating to transport, logistics and the distribution of goods, both for national and international transit, are carried out by various operators.*
>
> *These operators can either be owners or tenants of buildings and facilities (warehouses, break-bulk centres, storage areas, offices, car parks, etc...) which have been built there.*
>
> *Also, in order to comply with free competition rules, a freight village must allow access to all companies involved in the activities set out above. A freight village must also be equipped with all the public facilities to carry out the above mentioned operations. If possible, it should also include public services for the staff and equipment of the users.*
>
> *In order to encourage intermodal transport for the handling of goods, a freight village must preferably be served by a multiplicity of transport modes (road, rail, deep sea, inland waterway, air).*
>
> *Finally, it is imperative that a freight village be run by a single body, either public or private".*

An alternative definition is as follows[7]:

> *A "freight village" is a concentration (or a cluster) of freight related activities within a specific area, commonly built for such a purpose, master planned and managed. These activities include distribution centres, warehouses and storage areas, transport terminals, offices and other facilities supporting those activities, such as public utilities, parking space and even hotels and restaurants. Although a freight village can be serviced by a single mode, intermodal facilities can offer direct access to global and regional markets. The development of freight villages has many benefits to manage the freight flows generated by several unrelated users through economies of scale since they are sharing the same facilities and equipment, mostly around a transport terminal. This in turn reduces transport costs and promotes its reliability.*

The key points arising from these definitions include:

- The freight village is a cluster of freight related activities;
- The freight village provides many ancillary services to support and add value to the freight industry;

The freight village is planned, constructed and managed as an entity.

4.2.3 Freight village activities

The “core” terminal and adjacent and contiguous land uses will comprise a “freight village”. As discussed in section 4.2.2 above, the freight village is multi-functional area in which a broad range of interrelated

[6] Europlatforms is the European association of freight villages

[7] Hofstra University (New York)

freight and logistics tasks can take place. Additionally the freight village enhances the terminal function through associated value added uses, and accommodates industries which derive high value through their proximity to a transport terminal.

Activities within the freight village could include some or all of:

- warehousing;
- cold storage;
- retail distribution centres;
- containing stuffing and unstuffing;
- non-container freight handling;
- container storage and servicing;
- road / road interchange facilities;
- freight forwarding agents;
- rolling stock servicing;
- truck servicing and spare parts;
- food outlets and appropriate recreation facilities;
- manufacturing industry requiring direct access to transport facilities;
- customs and quarantine services;
- banks and offices.

There are examples of freight-village type developments (though not always identified by that name) in several Australian states. Examples include the Somerton terminal and business park in the Dandenong region of Melbourne, and the Albury-Wodonga freight village.

All elements of the freight village must have excellent accessibility to the intermodal terminal and the village as a whole must have excellent connections to the regional road network. Its internal road network is contiguous with that serving the terminal and other parts of Latitude 32, and must meet the criteria discussed in Section 6.2 below.

4.2.4 The Kwinana freight village

The form of the freight village associated with the Kwinana intermodal terminal will be largely determined by the provisions of the Hope Valley Wattleup redevelopment area structure plan. The plan provides for freight industry precincts in locations surrounding the preferred location of the terminal. It also provides for other forms of industry.

An important component of the Kwinana freight village will be provision for the handling and storage of containers associated with the Fremantle inner and outer harbours.

A more detailed discussion of the possibilities of a freight village at Kwinana is given in section 8 below.

5. Stakeholder consultation

5.1 Steering group

The study was overseen by a steering group, chaired by DPI and including representatives of various stakeholders. Steering group members provided valuable input into the preparation of this report.

Members of the steering group are:

- Don Challis Department for Planning & Infrastructure (Chair)
- Laurie Piggott Public Transport Authority
- Doug Brindal Fremantle Ports
- Luke Willcock Landcorp
- Tom Grigson Department of Industry and Resources
- Mohsin Muttaqui Department for Planning & Infrastructure
- Paul Hamersley Department for Planning & Infrastructure

5.2 Interviews

Key stakeholders were interviewed by Louise Meyrick and Paul Fisher to obtain views concerning terminal demand, likely operating parameters and impacts on existing operations. Interviews were conducted with the following:

- Fremantle Ports: Doug Brindal, Logistics Manager
- Public Transport Authority: Laurie Piggott
- Landcorp: Luke Willcock
- DPI: Don Challis, Alan Kleiden, Mark Brownell, Cane Spaseski, Mohsin Muttaqui, Paula Hayes
- Department of Industry and Resources: Tom Grigson
- Westnet Rail: Rick Leonhardt and Paul Thompson,
- Australian Railway Group: Vince Omodei, Paul Haigh and Roy Johnston
- Pacific National: Steve Gabrovec,

The consultation outcomes report is included at Appendix C.

5.3 Workshop

A stakeholder workshop was held on 27 September 2007. Details of attendees and outcomes are included at Appendix D.

The workshop discussion was based around four key issues:

1. Selection criteria
2. The freight task
3. Terminal layout and rail issues
4. Access and land planning issues

5.3.1 Selection Criteria

The main access point of the terminal was seen as critical to the overall operation of both the terminal and the surrounding road network. It was noted that the roads in the immediate vicinity of the terminal entrance could become congested to the extent that they become a constraint on terminal capacity.

Access to and from the new Fremantle outer harbour would be extremely important. A high-efficiency link will be required, which could comprise railway, public roads, or a dedicated road link using purpose-designed vehicles.

Integration of the terminal with surrounding and adjoining land uses is likewise very important. The terminal should be located so as to provide adequate buffers between the terminal and nearby rural / residential properties. The terminal must integrate with the Latitude 32 industry park so that the transfer of good and services between the terminal and industry is optimised. The concept should also provide for short term storage and warehousing in close proximity to the core terminal.

The concept should allow flexibility to respond to varying industry requirements, and should be capable of being developed in stages up to its ultimate configuration. It should also be designed, constructed and staged to enable the maximum value of extractive industries on the site.

The terminal should not adversely affect service infrastructure such as high pressure gas pipelines, and should be located and configured to facilitate the connection of services to the terminal.

Arising from these discussions the following selection criteria were agreed:

1. Main access point
2. Port access
3. Buffers to existing land uses
4. Interaction and integration with other land uses
5. Short term warehousing, interconnected with core terminal area
6. Flexibility
7. Service infrastructure
8. Maximise the value of extractive industries
9. Ability to stage the development to its ultimate size.

5.3.2 The freight task

As the ownership / management model for the terminal has not been established, the detail planning phase should take into consideration the possible need to provide specific spur lines for independent operators.

In addition to containerised freight, it will be necessary to provide for other types of freight, such as cross-dock freight (rail vans that are unloaded direct into warehouses or waiting trucks) and ‘ugly’ freight (freight that is just tied onto the wagons i.e. trucks, machinery etc).

Current industry trends aim at minimum storage on site with a high focus on rapid distribution soon after arrival at the terminal.

Options to transit freight to and from the new port should be indicated in the concept drawings. These could include rail, public road, dedicated road, or a mechanised system such as a conveyor.

5.3.3 Layout and rail issues

In relation to the concepts presented, the workshop was of the view that the location of container storage needs to be optimised to minimise travel distances. Containers also need to be in stored in strips for easy and quick access.

In all options, the width of the loading / unloading areas needs to be clarified and possibly widened. Delegates emphasised the necessity for the terminal to be of sufficient width.

None of the options provide sufficient terminal track off the mainline to allow for the shunting and reassembly of trains without encroachment onto the mainline.

Option 3 requires two road bridges over rail. The cost of these bridges and approaches may prove prohibitive.

It was noted that the existing dual gauge railway continues south only to Kwinana. The dual gauge should be expanded all the way to Mundijong, and the terminal may need to reflect this future upgrade of the main line.

5.3.4 Access & land planning issues

The presence of the landfill area west of the main railway is a severe constraint on development of the terminal. Options involving the use of the landfill site are unlikely to be viable. For this reason, options 4 and 5 (which are located east of the existing railway) are preferred.

It was noted that all options resulted in narrow strips or pockets of “dead land” which will be difficult or impossible to develop for industrial purposes.

Design of the terminal must take into account mining activities and conditions which may need to be imposed on those activities in relation to finished ground levels.

Consideration should be given to transport studies being undertaken as part of Latitude 32 Stage one. There is current proposal to relocate the intersection of Rowley Rd and Postans Road further west.

Several of the options would be reliant on gaining access via Rockingham Rd. While physically and logically possible, such access is unlikely to be supported by DPI and Main Roads as it is contrary to current regional road planning for the region.

5.4 Other consultation

Following the workshop, two industry stakeholders, Mark Rafferty from Pacific National and Geoff Li from Sadleirs were consulted about details related to the degree to which van based freight and break bulk or “ugly” freight form part of the total freight task that they handle and how the mixture of these with container freight ought to be taken into account in designing the layout of the intermodal terminal.

A subsequent meeting of the steering group with Stephen Peers of Pacific National brought forth a number of suggestions to improve the layout of the preferred option.

6. Site access

6.1 Rail

The Midland to Kwinana railway runs the full length of the site in a generally north-south orientation. The railway is a dual-gauge, single track section, operated by Westnet Rail.

Westnet have advised that access to the existing rail for the purpose of the terminal could be allowed. The railway is operating at high capacity and consideration should be given to dual-tracking the relevant section.

Current planning by DPI indicates a possible future rail connection to the Fremantle outer harbour, either along Rowley Road or Ankatell Road, depending on which harbour option is adopted.

6.2 Road

6.2.1 General

The site is bounded on the west by Rockingham Road, on the north by Russell Road and Ankatell Road to the south. The future Rowley Road will pass through the site from east to west.

Connections to Rockingham Road and the Kwinana Freeway would be via Russell, Rowley and Ankatell Roads. Direct connection to Rockingham Road is unlikely to be permitted.

Access roads to the terminal must provide:

- Adequate capacity to handle the anticipated numbers of trucks and light vehicles;
- Geometry suitable for road trains, B-doubles and similar large vehicles;
- Good connectivity with the regional road network;
- Good connectivity within Latitude 32, especially with the adjacent freight village land uses;
- Sufficient off-road capacity to avoid vehicles queuing on public roads while waiting to enter the terminal;
- Minimising the use of the public road system while transporting containers to and from storage areas.

6.2.2 Traffic generation

The standard references for traffic generation are not generally applicable to intermodal terminals. Consequently traffic generation from the core terminal has been estimated from first principles and compared with existing traffic in Fenton Street, Kewdale.

The following assumptions have been made:

- Between 70% and 100% of all throughput is carried on road through the terminal gate. The balance of throughput is either
  - rail-rail transfer;
  - rail-port traffic using either rail or a dedicated road link;
  - directly from the container handling areas into warehouses abutting the core terminal.

- Between 60% and 80% of throughput is in forty-foot containers (the balance being in twenty-foot containers or non-container freight). Each forty-foot container is equivalent to 2 TEU.
- Container trucks constitute between 30% and 70% of road traffic entering and leaving the terminal.
- The terminal operates 7 days per week, but is closed on major holidays, giving approximately 360 working days per year.

Based on these scenarios, the anticipated number of trucks per day will be between 1,400 and 2,333. The anticipated total traffic will be between 2,000 and 7,778 vehicles / day. By comparison, Fenton Street Kewdale has a weekday average of approximately 5,400 vehicles / day[8]. However Fenton Street carries traffic for the Kewdale intermodal terminal, and also for adjacent industrial areas around Sheffield Road. The study team has received advice from PTA that approximately 70% of vehicles using Fenton Street originate in the Sheffield Road industrial area.

The Kewdale terminal currently has a throughput of approximately 400,000 – 500,000 TEU/annum, compared with the projected 1.2 million TEU/annum at Kwinana.

Taking into account the above scenarios, the actual traffic in Fenton street, and the throughput of the respective terminals, it is recommended that the entry road for the Kwinana intermodal terminal be designed on a conservative basis of 10,000 vehicles/day, of which 40% would be container trucks.

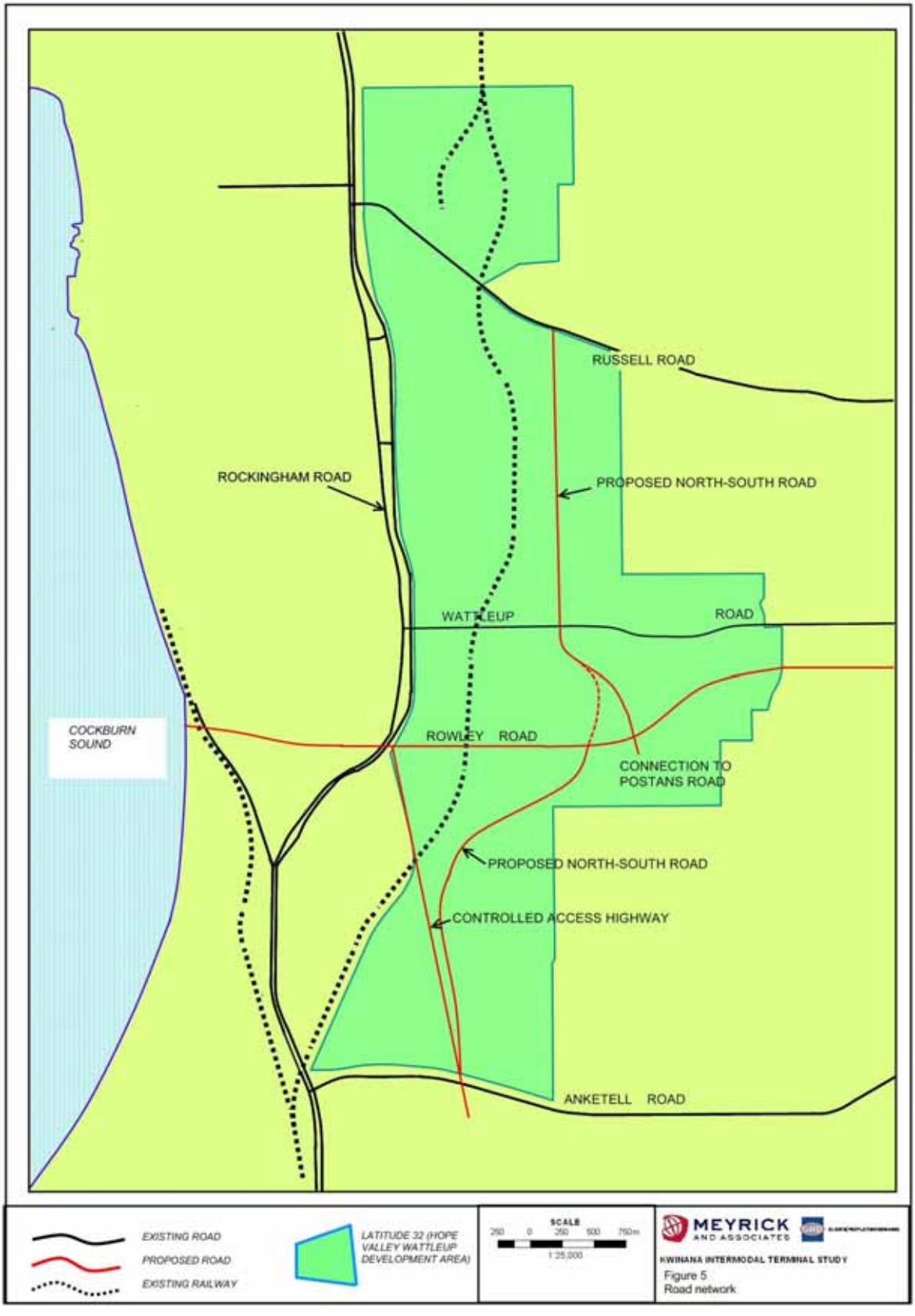
6.2.3 Latitude 32 road network

The major roads within the Latitude 32 development area will be primarily north-south, being constrained by the shape of the site, and the north-south orientation of the existing railway (and therefore also the intermodal terminal).

Current planning by Main Roads indicates a major entry point at the intersection of Rowley Road and a realigned Postans Road. More recent work undertaken for Landcorp shows a major north-south road running from Anketell Road through the length of Latitude 32 and possibly extending to Spearwood Avenue. This road would cross Rowley a short distance west of the planned Postans Road intersection.

Planning for the intermodal terminal will be sufficiently flexible so as to take both road options into account.

[8] Main Roads Western Australia SCATS output, intersection of Fenton Street & Kewdale Road, November 2007.


RUSSELL ROAD
ROCKINGHAM ROAD
PROPOSED NORTH-SOUTH ROAD
WATTLEUP ROAD
COCKBURN SOUND
ROWLEY ROAD
CONNECTION TO POSTANS ROAD
PROPOSED NORTH-SOUTH ROAD
CONTROLLED ACCESS HIGHWAY
ANKETELL ROAD
EXISTING ROAD
PROPOSED ROAD
EXISTING RAILWAY
LATITUDE 32 (HOPE VALLEY WATTLEUP DEVELOPMENT AREA)
SCALE
250 0 250 500 750m
1:25,000
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KWINANA INTERMODAL TERMINAL STUDY
Figure 5
Road network

7. Terminal options

7.1 Overview

In accordance with the study brief, a range of concepts has been developed, described and evaluated. Each option relies on using the existing railway through the site, either on its current alignment or a modified alignment.

Each option had to satisfy minimum selection criteria including:

- A minimum 1.8km length for the main arrival / departure track;
- Ability to service up to 115ha of terminal and associated uses;
- Good road access.

A fatal flaw analysis eliminated several of the options, as detailed in the following sections of the report.

7.2 Selection criteria

Arising from the stakeholder workshop held on 27 September 2007, the following criteria were identified:

- Main access point: Critical as part of the overall road network
- Buffers: Distances to existing land uses, inconvenience to the public/community
- Interaction / Integration: with other land uses
- Flexibility: Industry to be serviced, response to demand
- Port access: efficient transport links to the proposed outer harbour
- Extractive industries: Ability extract limestone (etc) before establishing the freight village
- Staging: Ability to stage the development to its ultimate size.
- Short term warehousing: A range of activities will require short term storage, interconnected with core terminal area

In addition, the study team suggest that the following should also be considered:

- Capacity to deal with dynamic freight tasks (ie containers, vans, “ugly” freight);
- Layout enables multiple users of the facility;
- Internal traffic flows are optimised;
- Recycling (including storage and servicing) of empty containers is facilitated;
- Provides for provisioning of wagons on-site.

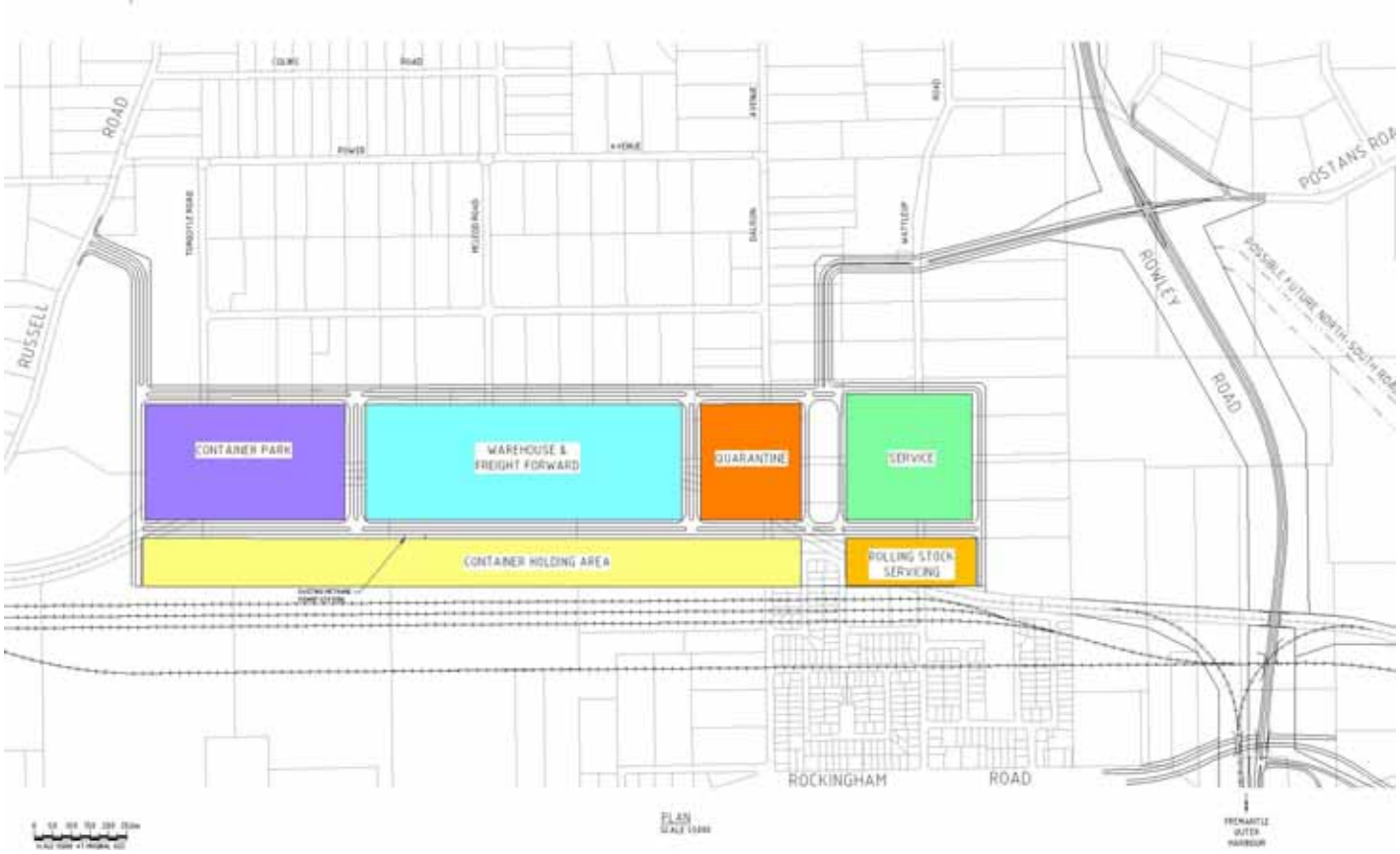


Figure 6: Concept option 1

7.3 Option 1

Rail configuration

The main line realigned to the west to achieve a 2.4 km straight. The terminal sidings are located east of the main line. The existing main line is abandoned.

Freight task

The option provides adequate room for warehousing and other freight village activities. There is considerable flexibility in relation to the location of each activity type.

Road access

The concept shows a local ring road around the freight village, with connections to both Russell and Rowley Roads.

Planning issues

The new main line traverses the refuse disposal site.

The area remaining between the new main line and Rockingham Road is narrow, especially near the Hope Valley townsite. This could result in “dead space”.

This location provides adequate buffers from adjoining rural / residential areas.

Engineering issues

Adequate grades could be achieved on the rail spurs.

Considerable earthworks would be required for the support areas, including land-forming in the refuse disposal sites.

Fatal flaws

The new main line traverses the refuse disposal site. It is unlikely the site will be available for many years into the future. Considerable rehabilitation of the refuse site would be required before any development could take place, and it is possible the site would never be suitable for any building development.

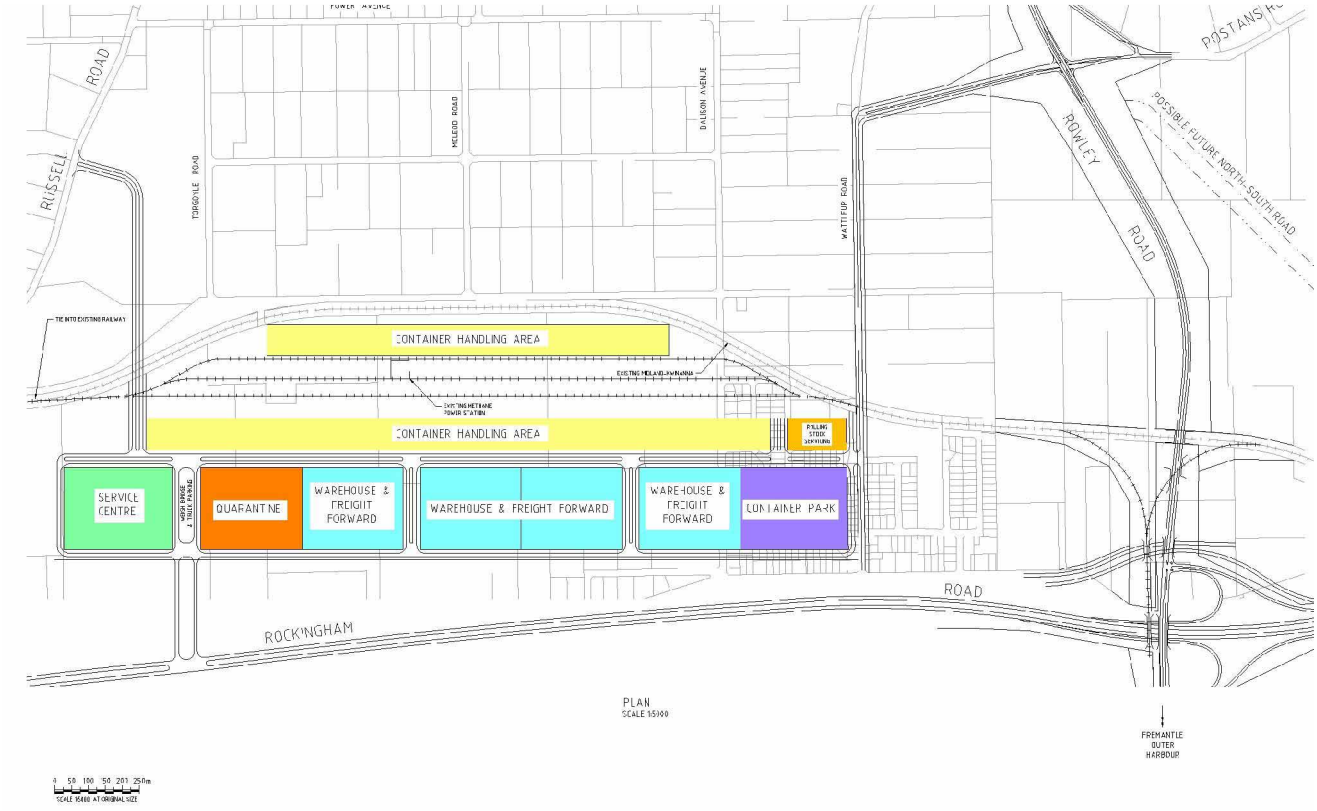


Figure 7 Concept option 2

7.4 Option 2

Rail configuration

The existing main line remains in position, with the terminal sidings located to the west. A siding length of 1.8km is achieved.

Freight task

The terminal activities are located west of the existing main line, and on either side of the sidings. The freight village activities are located further to the west.

Road access

This option relies on its primary road access from Rockingham Road. Whilst this connection is technically feasible, it runs counter to planning by DPI and Main Roads, and is unlikely to be approved.

Access to the remainder of the Latitude 32 site (and thence to Rowley Road) will require one or two crossings of the main line. These would need to be grade separated.

Planning issues

The majority of freight activities are located over the refuse disposal site.

The area remaining between the new main line and Rockingham Road is narrow. This could result in “dead space”.

This location provides adequate buffers from adjoining rural / residential areas.

Fatal flaws

The majority of freight activities are located over the refuse disposal site. It is unlikely the site will be available for many years into the future. Considerable rehabilitation of the refuse site would be required before any development could take place, and it is possible the site would never be suitable for any building development.

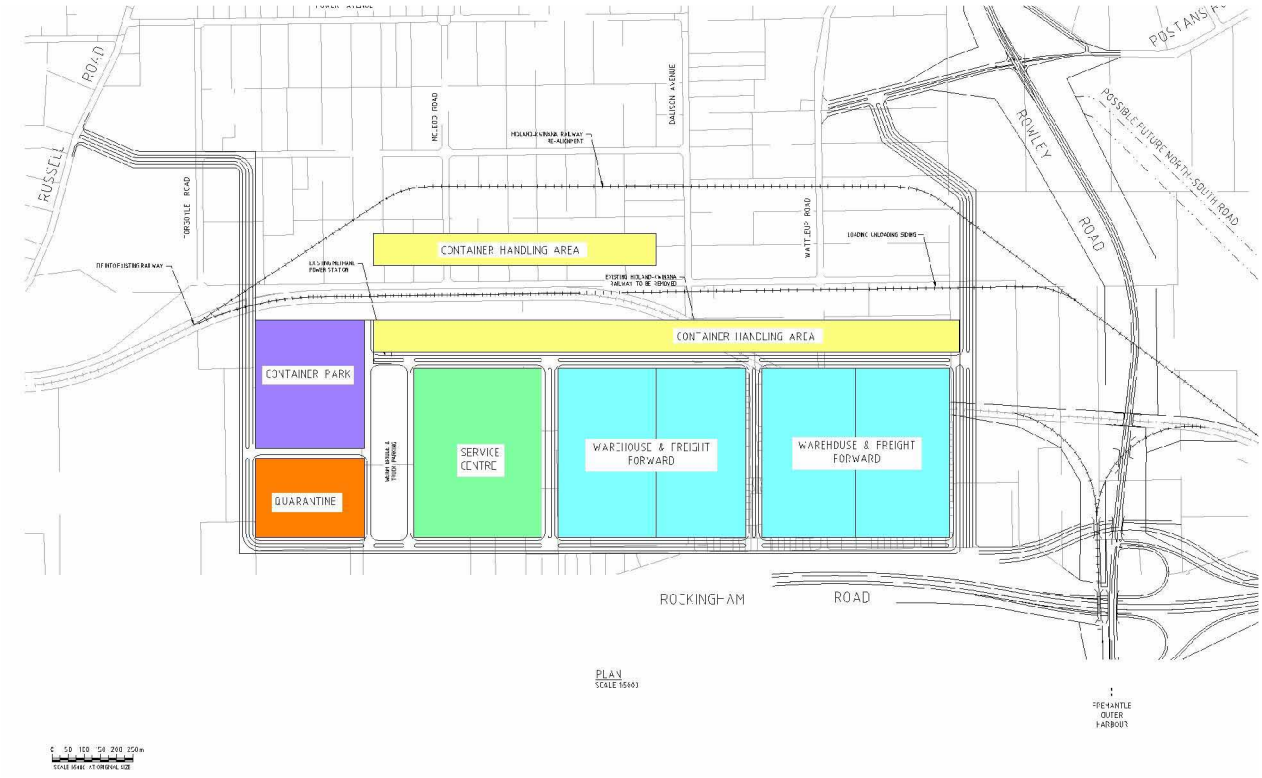


Figure 8 Concept option 3

7.5 Option 3

Rail configuration

The main line is realigned to the east to achieve a 1.8 km straight siding. The siding makes use of part of the existing main line.

Freight task

The IMT is located west of new main line. Container handling may take place either side of the new siding, thus utilising land between the siding and the new main line.

Warehousing and other freight village activities are located west of the terminal, partly over the refuse site.

Road access

This option relies on its primary road access from Rockingham Road. Whilst this connection is technically feasible, it runs counter to planning by DPI and Main Roads, and is unlikely to be approved.

Access to the remainder of the Latitude 32 site (and thence to Rowley Road) will require one or two crossings of the main line. These would need to be grade separated.

Planning issues

The majority of freight activities are located over the refuse disposal site.

The area remaining between the new main line and Rockingham Road is narrow. This could result in “dead space”.

This location provides adequate buffers from adjoining rural / residential areas.

Construction of the new main line alignment will involve substantially higher earthworks costs than some other options.

Engineering issues

Adequate grades could be achieved on the rail spurs.

Considerable earthworks would be required for the support areas, including land-forming in the refuse disposal sites.

Fatal flaws

The majority of freight activities are located over the refuse disposal site. It is unlikely the site will be available for many years into the future. Considerable rehabilitation of the refuse site would be required before any development could take place, and it is possible the site would never be suitable for any building development.

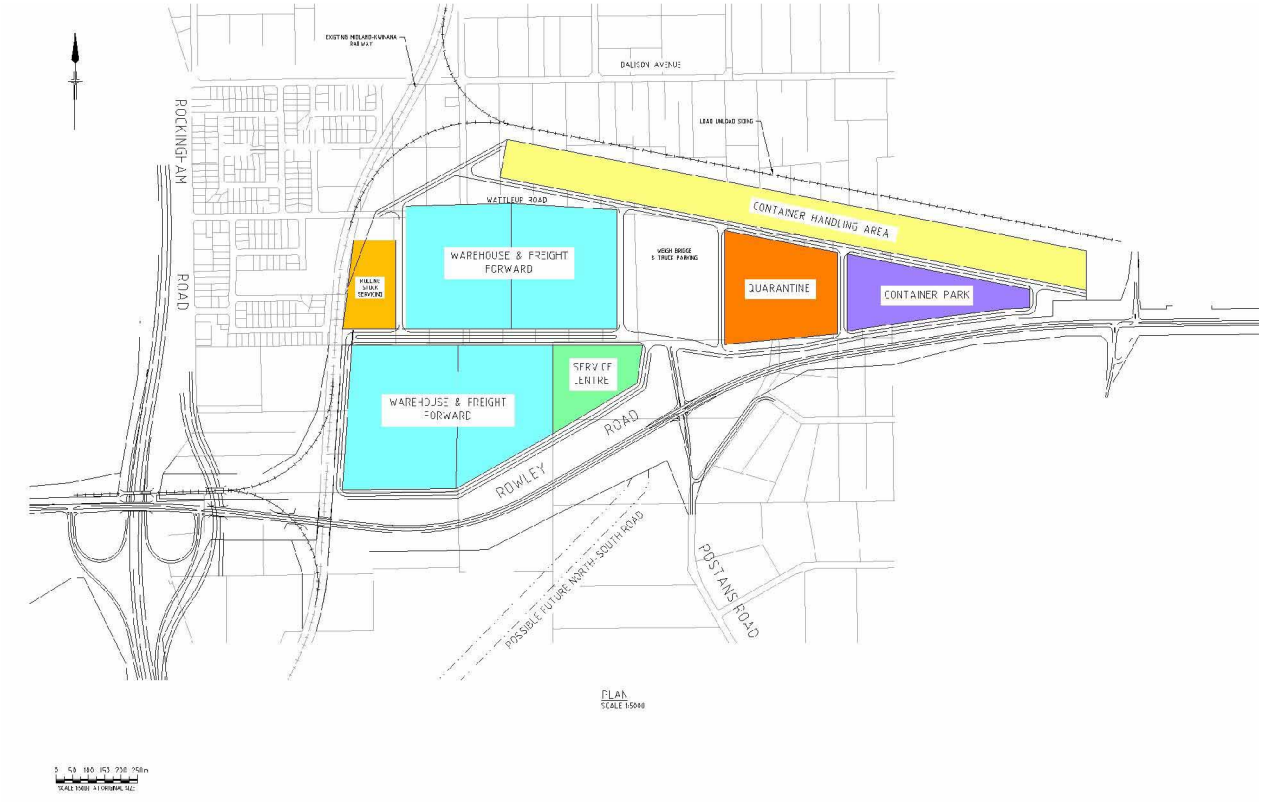


Figure 9 Concept option 4

7.6 Option 4

Rail configuration

The existing main line remains in position, with the IMT located east of existing main line on a 1.8 km spur line.

Freight task

Freight village activities are located south of the spur line, between the spur and Rowley Road. There is ample space for all required activities.

The spur is a single-ended facility, whereas the majority of operators prefer a double-ended facility (ie one where trains can arrive and depart at either end of the terminal).

Road access

There is excellent access to Rowley Road. However the spur effectively cuts access to the remainder of Latitude 32, requiring a road to loop around the north side of the spur.

Planning issues

The site is in close proximity to existing rural residential lots, and noise nuisance is a potential problem.

The design leaves an area of ‘dead space” on the north side of the spur.

Engineering issues

Very extensive earthworks would be required to achieve suitable grades and terminal working areas. The material extracted from the earthworks would have a commercial value as limestone and high quality fill.

The two gas pipelines would need to be re-routed around the site, at a very considerable cost.

Fatal flaws

Re-routing of gas pipelines may be prohibitive.

Nuisance arising from proximity to rural residential areas may not be overcome.

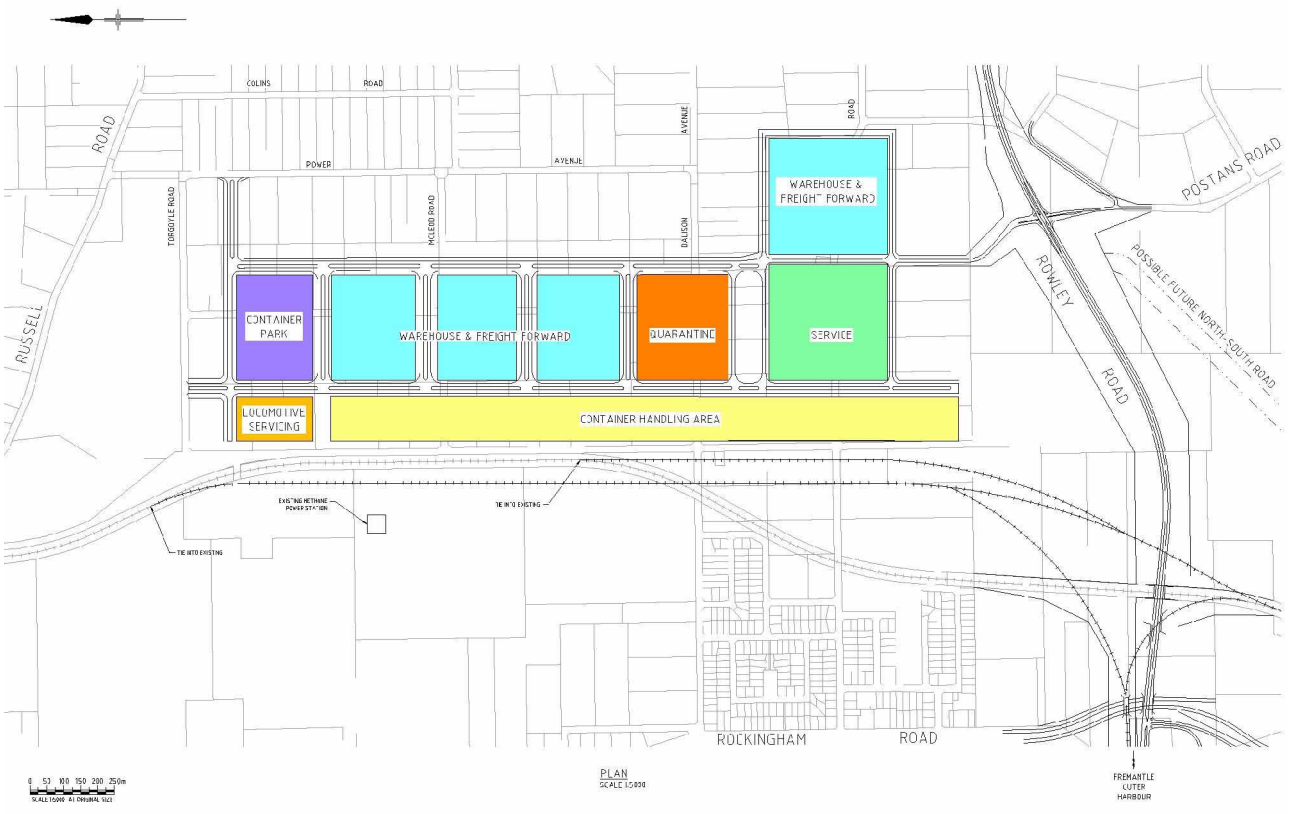


Figure 10 Concept option 5

7.7 Option 5

Rail configuration

The main line is realigned west (at the north end) and east (at the south end) to achieve a 1.8 km straight siding. The siding is east of the main line, and incorporates part of the existing main line.

Freight task

The IMT is located east of new main line and siding. The layout provides for ample room for freight village activities.

Road access

The concept provides for a north-south road link between Rowley and Russell Roads, and a ring road at the freight village. The western part of Latitude 32 woud be accessed by roads at the northern and southern end of the terminal – these roads would need to be grade-separated over the railway.

Planning issues

The westward realignment of the main line is limited to the edge of the refuse disposal area.

The site has sufficient buffer space to the rural residential areas to the east.

There is sufficient room for expansion of the freight village and ready integration of supplementary land uses.

Engineering issues

Adequate grades could be achieved on the railway and spurs.

Extensive earthworks would be required to achieve suitable grades in the terminal support areas. The material extracted from the earthworks would have a commercial value as limestone and high quality fill.

Fatal flaws

None

7.8 Comparison

The five options are compared using the selection criteria identified at the stakeholder workshop:

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5
Main access point	Good – direct access to Russel & Rowley Roads and internal Latitude 32 network.	Poor – relies on Rockingham Rd connection and crossings of main railway line.	Poor – relies on Rockingham Rd connection and crossings of main railway line.	Poor – the option has excellent access to Rowley Road but cuts off the balance of Latitude 32.	Good – direct access to Russel & Rowley Roads and internal Latitude 32 network. Grade separated links required to Latitude 32 west of railway.
Buffers	Good – sufficient distance from rural residential land	Good – sufficient distance from rural residential land	Good – sufficient distance from rural residential land	Poor – terminal is in close proximity to rural residential land	Good – sufficient distance from rural residential land
Interaction	Very good – freight village interfaces well to adjoining land uses and circulation system	Poor – freight village is isolated from the balance of Latitude 32 by the railway main line	Poor – freight village is isolated from the balance of Latitude 32 by the railway main line	Poor – terminal layout limits interaction and integration with other land uses	Very good – freight village interfaces well to adjoining land uses and circulation system
Flexibility	Good	Poor – site is constrained	Adequate – site is somewhat constrained	Poor – site is highly constrained	Very good
Port access	*Rail:* Good – port access links can be redesigned to suit *Road:* - Good access via Rowley Road	*Rail:* Good – rail layout does not impact on port rail connection. *Road:* Poor – traffic must backtrack to Rowley Road or use Rockingham Rd (likely not permitted)	*Rail:* Adequate – port access links will need redesign to suit *Road:* Poor – traffic must backtrack to Rowley Road or use Rockingham Rd (likely not permitted)	*Rail:* Good – rail layout does not impact on port rail connection. *Road:* Good access via Rowley road	*Rail:* Adequate – port access links will need redesign to suit. However provision can be made for port-oriented activities *Road:* Good access via Rowley Road.

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5
Extractive industries	Poor – relies on completion and rehabilitation of the landfill site	Poor – relies on completion and rehabilitation of the landfill site	Poor – relies on completion and rehabilitation of the landfill site	Average – extractive industries near Wattleup Road will impact terminal development	Good – the site is more remote from active quarrying operations
Staging	Poor – relies on new main line being built in its entirety	Poor – relies on new siding being built in its entirety	Poor – relies on new main line being built in its entirety	Poor – relies on new siding being built in its entirety	Good – could be developed in two sections of approx 900m each
Short term warehousing	Very good – adequate provision of warehousing space	Adequate – site is constrained with small area available	Very good – adequate provision of warehousing space	Very good – adequate provision of warehousing space	Very good – adequate provision of warehousing space.
Dynamic freight tasks	Good - Layout provides flexibility for various freight tasks and specific provision for vans and “ugly” freight.	Poor – site is constrained with insufficient area available.	Good - Layout provides flexibility for various freight tasks and specific provision for vans and “ugly” freight.	Good - Layout provides flexibility for various freight tasks and specific provision for vans and “ugly” freight.	Good - Layout provides flexibility for various freight tasks and specific provision for vans and “ugly” freight.
Multiple users	Good – layout provides for multiple users and extensive warehouse / container interaction	Adequate – site constraints may mitigate	Good – layout provides for multiple users and extensive warehouse / container interaction	Adequate – site constraints may mitigate	Good – layout provides for multiple users and extensive warehouse / container interaction
Traffic flows	Good, though concept is not fully developed. Potential for further design development	Poor – traffic flow is predicated on an access at Rockingham Road. Site is narrow, restricting internal circulation	Good, though concept is not fully developed. Potential for further design development. Requires road links to east of the railway	Adequate within site, but severely restricts access to the balance of latitude 32	Very good – internal and external traffic flows well catered for. May need one or two grade separated connections to west side of Latitude 32
Recycling of empty containers	Adequate – provides one area contiguous with core terminal	Adequate – provides one area contiguous with core terminal	Adequate – provides one area contiguous with core terminal	Adequate – provides one area contiguous with core terminal	Very good – provides two areas contiguous with core terminal
Provisioning of wagons	Adequate – frontage could be provided	Poor – limited frontage is available	Good – frontage could be provided	Poor – limited frontage is available	Very good – provides 400m rail frontage for this purpose

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5
Fatal flaws	The new main line traverses the refuse disposal site. It is unlikely the site will be available for many years into the future. Considerable rehabilitation of the refuse site would be required before any development could take place, and it is possible the site would never be suitable for any building development	The majority of freight activities are located over the refuse disposal site. It is unlikely the site will be available for many years into the future. Considerable rehabilitation of the refuse site would be required before any development could take place, and it is possible the site would never be suitable for any building development	The majority of freight activities are located over the refuse disposal site. It is unlikely the site will be available for many years into the future. Considerable rehabilitation of the refuse site would be required before any development could take place, and it is possible the site would never be suitable for any building development	Re-routing of gas pipelines may be prohibitive. Nuisance arising from proximity to rural residential areas may not be overcome	None

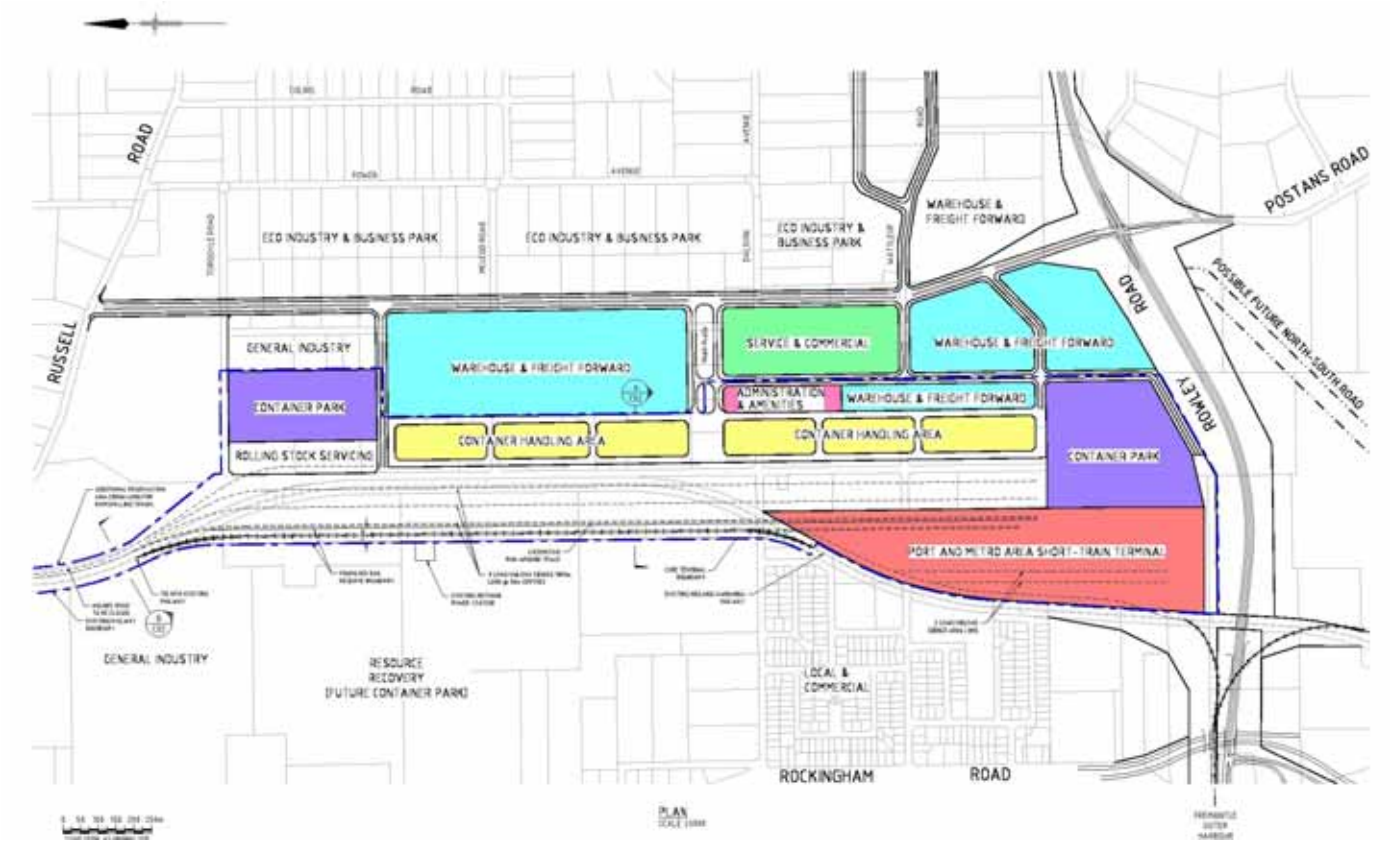


Figure 11: Preferred option - plan

7.9 Preferred option

On the basis of the evaluation above, and consistent with feedback from stakeholders, Option 5 has been selected as the preferred option. Further development of this option has been undertaken to address issues raised by stakeholders.

7.9.1 Key features

Key features of the preferred option include:

- **Base configuration**
  - The core terminal comprises a rail and container handling area, approximately 1800 metres long by 300 metres wide, together with an adjacent terminal for handling port and intrastate short trains (600 – 900 metres long).
  - Administration and amenities areas, limited warehouse facilities, two container parks and a rolling stock servicing centre are also provided within the core terminal.
  - Although there are benefits in operating a “double-ended” terminal (ie where trains can enter or leave the terminal from either end), the preferred concept has been developed as a single-ended operation. This provides the opportunity for integration of the short-train operations area with at-grade road access.

- **Location**
  - The preferred option is located within the Latitude 32 development area, east of the Midland – Kwinana railway, and occupying most of the distance between Russell Road and Rowley Road.
  - The main Midland – Kwinana railway is realigned, and located as far west as possible without encroaching on the landfill areas. The core terminal activities are located east of the main line.
  - A short-train terminal suitable for intrastate and port trains, is provided in the south-west corner of the site, adjacent to Rowley Road.
  - Container storage facilities may eventually be provided west of the main line, on the refuse disposal site. The availability of land for this purpose is subject to future closure and rehabilitation of the site. However for efficiency of operation it is recommended that container parks also be provided contiguous with the main working areas of the core terminal.

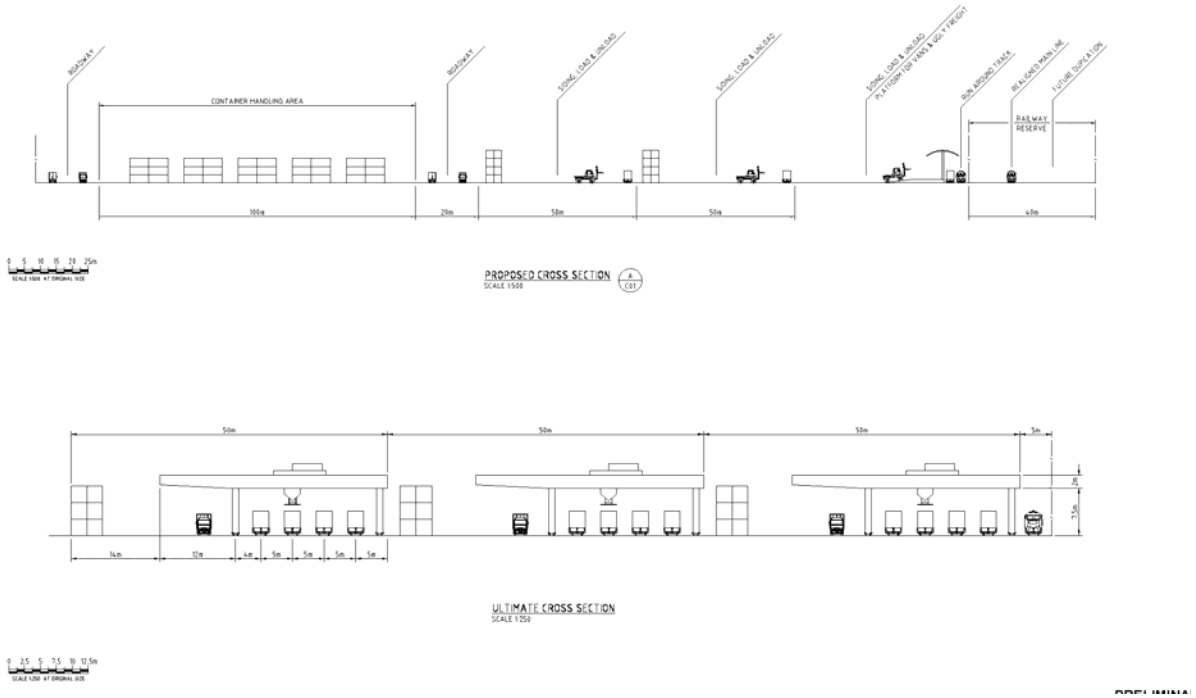


Figure 12: Preferred option - cross section

- **Rail facilities**
  - A 40m rail reserve has been nominated, to provide for future duplication of the Midland – Kwinana railway.
  - An additional 40 metre reservation, two kilometres long, will provide arrival / departure and storage sidings sufficient for 1800+ metre trains.
  - Locomotive run-around track.
  - Three parallel load/unload sidings each with a working length of 1800 metres. Depending on the ownership / operation model adopted, these could be sub-divided into 900 metre lengths.
  - All sidings are extended to the limits of the site, giving additional shunting and train assembly length.
  - It is anticipated that each of the sidings would ultimately comprise up to four closely-spaced tracks, serviced by gantry cranes.

  - A rail vehicle servicing facility has been nominated, with 400m rail frontage at one end of the terminal.
  - The short-train terminal will handle trains of 600 – 900 metres length.
  - It is noted that the geometry of the turnouts from the main line need further development, which would occur during the design phase.

- **Container handling**
  - Extensive container handling areas are provided, notionally divided into six cells, each about 300m x 100m.
  - Container parks are located at each end of the facility, sufficient to serve the needs of the terminal. Additional container storage may be required by Fremantle ports for the proposed outer harbour – it is likely that such storage would need to be west of the main line.
- **Non-container freight**
  - Stakeholder input has indicated that 15% to 17% of the total freight task is via van freight and "ugly" freight.
  - In the concept plan, one siding has been nominated for this purpose. The siding would have a ramp and platform to enable easy access to wagons, and a canopy to enable all weather operations.
  - Depending on demand at the time of construction, it may be necessary to configure this siding to allow unloading of motor vehicles.
  - Whether the platform and canopy need to extend for the full length of the siding would be determined in a more detailed design exercise.
- **Warehousing**
  - Extensive warehousing and freight forwarding facilities have been nominated.
  - The majority of these facilities would be located within the core terminal or directly abut it.
  - Lot sizes for this activity vary between two hectares and ten hectares. One lot of four hectares has been provided within the core terminal. An additional superlot of 30 hectares has been provided abutting the core terminal.
  - Additional facilities are located in adjacent streets.
- **Road traffic**
  - A major north-south road will be provided between Rowley Road and Russell Road. This will form the eastern perimeter of the terminal area.
  - At Rowley Road, the new north-south road will connect with either Postans Road (as per current DPI / Main Roads planning) or with a new road extending to Anketell Road.
  - A number of terminal entry points have been provided, with the actual configuration likely to depend on the ownership / management model adopted.
    - The main entry to the terminal will be via a very wide divided road / truck plaza, which continues through the gate area into the terminal itself. This road will provide substantial parking for trucks as well as queuing areas for vehicles waiting to access the terminal.
    - A road is provided around the southern end of the site, adjacent to Rowley Road. This allows access to the short train terminal, and provides a substantial length for queuing trucks.

- A third access point could be provided near the northern end of the site, adjacent to the container park.

– Within the core terminal, 20m wide roadways will provide circulation around the container handling areas.

– A notional layout for subdivisional roads adjacent to the terminal has been provided.

– That part of Latitude 32 west of the railway will not have road access to either Rowley Road or Rockingham Road. It is therefore recommended that one or two roads from the east are provided. These would need to be grade separated where they cross the terminal and main line.

- **Fremantle outer harbour**

– Provision has been made for port-related activity in the area freed up by realignment of the main railway.

– If Anketell Road is adopted as the port access, then freight between the port and the intermodal terminal would travel via the Midland – Kwinana railway and the regional road network

– If Rowley Road is adopted as the port access, then freight movements between the port and terminal would be via Rowley Road. Alternatively, consideration could be given to a dedicated freight-only carriageway between the port and terminal. Freight on the dedicated carriageway could be carried by high productivity vehicles.

– If Rowley Road is adopted as the port access, then rail connections to the main line and terminal would require detailed development.

7.9.2 Area

The area of land identified for the various tasks and activities within the “core terminal” is as follows:

Table 7 Land allocation

New mainline reserve	7.2 ha
Arrival / departure roads and train marshalling	8.0 ha
Load / unload sidings & container handling	39.0 ha
Container & non-container freight handling	15.5 ha
Container parks	22.1 ha
Rolling stock servicing	3.8 ha
Warehousing	4.1 ha
Administration & amenities	2.5 ha
Traffic circulation	3.8 ha
Port and metropolitan short-train terminal	26.6 ha
Total core terminal	**132.6 ha**

Note that 6.8 ha of the existing mainline reserve is incorporated in the terminal area.

8. Freight village

8.1 Overview

The concept of a freight village brings together the transport operations with services and industries that both service the transport industry and directly benefit from its proximity. The freight village has three major, but overlapping areas of activity:

- The core terminal
- Terminal support areas
- Industry park

8.2 Core terminal infrastructure:

The site containing rail corridors serving the terminal, all rail and road facilities for transfer of freight, storage and handling of containers and other goods, provisioning and servicing of rolling stock, management of rail wagons, management of containers and other maintenance activities.

For the preferred option, these core areas would include

- The railway, sidings and shunting areas
- The short train operations area
- Container handling areas
- Container parks, located contiguous with the main terminal
- Rolling stock servicing facility with direct rail access
- Administration & amenities
- Some warehousing and freight forward facilities
- Traffic circulation, parking areas, weighbridge and security facilities.

8.3 Terminal Support Areas

The land subdivision adjacent to the terminal that has a structure plan and land use that supports the terminal activities. Typical uses include transport operations and warehousing.

The preferred option shows warehouse and freight forward facilities abutting the core terminal, as well as clustered in the adjoining streets. In addition, container parks are located contiguous with the core terminal, and a rolling stock servicing facility (with direct rail access) has been provided.

In addition to the container parks within the core terminal, there will be a need for a very substantial container park to service the Fremantle inner and outer harbours.

8.4 Industry Park / Cluster Development

Land areas that support the core transport functions, as well as providing the opportunity to enhance the terminal function through associated value added uses in areas surrounding the terminal.

Adjacent to the terminal main entrance is a service and commercial area which would provide services to the businesses and employees located within the freight village. The exact range of services would

depend on commercial considerations and provisions of the Hope Valley Wattleup redevelopment area master plan and the Kwinana industrial area buffer zone. Typical services could include:

- Banks and offices of companies associated with the freight industry
- Food outlets and shops
- Day care centre, catering specifically for freight village employees
- Recreation facilities

In close proximity to the terminal, the plan identifies areas of general industry and eco-industry / business park. It is anticipated that these zones will include the following activities:

- Low environmental impact manufacturing industry, especially utilising components imported through the intermodal terminal
- Production of goods for export such as building products and domestic goods, or other goods utilising materials imported through the intermodal terminal or from the Kwinana industrial area
- Repair and servicing of trucks and rolling stock, spare parts suppliers and related activities

Container parks could be located west of the main railway, provided the landfill areas can be satisfactorily and economically rehabilitated. Because of the large number of containers potentially crossing the main railway, a grade-separated road crossing or a mechanised container transfer system would be required.

9. Summary & recommendations

9.1 Summary

The Western Australian Planning Commission has commissioned GHD Pty Ltd and Meyrick & Associates to undertake a site evaluation and planning study for a proposed intermodal freight terminal to be located in the Kwinana area.

This report describes the study methodology, consultations undertaken, and investigations carried out. It provides a conceptual design for a preferred terminal option, and makes recommendations relating to the future design and construction of the terminal, and the protection of the required land.

The preferred location for the Kwinana intermodal terminal is within the Hope Valley Wattleup Redevelopment Area, adjacent to the existing Midland – Kwinana railway, between Russell and Rowley Roads.

Five terminal options were produced for the preferred site, and referred to the steering group and a stakeholder workshop. Concept option no 5 was adopted as the preferred option, and further developed with input from the steering group and industry stakeholders. Key features of the preferred option include:

- A core terminal comprising a rail and container handling area, approximately 1800 metres long by 300 metres wide, together with an adjacent terminal for handling port and intrastate short trains (600 – 900 metres long).
- Administration and amenities areas, limited warehouse facilities, two container parks and a rolling stock servicing centre are also provided within the core terminal.
- The preferred concept has been developed as a single-ended operation to provide the opportunity for integration of the short-train operations area with at-grade road access.
- The main Midland – Kwinana railway is realigned, and located as far west as possible without encroaching on the landfill areas. The core terminal activities are located east of the main line.
- A 40m rail reserve has been nominated, to provide for future duplication of the Midland – Kwinana railway.
- An additional 40 metre reservation, two kilometres long, will provide arrival / departure and storage sidings sufficient for 1800+ metre trains.
- Extensive container handling areas are provided.
- Container parks are located at each end of the facility, sufficient to serve the needs of the terminal.
- Stakeholder input has indicated that 15% to 17% of the total freight task is via van freight and “ugly” freight. Sufficient land has been allowed to handle this type of freight.
- Extensive warehousing and freight forwarding facilities have been nominated, either within the core terminal or directly abutting it.
- A major north-south road will be provided between Rowley Road and Russell Road. This will form the eastern perimeter of the terminal area.
- A number of terminal entry points have been provided, with the actual configuration likely to depend on the ownership / management model adopted.

- A notional layout for subdivisional roads adjacent to the terminal has been provided.
- Provision has been made for port-related activity in the area freed up by realignment of the main railway.

9.2 Recommendations

The study team make the following recommendations in relation to the Kwinana intermodal terminal:

Recommendation 1

The Kwinana intermodal terminal should be located within the Hope Valley Wattleup Redevelopment Area (Latitude 32), and between Russell Road and Rowley Road.

Recommendation 2

The Kwinana intermodal terminal should be arranged generally as shown on Figure 11 of this report.

Recommendation 3

A planning control area should be declared under the Hope Valley Wattleup Redevelopment Area Act (2000), covering the core terminal area as shown on Figure 11.

Recommendation 4

The land adjacent to the core terminal should be designated appropriately under the Hope Valley Wattleup Redevelopment Area structure plan. It will be important to ensure that terminal-related activities such as container parks are appropriately recognised and planned accordingly.

Recommendation 5

A site grading plan should be prepared covering the whole of the terminal area. Extractive industries licenses issued within the project area should include a requirement to construct finished ground levels in accordance with the grading plan.

Recommendation 6

Environmental recommendations contained at Section A 5, in Appendix A of this report, should be implemented.

Appendix A

Environment

Environmental appraisal

A 1 Executive Summary - Environmental

The Department for Planning and Infrastructure commissioned GHD Pty Ltd and Meyrick & Associates to undertake a site evaluation and planning study for the proposed development of the Kwinana Intermodal terminal.

The intermodal terminal will be located within the proposed Hope Valley Wattleup Redevelopment Project (HVWRP). The intermodal terminal will be a central hub of importance, combining road, rail and sea freight facilities in one location, to effectively import and export materials around the state.

A number of desktop assessments including database, literature reviews and consultation with state government departments was undertaken to determine the potential environmental impacts of the proposed works. These included identification and reporting of:

- Climate;
- Geology and soils;
- Topography and hydrology;
- Vegetation;
- Weed management;
- Significant fauna;
- Indigenous heritage;
- Non-indigenous heritage;
- Land use; and
- Construction phase impacts.

The major issues identified from the desktop assessment, are summarised as follows:

- Clearing of native vegetation for the proposed terminal location, and infrastructure links to the terminal;
- Groundwater contamination, movements and use;
- Potential Acid Sulphate Soil issues from dewatering or construction activities;
- Air quality issues from activities onsite;
- Odorous or toxic materials handled through the port causing offsite impacts;
- Noise from activities at the terminal potentially impacting offsite;
- Terminal design negatively impacting to persons surrounding the terminal; and
- The requirement for a formal risk assessment for materials handled at the facility.

Additional studies and permits identified during the desktop assessment that may require further work to be undertaken are as follows;

- A clearing permit may be required for the removal of vegetation at the proposed intermodal terminal location;
- A fauna assessment may be required for areas marked for vegetation removal;

- The development of a water allocation plan for major parties onsite that require groundwater extraction;
- A groundwater monitoring plan should be developed to identify significant changes to the groundwater in the project area;
- The development of an Acid Sulphate Soil investigation and management plan;
- The development of a noise assessment report to accompany the terminal development and proposed activities at the site;
- A design development plan will need to be developed, lodged and open for public comment upon finalisation of the design location and plan; and
- Undertaking of a formal risk assessment to determine potential offsite impacts from potential activities to be undertaken at the terminal.

With the information identified in this report, it was concluded that the most suitable location for the intermodal terminal would be a centrally located facility, requiring only minor deviance from the existing rail line location. The master plan identified precincts 4 and 7 as potentially suitable for the location of the intermodal terminal. From the environmental constraints identified within this study, it was identified that those precincts remain as the preferred location for the facility.

A 2 Introduction

The Department for Planning and Infrastructure (DPI) commissioned GHD and Meyrick & Associates to undertake a site evaluation and planning study for the proposed development of an intermodal terminal in the Kwinana area.

Landcorp is undertaking the Hope Valley-Wattleup Redevelopment Project (HVWRP), which includes the redevelopment of land in the local government areas of Cockburn and Kwinana.

This report identifies potential environmental constraints within the project area to identify the most suitable location for the intermodal terminal and any additional studies as required.

A 2.1 Scope of Report

This report has been prepared to conform to DPIs Consultant Brief. It:

- Identifies and reviews existing environmental reports;
- Conducts an initial assessment to determine the key environmental aspects for the proposal;
- Assesses all environmental aspects likely to require referral of the project and advises whether the project should be referred to the Environmental Protection Authority (EPA);
- Assesses all Matters of National Environmental Significance likely to require referral of the project to the Commonwealth Department of Environment and Water Resources (DEWR);
- Determines (but does not apply for) clearances required under other legislative provisions, including (but not limited to) those required under the following Acts:
  - *Conservation and Land Management Act (1984);*
  - *Wildlife Conservation Act (1950);*
  - *Environmental Protection Act (1986);*
  - *Rights in Water and Irrigation Act (1914);*
  - *Heritage of Western Australia Act (1990);*

– *Aboriginal Heritage Act (1972); and*

Based on the information provided by LandCorp and database/literature reviews, the environmental and social aspects considered and discussed in this report include:

- Climate;
- Flora and vegetation (presence of Declared Rare Flora, Threatened Ecological Communities and Dieback risk);
- Fauna;
- Hydrology / hydrogeology;
- Contaminated sites;
- Aboriginal and European heritage;
- Geology;
- Soils and landform;
- Potential impacts during construction;
- Other issues if they arise.

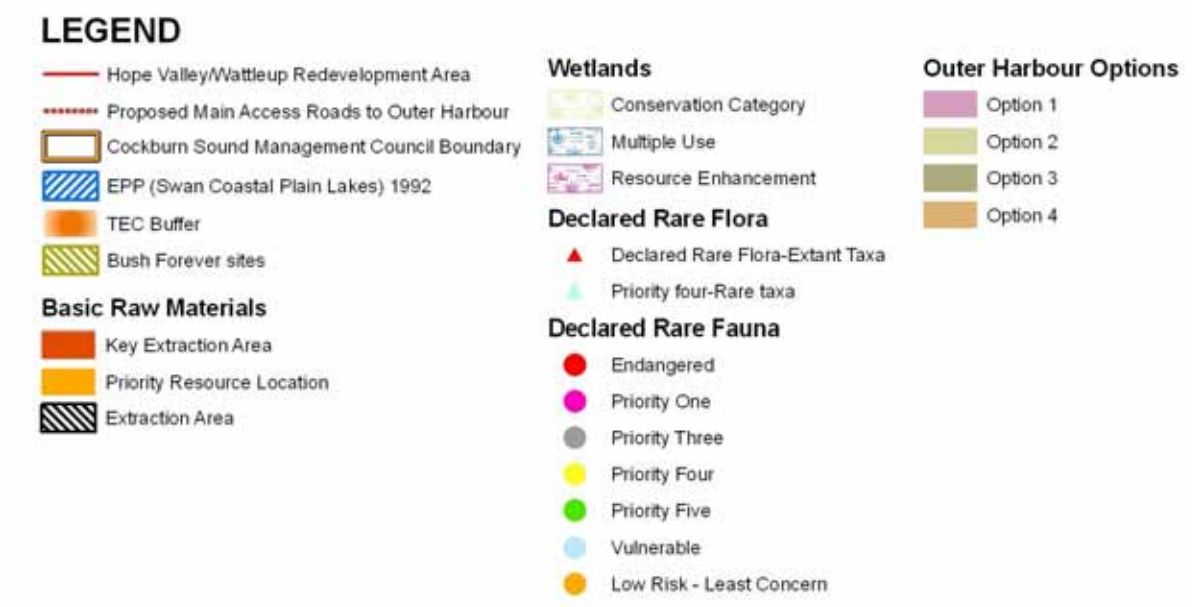
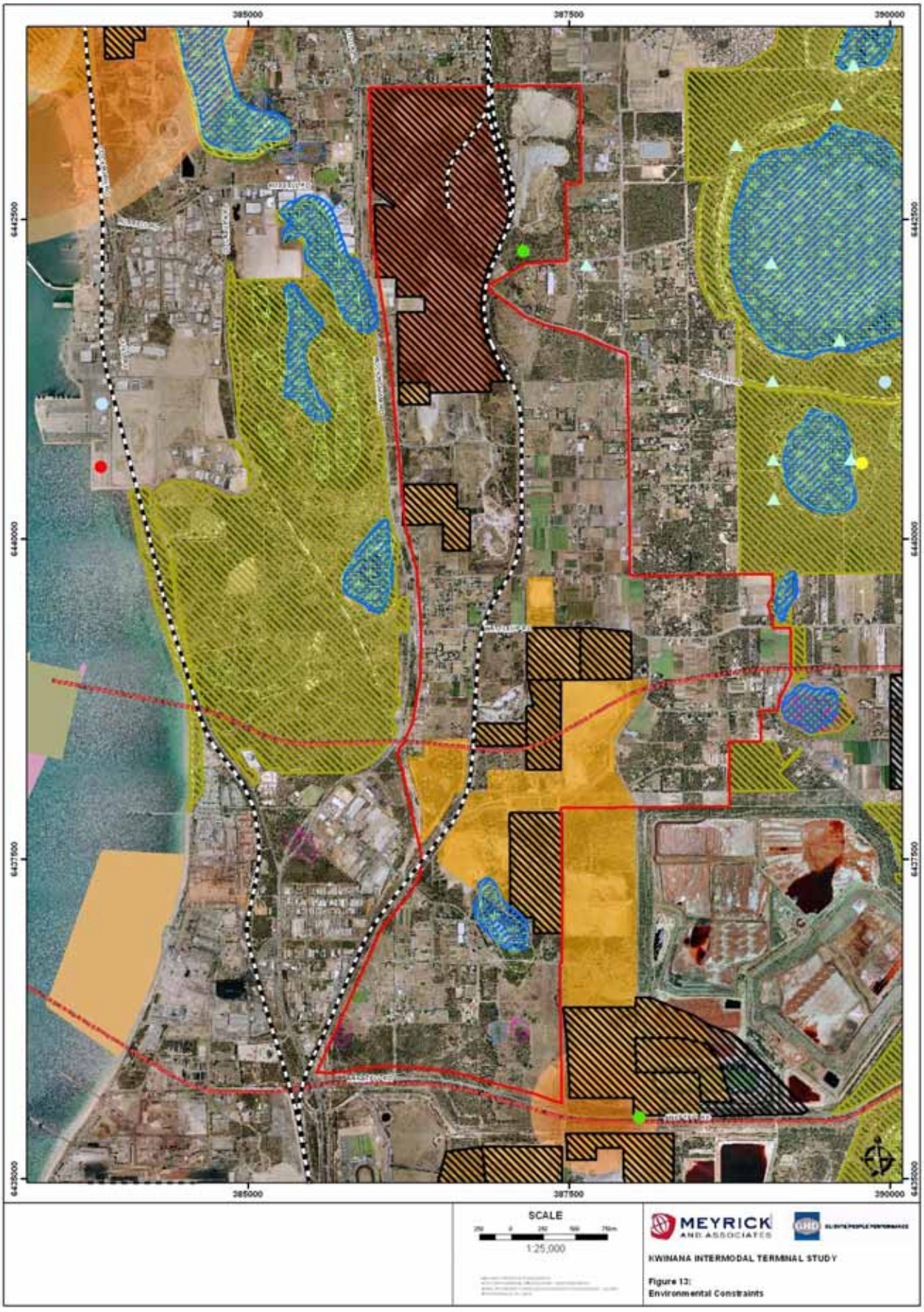


Figure 13: Environmental constraints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KWINANA INTERMODAL TERMINAL STUDY
Figure 13:
Environmental Constraints

A 2.2 Project Area

Figure 13 shows the location of the project area and potential environmental constraints.

The Hope Valley Wattleup Redevelopment Project includes the proposed development of approximately 1,426 hectares of land in the local government areas of Cockburn and Kwinana. The project will include the development of both industrial, commercial and parks / recreation areas.

The project area encompasses the towns of:

- Hope Valley in the south of the project area; and
- Wattleup, centrally located within the project area.

Towns surrounding the project area include:

- Coogee and Beeliar to the north;
- Mandgaul to the east;
- Postans and Kwinana Beach to the south; and
- Naval Base and Henderson to the west.

The predominant road infrastructure within the project area includes:

- Rockingham Road to the west of the site;
- Anketell Road to the south;
- Beeliar Road to the north; and
- Russell Road runs through the northern part of the project area.

The location of the HVWRP, particularly the internodal terminal, is dependant upon the location of major infrastructure surrounding the facility, including rail, road and sea accessibility.

There is an active railway line that runs through the centre of the site, in a north-south direction. The location of the rail line is the major factor in the overall determination of the intermodal terminal location.

A 2.3 Preferred Terminal Location

The HVWRP, as an existing proposal has previously identified a preferred location for the intermodal terminal. Dependant on the location of rail line and topography, the preferred location had been identified within the centre of the project area, as shown in Figure 13.

A 2.4 Previous Reports

Hope Valley Wattleup Redevelopment Project (2004), Master Plan. Western Australian Land Authority, December 2004.

The HVWRP Master Plan sets out the planning framework for the redevelopment of the proposed project area. The main aims of the master plan are to:

- protect the Kwinana Industrial Area by resolving surrounding land conflicts;
- protect significant heritage in the redevelopment area;
- conserve areas of local and regional environmental significance;

- minimise sources of pollution;
- distribute the cost of common infrastructure;
- ensure the development and use of land within the Redevelopment Area occur in a proper and orderly way;
- promote sustainable development; and
- facilitate development generally in accordance with the Master Plan Report and Planning Strategy.

The HVWRP Master Plan, as a planning strategy document, sets out guidelines for ensuring that all redevelopment activities are compliant with relevant legislation and conditions of development. The Master Plan documents policies for ensuring that environmental impacts to the project area and surrounds are reduced to lowest practicable levels.

Hope Valley Wattleup Redevelopment Project (2003),* Environmental Review (EPA Assessment Number 1470)*, (HVWRP Environmental Review). Western Australian Land Authority, December 2003.

The HVWRP Environmental Review (ER) provides a detailed description of the existing environment and the potential environmental impacts resulting from the implementation of the proposed Master Plan. THE HVWRP ER describes the proposed management strategies, relevant EPA requirements and subsequent planning processes.

Information identified in the Environmental Review with findings of particular relevance to this study included:

- Catchment management – documents potential impacts to wetlands within the study area and Cockburn sound;
- Flora – protection of existing remnant bushland, conservation areas and wetlands;
- Fauna – protection of existing fauna within the project area;
- Wetlands – protection of existing wetlands within the study area;
- Soil quality and contaminated lands – potential issues from contaminated lands;

The Environmental Review identified environmental constraints within the project area and documented potential actions, in line with the master plan to minimise the potential impacts.

A 2.5 Environmental Aspects and Management

The environmental and social issues considered relevant to this project are outlined on a topic-by-topic basis in the following sections. Each of the topics includes a baseline environmental description, where appropriate a preliminary assessment of potential environmental constraints and GHD's recommendation to DPI.

A 2.6 Climate

Meteorological information obtained from the Australian Bureau of Meteorology provided information on the likely climate of the closest meteorological monitoring site to the project area: Kwinana BP Refinery Weather Station. Table A1 presents annual temperature and rainfall data whilst Table A2 presents seasonal wind direction information.

Table A 1 Climate Information from Kwinana BP Refinery Weather Station (009064)

Mean Annual Maximum Temperature Range	29.3 ^{0}C (February) & 17.6^{0}C (July)
Mean Annual Minimum Temperature Range	19.1^{0}C (February) & 10.5^{0}C (August)
Mean Annual Rainfall	759.4 mm
Mean Annual Raindays per year	86.4

Source: Bureau of Meteorology Climatic Averages of Australian Sites, 2007.

Table A 2 Site Prevailing Wind Directions

Time period	Wind direction
Sept - Apr	
9am - 3pm	South Easterly
9pm - 3am	South Westerly
May - Aug	
3am - 9am	Easterly, North Easterly
3pm -9pm	Westerly, North/South Westerly

Source: Bureau of Meteorology Climatic Averages of Australian Sites, 2007.

Issues associated with weather conditions could include, dust, heat, availability of water and strong winds, however these impacts are covered in the HVWRP Master Plan.

A 2.7 Flora and Vegetation

The project area is located on the Swan Coastal Plain, predominately dominated by open forest and grasslands. The project area contains some remnant vegetation, with the majority of vegetation cover being altered at some point.

The remnant vegetation that has been left within the project area only accounts for a small percentage (approximately 18% or 260ha) of the overall area. Most of the lands have been cleared for rural development or for farming purposes.

A 2.8 Remnant Vegetation

The remnant vegetation that has been identified within the project area consists of the following flora classifications as described by *Heddle et al, 1980*.

- Karrakatta complex, central and south – A marginally tall and open forest consisting of Tuart-Jarrah-Marri, with Jarrah and Marri replacing Tuart as while progressing eastwards.
- Cottesloe Complex, central and south – A closed heath on limestone areas. Deeper sands supports a mosaic woodland of tuart and open forest of tuart-jarrah-marri, shrubs such as Melaleuca, Acacia, Grevillias and Banksias.

A 2.8.1 Threatened Ecological Communities

As part of the assessment for the project area, the presence of Threatened Ecological Communities (TECs) was identified through the Department of Environment and Conservation (DEC).

One TEC was identified in the project area in the south eastern corner of the site. The TEC is located in Precinct 1, identified in the Master Plan for General Industry. No other TECs were identified within the project area.

No TECs were identified within or nearby the preferred location for the intermodal terminal. No impacts from the intermodal terminal are predicted at the location of the TEC in the south eastern corner.

A 2.8.2 Declared Rare and Priority Flora Species

The Department of Environment and Conservation (DEC) was consulted to determine the presence of any Declared Rare and Priority Flora species over a search area covering the project and surrounding areas. Figure 1 displays the locations of the Declared Rare or Priority Flora located within the study area.

The preferred location for the intermodal terminal will not impact any identified locations of Declared Rare and Priority Flora species.

A 2.8.3 Conservation Areas

One conservation wetland was identified within the project area. Long Swamp, in the south of the site was identified in the Master Plan as Precinct 14, reserved for parks and recreation. Precinct 14 is protected from future development and will be linked to fauna corridors within the HVWRP.

The conservation areas surrounding the project area have been identified as:

- Beeliar Regional Park, including Mt Brown Lake, Brownman Swamp, Kogaulp Lake (approximately 1.5km to the west of the preferred intermodal location);
- Lake Coogee and its surrounding parklands, (approx. 3km north west of the preferred terminal location);
- Lake Yangebup Flora and Fauna reserve, (>6km to the north north east of the preferred terminal location);
- Thomsons Lake nature reserve, including Lake Thomson, (approx. 3km to the east of the preferred terminal location);
- Harry Waring Marsupial reserve, including Banganup Lake, (approx. 3km east of the preferred terminal location); and
- The Spectacles Wetlands, (>6km to the south east of the preferred terminal location).

Infrastructure planning for access to the preferred facility site will need to incorporate wetlands, conservation areas and Bush Forever Sites locations into the infrastructure layout design.

The development and operation of the intermodal terminal is not likely to impact on the conservation area locations and the preferred location of the Intermodal Terminal. Precinct 14 was identified in the Master Plan as being set aside for the protection of conservation sites within the project area.

Recommendation 1

It is recommended that the infrastructure structure planning for access to the intermodal terminal takes into account the conservation areas surrounding the project.

A 2.8.4 Wetlands

Long Swamp is the only wetland identified within the project area. Perceived impacts to Long Swamp could include such things as additional nutrients, eutrophication and contamination from surface and groundwater runoff and movements.

Long Swamp has been identified as a Resource Enhancement wetland, requiring protection to maintain its environmental values. Wetlands in or surrounding the project area are not likely to affect the preferred location of the intermodal terminal.

The Commonwealth Department of Environment and Water Resources (DEWR) search identified Thomsons Lake and The Spectacle Wetlands as Ramsar wetlands of significant importance. Thomsons Lake and The Spectacle Wetlands are located outside of the project area, approximately 3 km and 6km respectively from the preferred intermodal terminal location.

Groundwater movements are reported in the HVWRP ER as moving westerly, towards Cockburn Sound. Potentially, contaminated groundwater may impact on the wetlands located west of the preferred terminal location, namely Brownman Swamp, Mt Brown Lake and Cockburn sound (<1.5km from the preferred site).

Wetland locations will not directly affect the preferred location of the Internodal Terminal.

Recommendation 2

The final design location for the intermodal terminal will need to develop a Wetland Management Plan, including site drainage and runoff, (as identified in the Master Plan) to minimise runoff impacts to the surrounding wetlands, namely Brownman Swamp, Mt Brown Lake, Thomsons Lake, Long Swamp and Cockburn sound.

The Department of Environment and Conservation (DEC) should be consulted regarding development of the Wetland Management Plan (WMP) to help identify requirements for EPA consultation regarding development and appropriateness of the WMP.

A 2.8.5 Bush Forever Sites

The Bush Forever Sites (BFS) identified surrounding the project area coincide with the conservation areas, regional parks and wetlands as identified in sections 4.2.4 and 4.2.5. Bush forever sites in the proximity of the project area include:

- Bush Forever Site no. 256: Yangebup Lake flora and fauna reserve, north east of the project area.
- Bush Forever Site no. 261: Lake Coogee, west of the northern end of the project area.
- Bush Forever Site no. 267: Located near Postans Rd and Sayer Rd. BFS is located adjacent to and borders on land nominated as the project area.
- Bush Forever Site no. 268: Located in Mandogalup, east of the project area on land adjacent to the tailings ponds for the quarry.
- Bush Forever Site no. 269: Incorporates the Spectacle Wetlands (A Ramsar listed wetland), south east of the project area and lies adjacent to the Kwinana Freeway.
- Bush Forever Site no. 270: Adjacent to BFS 269 on eastern side of Kwinana freeway.

- Bush Forever Site no. 346: Lies adjacent to the project area and includes Brownman Swamp and Mt Brown Lake. Identified as part of the Beeliar Regional Park. Located on the western side of Rockingham Rd from the project area.
- Bush Forever Site no. 349: Located in Medina and includes the Kwinana Golf Course. South of the project area.
- Bush Forever Site no. 391: Located to the east of the northern end of the project area in the Beeliar Regional Park and includes Thomsons Lake and Kogolup Lake. Northern end of BFS 391 borders onto Beeliar Rd and BFS 392 in the south.
- Bush Forever Site no. 392: Harry Waring Marsupial Reserve including Banganup Lake, located on the eastern side of the project area, only a small section is adjacent to the project area.
- Bush Forever Site no. 393: Located adjacent to the project area, includes two small un-named lakes.

No system 6 sites where identified within the project area. The HVWRP ER identified two system 6 sites. They have been incorporated into the Bush Forever Sites 346, 391 and 392.

No Bush forever sites have been identified as existing within the project area and will not affect the preferred location of the intermodal terminal.

However the location of proposed main access roads or other infrastructure (Rowley road extension), as documented in the Master Plan, may encroach into zones marked as Bush Forever Sites, specifically sites no. 346 and 393.

Recommendation 3

Should the final design for the location of the intermodal terminal (dependant on infrastructure layout) include the clearing of vegetation, a clearing permit may have to be lodged with the DEC.

A 2.8.6 Clearing of Native Vegetation

No sites have been identified within the project area that will require an application for a clearing permit. On determination of infrastructure link locations, clearing permits may be required for areas outside of the project area. This determination will need to be identified by LandCorp as outside the scope of work for this project.

There are pockets of remnant vegetation that are identified within the project area, however it was documented in the HVWPR ER that the existing bushland would not be in its original form i.e. pristine bushland, however a clearing permit may still be required.

A 2.8.7 Weeds

During the construction phase there may be a requirement to implement a weed management plan to reduce the potential for weeds to dominate cleared lands.

A 2.9 Fauna

A search of the DECs Threatened and Priority Fauna database identified 1 Priority Five mammal species within the project area. Within the study area, figure 1, 35 species of mammals, reptiles, insects or birds were identified with varying levels of Declared Rare Fauna (DRF) classification. The majority of DRF identified within the study area are located within existing Bush Forever Sites and not

likely to be disturbed from the development of the intermodal facility. However it must be noted that mammals have the ability to move and so may relocate to within the project area.

The one identified mammal within the project area is listed as priority five taxa, which is defined as *Taxa in need of monitoring (conservation dependent).* The species of mammal was not identified in the search results.

A search of the Commonwealth's *EPBC Act* Protection Matters Database identified additional threatened species and Listed Marine Species that may occur in within a five kilometre radius of the project area.

The HVWRP ER describes potential bush corridors for the remnant bush areas in and around the project area. Due to the size of the proposed project area bush corridors have been identified as essential to maintaining fauna links.

It is stated in the HVWRP ER that any proposed actions that may impact on protected fauna will have to be referred to the commonwealth minister for environment.

No declared rare fauna was identified within the preferred location for the intermodal terminal. One Priority Five declared rare fauna species was identified, located in Precinct 11 in the far north of the project area. It is not expected to be impacted by the proposed location of the intermodal terminal.

Recommendation 3

The clearing of bushland may impact on fauna habitats within the proposed terminal location, this project may require a fauna assessment to be undertaken and referred to the DEC prior to development approval.

A 2.10 Hydrology / Hydrogeology

A 2.10.1 Surface Water

The project area is located on the Swan coastal plain and is dominated by sandy soils underlain by predominantly superficial limestone and cemented sand deposits. The sandy nature of the soils at this location provide for excellent drainage of surface waters into the groundwater table.

The Western Australian Online Atlas indicated no drainage lines within the project area.

For the construction of the proposed intermodal terminal large scale earthworks may be required to level the site. The earthworks could significantly alter any existing drainage lines within the project area.

The intermodal terminal development will introduce extensive hard stands (bitumenised areas and surface drainage (i.e roofs)) to the site. The HVWRP ER extensively documents the potential issues associated with this and discusses measures that may be implemented to deal with run off from the site entering surrounding water bodies and groundwater.

A 2.10.2 Ground Water

A DEC WIN Database Bore Search within the study area (the area covered in figure 1) indicated approximately 155 bores or wells located within the project area.

It was identified that the groundwater within the project area generally flows in a westerly direction and lies between the depths of 8m AHD and 0.5m AHD, west to east respectively. Groundwater

depths on site (below the surface) range between approximately 30m and 5m. Depending on final design location of intermodal terminal and the requirement for earthworks, dewatering operations may be required at some locations.

It was identified in the HVWRP ER that the allocation of groundwater resources and subsequent sustainable use will be managed by the DOW. All significant quantities of groundwater extraction will be under license according to allocation and sustainable practices, as determined and managed by the DOW. The use of groundwater within the project area will have to be monitored to ensure sustainable extraction rates.

It is not considered that the location of bores will affect the proposed location of the intermodal terminal. However the use of groundwater bores to potentially identify risks from Acid Sulphate Soils and contamination will need to be considered during construction and the onsite use of bore waters.

With consideration given to the movement of groundwater in a westerly direction, Brownman Swamp and Mt Brown Lake and Cockburn sound, there is the potential for contaminated groundwater movements to affect these two locations. All surface and groundwaters discharging from the project area must be monitored to ensure that excess nutrients or contaminants are not emitted from the site to surrounding areas.

Recommendation 4

It is recommended that a water allocation plan be devised for the major parties on site that require the use of groundwater extraction for general industries. (The allocation of groundwater licenses must enure sustainable use so as to not negatively alter groundwater flows and levels, potentially affecting the surrounding wetlands and Cockburn sound).

Recommendation 5

A groundwater monitoring plan, including baseline and background groundwater monitoring should be developed to ensure that any significant changes to groundwater is identified.

Recommendation 6

The development of the intermodal terminal will need to identify the requirement for dewatering operations, the potential for groundwater contamination, potential groundwater level variations and the movements of groundwater from surrounding operations potentially introducing contaminants with the dewatering process.

A 2.11 Soils and Landform

A 2.11.1 Soils

The Atlas of Natural Resources (*Heddle et al, 1980*) has classified the soils in the area with the following descriptions:

- Cottesloe Complex (Predominately in the Project Area) – Low hilly landscape with shallow brown and yellow sands over limestone.
- Karatta Complex (On the western side of the Project Area) – Undulating landscape with deep yellow brown sands over limestone.

- Herdsman Complex – To the east of the Project Area (but not within) is the Herdsman Complex, which includes the wetlands (Thomsons Wetland) in the area and is defined as Peaty swamps associated with Bassendean and Karrakatta units.

The project area is predominately sandy soils overlain on limestone foundations, allowing for good drainage and easy earth works. THE HVWRP ER has identified the geology of the area and displays that the project area comprises mainly of Tamala Limestone and Tamala Limestone Sand.

A 2.11.2 Acid Sulphate Soils

According to the West Australian Planning Commission (WAPC) Planning Bulletin 64 for Acid Sulfate Soils (ASS), the risk of Acid Sulphate Soils within the project area is stated as "no known risk of ASS occurring with 3m of natural soil surface (or deeper)".

The parks and recreation area set aside for precinct 14 in the southern end of the project area (Long Swamp) was identified from the WAPC Planning Bulletin No. 64 as having a high to moderate risk of ASS occurring within 3m of the natural soil surface. The high to moderate risk identified here is consistent with the location of wetlands.

For the current land and soil configurations the risk of ASS is not likely to affect the preferred location of the intermodal terminal. If major earthworks are required there may be the potential for ASS to the development.

Recommendation 7

Should the final design location for the intermodal terminal include major[9] earthworks and re-alignment of the rail line, an ASS investigation and management plan will have to be implemented to control any potential risks from ASS and soil movement.

A 2.12 Landform

The lands within the project area have undergone considerable alteration over the years with current operations including the Cockburn Sound Cement Works, limestone quarry and Henderson landfill existing within the project area.

Low hilly landforms exist on the eastern side of the project area. A central consistent gradient exists through the centre of the site (current rail alignment location). The cement works and landfills exist on the western side of the project area. In general, the project area consists of low undulating hills.

In terms of preferred location of the intermodal terminal, the central and western side of the site is far more suited to the gradient required for the facility. The eastern side of the site contains landforms with higher elevations than the central and western parts of the project area.

If the intermodal facility were to be located on the eastern side of the project area, it could require significant earthworks to reduce the ground level till suitable for rail access and container handling facilities.

The existing quarry pits and landfills are located within the project area, depending on the level of earthworks required the landfill and limestone extraction pits would most likely prevent rail re-alignment over these locations.

[9] Major earthworks potentially may require excavation of the earthen mounds on the eastern side of the Project Area. Contour maps display significant hills, and depending on choice of rail alignment significant earth moving may be required.

A 2.13 Landuse

The Hope Valley Wattleup Redevelopment Act, overrides all current land use and zoning that is on the site. There are existing leases within the project area that will allow for continued existing operations, including the cement works in precinct 11, and the landfills in Precinct 1 and Precinct 8.

Much of the land proposed for the preferred terminal location currently consists of semi rural/urban lands, lightly populated with much of the land used for market garden type farming, or bushland.

A 2.14 Contaminated Lands

A search of the Department of Conservation (DEC) Contaminated Sites Database revealed that there were no recorded contaminated sites within the project area. A desktop review of the project area indicated that three potentially contaminated areas are identified within the HVWRA and these include:

- Cockburn Cement's Shellsand Operation, precinct 10;
- City of Cockburn's Henderson Landfill, precinct 8; and
- Western Power's Perron Quarry fly-ash disposal site, precinct 3.

Issues relating to the location of the intermodal terminal within the project area may involve:

- Requirement for backfilling operations;
- Potentially unstable lands (subsidence) at the landfill, cement works and fly-ash disposal;
- Impacts and removal of contaminated materials;
- Requirement for monitoring and potential impacts of toxic plumes (groundwater);
- Leases on land extending into the future preventing redevelopment;
- Locations of pipelines (oil, fly-ash and shellsand);
- Location of Dampier Bunbury Pipeline, high voltage power lines located in a central service corridor; and
- Unsewered Hope Valley and Wattleup townsites.

From the identified constraints it is suggested that any future land use planning activities to be undertaken at the project area must consider the potential for contaminated impacts to persons or business occupying these lands.

Presently, the future leases on the lands and the current land use / topography would prevent the development of the intermodal terminal at the above-mentioned potentially contaminated locations, located in precincts 3, 8 and 11.

The re-alignment of the rail line further to the west could potentially encroach in to the land currently used as the Henderson Landfill. Henderson landfill (Precinct 8) presents the greatest constraints to the development of the intermodal facility, particularly rail line locations in the location proposed (Precinct 4) in the master plan.

The Henderson landfill would require significant engineering works to be undertaken before construction of the terminal could proceed at this location. Engineering works would include back filling, stabilisation and potential contamination monitoring / remediation.

The potential for contaminated materials in groundwater flowing into the nearby located Brownman Swamp, Mt Brown Lake and eventually into Cockburn sound may also need to be identified. A

hydrogeology study may need to be undertaken to determine the extent of groundwater movements and groundwater contamination.

The preferred location for the intermodal terminal will not be affected by the location of the identified contaminated sites.

Earthworks potentially required for the terminal development could facilitate movement of contaminated materials (groundwater plumes) from the contaminated sites to surrounding areas.

A 2.15 Aboriginal and European Cultural Heritage

A 2.15.1 Non-indigenous Heritage

A search of the Heritage Council of Western Australia database, the Commonwealth's Australian Heritage Place Inventory and the EPBC Protection Matters database did not identify any non-indigenous Australian heritage sites that may be impacted by the proposed works. In summary:

- No World Heritage lands where identified within the project area.
- No Commonwealth Heritage sites where identified within the project area.
- No National Heritage sites where identified within the project area.

The HVWRP ER identifies three Kwinana Municipal Heritage sites located in the southern end of the project area.

The Kwinana municipal heritage sites located in the southern end of the project area are identified in the HVWRP ER as having low heritage ratings. The ER describes them as "not representing a threat to future development". There are methodologies for ensuring that heritage sites identified as having significant cultural heritage be conserved through a special planning control area. The WAPC may, by resolution, designate areas as heritage areas.

The preferred location for the intermodal terminal will not impact on any heritage listed areas.

A 2.15.2 Native Title and Indigenous Heritage

Reference to the Department of Indigenous Affairs database indicated no Native Title claims within the project area. The land is designated as Freehold land.

Thomsons lake and Lake Coogee are both listed as Aboriginal Heritage Sites, however they are located outside the project area and not likely to be impacted by the development of the Intermodal terminal.

No archaeological sites have been identified within the project area. There may be the potential for ethnographic (mythical sites) to be located at Long swamp wetland (Precinct 14) reserved for parks and recreation, located outside of the preferred terminal location.

With regard to the information supplied by the DIA database, native title and Indigenous heritage areas will not affect the preferred location of the intermodal terminal.

A 2.16 Aesthetic values

A 2.16.1 Air Emissions

The HVWRP ER describes the potential for air emissions emitted from the proposed precincts including the intermodal terminal. The HVWRP ER identifies that the HVWRA needs to meet the

standards expected for industrial and non-industrial areas in accordance with the *Environmental Protection (Kwinana) Atmospheric Wastes Policy 1999.*

Potential dust issues could arise during construction processes. It is expected that a construction management plan, including such things as dust and rubbish issues would be implemented prior to commencement of construction work within the project area.

Once operational, activities at the intermodal terminal may increase emissions generated at the site. Potential emission generators will include additional trucks, trains, and industrial processes. Emissions would be in the forms of vehicle combustion vapours and emissions from industries.

The Kwinana industrial area lies to south east of the proposed location for the HVWRA. It is reported in the HVWRP ER that the DoE operates air monitoring surveys in this area to ascertain the levels of emissions from the industrial area, in particular sulphur dioxide, nitrogen oxides and visibility.

Recommendation 8

Additional air quality monitoring may be required surrounding the HVWRP, before and after development of the intermodal facility to identify any air quality issues.

It is not expected that the potential for emissions will prevent the development of the intermodal facility at the preferred site.

A 2.16.2 Odour Impacts

Excluding air emissions (vehicles, dust etc), any additional odour impacts from the intermodal terminal are more likely to be associated with onsite activities and the movements of hazardous materials through the site. It is not expected that the intermodal terminal will generate additional odours likely to have significant impacts.

Activities that may be undertaken at the Intermodal terminal with the potential for odour generation could include such things as:

- Container quarantine activities including pest control;
- Container maintenance activities including welding or painting;
- Live Animal Export operations;
- Air impacts (section 4.8.1) including additional exhaust emissions from vehicle movements;
- Hazardous material releases, storage and handling operations; and
- General industrial business activities.

Existing activities within the project area that could potentially have offsite odour impacts including:

- City of Cockburn Henderson Landfill;
- Cockburn Cement works;
- Western Power Fly Ash landfill; and the
- Hazardous materials release, storage and handling operations.

Recommendation 9

The risk assessment stage of this project must quantify what materials being handled through the intermodal terminal may cause odour issues with potential for offsite impacts.

A 2.16.3 Noise

Noise generated from the intermodal terminal could potentially impact to populations surrounding the proposed facility, particularly residential areas. The noise levels generated could potentially reach levels that cause discomfort or nuisance above statutory requirements and acceptable standards, especially night time activities.

Noise levels within Australia are governed by the *Environmental Protection (Noise) Regulations 1997.* Noise generated from the proposed intermodal terminal will need to be assessed under the Preliminary Draft EPA (DEP 2000a) *Guidance for the Assessment of Environmental Factors No. 14 – Road and Rail Transportation Noise.*

The proposed Master Plan states in section 6.4.3 "*Land use and development within the Redevelopment Area shall be carried out and managed in such a manner as to ensure that any individual or cumulative noise generated during the construction or operation of any development does not adversely affect existing and potential future neighbouring land uses, development, land uses, employees or the general public, and prevents an unacceptable level of noise encroaching beyond the redevelopment Area Boundary".*

Predominately lightly wooded and generally sparsely spaced rural residential areas currently surround the proposed HVWRP area. The distances between the current noise generating sites and rural / residential developments are currently sufficiently spaced to not prevent current operations from being undertaken. The existing operations likely to generate noise impacts include:

- City of Cockburn Henderson Landfill;
- Limestone quarry;
- Cockburn Cement Works;
- Freight Rail (Bunbury to Perth);
- Kwinana Motoplex;
- Kwinana Beach Road.

The development of the intermodal terminal is likely to generate noise impacts from such activities as:

- Freight rail movements, train shunting, container loading and unloading;
- Truck movements;
- Freight container handling noises;
- Truck / vehicle reversing warning alarms; and
- Intermodal construction phase noises.

The location of the intermodal terminal within the proposed master plan precincts of 5, 6, 7, 8, 9 or 10 could potentially have noise impacts to the residential areas east of the project area, particularly the township of Wattleup.

Given the preferred location for the intermodal terminal within the project area, predicted noise levels will need to be identified to ascertain potential impacts to residential areas surrounding the project area.

Precinct 5 designated as a local commercial centre will be closely located to the preferred location for the intermodal terminal. Any activities undertaken at the intermodal terminal will have to ensure noise levels generated do not exceed current regulations at this location.

It is stated in the HVWRP ER that a proposed development that is likely to lead to increased road or rail transport noise must prepare a noise assessment report.

Recommendation 10

It is recommended that a noise assessment report will need to be developed to accompany any development. The final design location for the intermodal terminal may need to identify and incorporate potential noise impacts from activities undertaken at the intermodal terminal

A 2.16.4 Visual amenity

It is not expected that the potential visual impacts from the development of the intermodal terminal will vary between the different sites within the project area. The eastern side of the project area is slightly more elevated that the central and western regions.

Rural / residential lots on the eastern side (elevated positions) of the project area could possibly have direct visual contact with the proposed intermodal terminal.

Visual or aesthetic impacts from such a development could include things such as:

- Stacking of containers;
- Warehouses and container warehouses;
- Additional lighting for night time activities;
- Cranes and forklifts;
- Loading and unloading hard stacks;
- Trains and additional train lines.

It is proposed that the intermodal facility is to be constructed on the lower lying grounds to the central and western parts of the HWVRA.

Recommendation 11

It is recommended that a design development plan will need to be developed, lodged and open for public comment upon finalisation of the design location and plan.

A 2.17 Safety and Risk Management

The proposed intermodal terminal will be a central hub for the movement of freight throughout WA and the world. As a freight terminal, it is expected that a certain quantity per annum of hazardous materials / dangerous goods will be shipped through the outer harbour and Fremantle ports and subsequently the intermodal terminal.

Shipments of hazardous materials may include potentially toxic, flammable or explosive substances that could impact offsite or have cumulative impacts to other industries within the HVWRA. Potential hazardous events could include:

- Toxic vapour cloud / liquid impacts (Chlorine, sulphur dioxide, hydrogen fluoride);
- Flammable impacts (Bulk hydrocarbons, Oils, flammable gases);
- Explosive impacts (Ammonium Nitrate, containerised flammable gases (BLEVES), military explosives).

The proposed locations for the intermodal terminal are surrounded by residential / rural areas, a commercial area (Precinct no. 5) and other industrial areas. As part of the development application and approval process, a risk assessment of the potential offsite hazardous impacts will need to be undertaken to satisfy the requirements stipulated by the WA EPA and DoCEP.

Recommendation 12

It is recommended that once the final design location of the intermodal terminal is decided, a formal risk assessment should be undertaken to determine the potential for offsite / onsite impacts to the movements of hazardous materials.

A 2.18 Impacts During Construction

Potential environmental and social impacts likely to require consideration during the construction phase of the Project include:

- noise;
- dust;
- clearing;
- weeds;
- traffic safety and access;
- fire management;
- pollution management; and
- rubbish disposal.

These issues will need to be managed through the implementation of a construction environmental management plan (CEMP).

A 3 Consultation

The HVWRP ER briefly documented the extensive level of community and stakeholder consultation that has been undertaken for the development of the HVWRP up to the year 2002.

Consultation in relation to the location and planning of the intermodal terminal to date has been undertaken with a limited number of key stakeholders, primarily from government and industry.

A 4 Environmental Approvals

A 4.1 Commonwealth Approvals

No environmental impacts identified during the preparation of this report warrant referral of the project to the Commonwealth under the provisions of the *Environmental Protection and Biodiversity Conservation Act (1999).*

A 4.2 Government of Western Australia

The DEC is responsible for administering the *Environmental Protection Act (1986)*. This report indicates that no environmental and social impacts from the proposed works are likely to occur and as such, a formal assessment by the DEC and EPA is considered to not be required.

A 4.3 Clearing Regulations

Based upon available information it is possible an area specific clearing permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations (2004)* may need to be issued by the DEC prior to the commencement of any clearing in the project area.

A 5 Conclusions and Recommendations

There is a low level of potential environmental constraints associated with the preferred location of the intermodal terminal.

It is concluded from the information supplied in this report that the most suitable location for the intermodal terminal, based on environmental constraints, is a centrally located facility, in precincts 7 and 4.

Based on the location of the rail line, and the availability of relatively level ground, the study team has proposed a centrally located intermodal facility. No environmental constraints were identified that would prevent the development of the preferred centrally located facility.

GHD advises the Department for Planning and Infrastructure of the following recommendations to ensure that the proposed works occur with least possible impact on the immediate and surrounding areas.

Recommendation 1

It is recommended that the infrastructure planning for access to the intermodal terminal takes in to account the conservation areas surrounding the project.

Recommendation 2

Should the final design for the location of the intermodal terminal (dependant on infrastructure layout) include the clearing of vegetation in the Bush Forever Sites surrounding the Project Area, a clearing permit may have to be lodged with the DEC.

Recommendation 3

The clearing of bushland may impact on fauna habitats within the proposed terminal location, this project may require a fauna assessment to be undertaken and referred to the DEC prior to development approval.

Recommendation 4

It is recommended that a water allocation plan be devised for the major parties on site that require the use of groundwater extraction for general industries. (The allocation of groundwater licenses must ensure sustainable use so as to not negatively alter groundwater flows and levels, which could affect the surrounding wetlands and Cockburn sound).

Recommendation 5

A groundwater monitoring plan, including baseline and background groundwater monitoring should be developed to ensure that any significant changes to groundwater is identified.

Recommendation 6

The development of the intermodal terminal will need to identify the requirement for dewatering operations, the potential for groundwater contamination, potential groundwater level variations and the movements of groundwater from surrounding operations potentially introducing contaminants with the dewatering process.

Recommendation 7

Should the final design location for the intermodal terminal include major[10] earth works and re-alignment of the rail line, an ASS investigation and management plan will have to be implemented to control any potential risks from ASS and soil movement.

Recommendation 8

Additional air quality monitoring may be required surrounding the HVWRP, before and after development of the intermodal facility to identify any air quality issues.

Recommendation 9

The risk assessment stage of this project must quantify what materials being handled through the intermodal terminal could cause odour issues with potential for offsite impacts.

Recommendation 10

It is recommended that a noise assessment report will need to be developed to accompany any development. The final design location for the intermodal terminal may need to identify and incorporate potential noise impacts from activities undertaken at the intermodal terminal

Recommendation 11

It is recommended that a design development plan will need to be developed, lodged and open for public comment upon finalisation of the design location and plan.

Recommendation 12

It is recommended that once the final design location of the intermodal terminal is decided, a formal risk assessment must be undertaken to determine the potential for offsite / onsite impacts from the movement of hazardous materials.

A 6 References

Heddle et al (1980), *Atlas of Natural Resources, Darling System Western Australia*. Department of Conservation and Environment WA 1980.

Beard, J. S (1979) *Vegetation of the Perth Area Western Australia: Map and Explanatory notes* 1:250,000 Series, Vegmap Publications, Perth Western Australia

Hope Valley Wattleup Redevelopment Project (2004), *Master Plan*. Western Australian Land Authority, December 2004.

Hope Valley Wattleup Redevelopment Project (2003), *Environmental Review (EPA Assessment Number 1470)*, (HVWRP ER). Western Australian Land Authority, December

[10] Major earth works potentially may require excavation of the earthen mounds on the eastern side of the Project Area. Contour maps display significant hills, and depending on choice of rail alignment significant earth moving may be required.

Department of Environment and Conservation (2006) Florabase [online] Available at: http://florabase.calm.wa.gov.au/browse/flora?f=345&level=s&id=7916. Accessed 22/09/2006.

Commonwealth Bureau of Meteorology, (2006), [online] Available at: http://www.bom.gov.au/lam/climate/levelthree/cpeople/travelmap.htm, Accessed 13/09/2007.

Appendix B

Geotechnical

Geotechnical study report

B 1 Geotechnical

B 1.1 Introduction

The geotechnical component of this report consists of a desktop study, with no allowance for site inspection and fieldwork. The scope of work is outlined as follows and completed in accordance with the GHD proposal, 'Kwinana Intermodal Terminal' (ref. 67698) dated March 2007, and includes a review of general geological conditions, groundwater depths, presence of wetlands, and known quarries and tip sites.

We understand the site will undergo redevelopment, consisting of the upgrade of the current railway network and associated industrial facilities and structures.

The site is located at Hope Valley and Wattleup, bounded by Anketell Road to the south, Rockingham Road to the west, Fanstone Avenue to the north and Henderson Road / Power Avenue / Mandogalup Road / Abercrombie Road to the east (please refer to site plan). The site is approximately 700m from the coast and covers an area of approximately 16.5km².

B 1.2 Regional Geology

The site is located on the Swan Coastal Plain, which consists predominantly of sedimentary deposits of alluvial and eolian origin (Spearwood Dune System). The Spearwood Dune System comprises swamp deposits, Spearwood Sand and Tamala Limestone, as indicated by the 1:50,000 Environmental Geology Map (Fremantle), as outlined in drawing '6121026-G6'. The deposition of these sedimentary units are distributed parallel to sub-parallel to the current coastline, and the geomorphology is dominated by the regression of sea level.

B 1.3 Site Geology

B 1.3.1 Swamp Deposits

The 1:50,000 Environmental Geology Series (Fremantle) indicates the swamp deposits to be silt and sandy silt. The silt is brown-grey, partly calcareous, with some fine-grained sand. The sandy silt is dark brown-grey, fine-grained quartz sand, with variable clay content.

The swamp deposits are interdunal deposits located at the depression of the dunal system. It is typically associated with groundwater discharge such as lakes. This deposit is formed in organic-rich, low energy, anaerobic environment and is usually high in organic silt with minimal secondary sand content, deposited during the Holocene period.


385000
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LAKE COOGEE
KOGOLUP LAKE
Qpb
THOMSONS LAKE
BROWNMAN SWAMPS
Qhm
Qhg
COCKBURN SOUND
Qs
Qts
LONG SWAMP
Qhs
SCALE
250 0 250 500 750m
1:25,000
MEYRICK AND ASSOCIATES
KWINANA INTERMODAL TERMINAL STUDY
Figure 14:
Urban Geology

B 1.3.2 Spearwood Sand

The Spearwood Sand is derived from the Tamala Limestone and comprises pale yellowish-brown, medium to coarse grained sub-angular quartz, with traces of feldspar and is moderately sorted. The Spearwood Sand was deposited during the late Pleistocene period.

B 1.3.3 Tamala Limestone

Tamala Limestone is a medium to coarse-grained calcarenite that outcrops and/or underlies the Spearwood Sand. It is an interbedded shallow marine and eolian deposit, with variable degrees of cementation, kankar characteristics, and is potentially karstic. Crossbedding, paleosols (fossilised soil horizons) and rhizoliths (calcified fossil roots structures) are common features in this unit.

Possible karst features include cavities formed by groundwater dissolution of calcium carbonate. However, they are not generally common in this area (Gordon, 2003).

B 1.4 Groundwater

The Perth Groundwater Atlas indicates that the maximum probable groundwater (in May 2003) is likely to be between 0 to 1m AHD at the central part of the site. The maximum probable groundwater at the northern part of the site is most likely to be 1 to 6m AHD, increasing in depth towards the north-east direction. The groundwater at the western part of the site trends in the easterly direction, grading from 1 to 9m AHD.

The groundwater level below the ground surface is dependant on the topography of the site. At the western end, the groundwater level is anticipated to be shallower. Long Swamp is an interdunal depression between dune systems and represents groundwater discharge at the ground surface. The groundwater level below the ground surface increases in depth dramatically towards the east due to the rise in topography by crests of the dune systems.

The regional groundwater flows from the northeast at Rowley Road towards the southeast at the intersection of Anketell Road and Abercrombie Road. It then changes to a north-westerly direction towards the coast and discharges into Cockburn Sound.

Salinity levels are judged to be between 500-1000 mg/L of total dissolved solids from the Perth Groundwater Atlas, which shows the groundwater salinity to be ‘marginal’.

B 1.5 Wetlands

Two main areas have been identified from the geological map and UBD as wetlands. One of these, Long Swamp, is located at the southern part of the site, north of Hope Valley Road. The other wetland is located beyond the eastern boundary at the intersection of Wattleup Road and Mandogalup Road.

The South Metropolitan Regional Scheme *Acid Sulfate Soils* by the Western Australian Planning Commission indicates that the majority of the site is at low to no risk of Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS). High risk AASS and PASS are indicated at the southern part of the site at Long Swamp and at the eastern boundary at the intersection of Wattleup Road and Mandogalup Road.

Wetlands are a valuable resource as they house a high level of ecological features. Some wetlands may be culturally sensitive areas for the indigenous communities and have significant cultural value. The Perth Groundwater Atlas indicates that Long Swamp is categorised as a ‘conservation’ area by the Department of Environment and Protection. Wetlands are protected under the Environmental Protection Act (1986).

B 1.6 Quarries

Limestone quarries dominate the central part of the site. A Geoview map from the Department of Industry and Resources website indicates that there are two inactive quarries, one active quarry (Cockburn Cement) located at the central part of the site, and a proposed quarry (ROCLA) located at the north-eastern part of the site.

B 1.7 Landfill

The Henderson Landfill site is located on the eastern side of Rockingham Road, to the south of Russell Road in Henderson. This landfill site is operated by the City of Cockburn and is located at an inactive quarry site.

At present, the landfill is a category 63 and 64 site (licence number 6965/1), in accordance with the classification provided by the Department of Environmental Protection, Waste Management Division. The site is available to accept Class 2 waste, comprising of domestic and commercial putrescible waste, and industrial waste with minimum 'TCLP' contaminants.

The leachate produced by the decomposing wastes and natural rainfall percolating into the landfill, are prevented from entering the natural subgrade and groundwater by the use of high-density polyethylene (HDPE) lined cells. HDPE is placed at the base of the landfill containment area and the leachate is drained into a sump. The leachate is pumped into a leachate treatment plant and processed to an acceptable level before it is discharged into the groundwater. The plant is capable of processing 100kL of leachate per day.

The following table is a summary of the Henderson Landfill provided by the City of Cockburn website.

Table 1 Summary of Henderson Landfill

Total Site Area	67 Ha
Area of Lined Cells Stage 1 (Cells 1 & 2 – 65,000m² and Cell 3 – 41,000m²)	10.6 Ha
Design Capacity Stage 1 (Cells 1, 2 and 3) Assumes compaction rate of 680 kg/m³ and 15% cover	1,050,000m³ or 920,000m³
Ultimate Capacity of Site	Approximately 3,500,000m³
Life Expectancy Assuming current waste volumes are maintained with average growth of 2-3% per annum	2010 - 2025
Annual Average On Liner	120,000 tonne
Annual Average Off Liner	13,000 tonne

B 1.8 Assessment of Geotechnical Issues

B 1.8.1 Earthworks

Limestone gives an uneven and irregular surface profile due to the development of pinnacles of hard rock and deep sand filled cavities. This can be problematic when trying to achieve a flat, continuous horizon along the limestone unit. Limestone outcrops exposed to weathering conditions will undergo hardening and become caprock (Calcrete). Caprock layers have been known to cause problems during excavation.

Although not common in this area, cavities at Yanchep and areas north of Wanneroo have been documented. Heavy machinery such as excavators and compactors used during the earthworks may be at risk from breaking into such cavities (Gordon, 2003).

The South Metropolitan Regional Scheme *Acid Sulfate Soils* by the WAPC indicates that wetlands present at the site, such as Long Swamp, are categorised as high risk for the presence of Actual Acid Sulfate Soils and Potential Acid Sulfate Soils. High risk zones will be required to undergo detailed environmental assessment, including field testing and environmental management planning. Details of such work are outlined in the Department of Environment and Conservation Guideline for Acid Sulfate Soils, 'Draft Identification and Investigation of Acid Sulfate Soils', May 2006.

Extensive quarrying of the local limestone has occurred throughout the site. Depending on the required land usage, these quarries may need to be engineered and backfilled to design level to meet construction requirements. Structural backfill material could be sourced from the local area in order to minimise construction costs.

B 1.8.2 Foundations

Spearwood Sand is predominant throughout the site and offers minimal settlement for foundations. Therefore, Spearwood Sand makes a viable source of material for use as structural fill.

Placing foundations on limestone is problematic due to its uneven and irregular surface, its highly variable strength (which is dependant on the degree of cementation), and its potential for karsts, which can affect settlement and bearing capacity. Limestone caprocks are known to cause engineered pilings to lose their verticality (Gordon, 2003).

Defects common in limestone comprise bedding and natural joints. Natural joints are usually vertically or steeply dipping, have planar features with no displacement, and are usually infilled by sheet calcrete. Defects such as these can also have an effect on the settlement and bearing capacity of foundations.

It had been documented that karstic subsidence and collapse in limestone have been initiated by urbanisation. The loss of vegetation cover, overwatering, overflowing of stormwater sumps after heavy rainfall, and lowering of local groundwater from overpumping are some examples, of this (Gordon, 2003).

Peaty subgrade is another example of an unstable foundation because of its low bearing capacity and high potential for settlement. This is caused by the decomposition of deleterious material.

Landfill sites have unstable foundations and are prone to high ground settlement. Extensive environmental and geotechnical investigations will be required prior to site development. Approvals from the relevant government bodies may also be required.

B 1.8.3 Drainage

The Spearwood Sand is highly permeable and has been shown to be a good material for drainage as indicated by the 1:50,000 Environmental Geology Map (Fremantle).

Silty or peaty subgrade from areas such as lakes and swamps will have a low permeability and therefore will not be suitable materials for drainage. Fines (<0.075mm) prevent water from percolating through the subgrade and promote flooding or perching of water.

B 1.8.4 Further Investigation

Further and more detailed investigations will be required at a later stage, as planning and design progresses. These investigations could include Cone Penetration Tests (CPT), excavations of test pits, drilling of boreholes and laboratory testing.

B 1.9 References

Geological Survey of Western Australia, 1986. Fremantle, 1:50,000 Environmental Geology Series.

GeoView.WA website, Department of Industry and Resources, http://www.doir.wa.gov.au/aboutus/geoview_launch.asp

Gordon, R., 2003. Coastal Limestones, The Engineering Geology of Perth – Part 2, Australian Geomechanics Society.

Gozzard, B., 2007. Geology and Landforms of the Perth Region, Geological Survey of Western Australia.

Henderson Landfill Site website, City of Cockburn, http://www.cockburn.wa.gov.au/Council_Services/Engineering_Services/Henderson_Landfill_Site/HLF_Technical_Data/default.asp

Protecting Our Wetlands in Western Australia, Department of Environment and Conservation, http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE_ADMIN/BROCHURE_REPOSITORY/PROTECTING%20OUR%20WET163F8D.PDF

South Metropolitan Regional Scheme *Acid Sulfate Soils* (Figure 4), Planning Bulletin Number 64, Western Australian Planning Commission.

SkyView.WA website, Landgate, http://www.landonline.com.au/skyviewwa/content/asp/skyviewwa_index.asp?product_group_id=78,

Appendix C

Consultation

Report on stakeholder consultation interviews

C 1 Stakeholders consulted

- Doug Brindal, the Logistics Manager Fremantle Ports
- Laurie Piggott, Public Transport Authority
- Luke Willcock, Landcorp
- Don Challis, Alan Kleiden, Mark Brownell, Cane Spaseski, Mohsin Muttaqui Paula Hayes, DPI
- Tom Grigson, Department of Industry and Resources
- Mark Brownell
- Rick Leonhardt and Paul Thompson, Westnet
- Vince Omodei, Paul Haigh and Roy Johnston, Australian Railway Group
- Steve Gabrovec, Pacific National

C 2 Insights and views

C 2.1 Fremantle Ports

Fremantle Ports' interests are to ensure that the area of land set aside for the intermodal terminal is large enough to accommodate future freight movements as well as a range of other logistics tasks that have been flagged in the Phase 1 study as well as an earlier study commissioned by Fremantle Ports on landside logistics options for the Outer Harbour.

The assumed throughput of the conceptual intermodal terminal that forms the basis of recommendations in the Phase 1 report is 600,000 TEU per year, with international freight accounting for 75,000 TEU per year. These throughputs are forecast to be reached by 2035 according to a medium case estimate based on there being on-dock rail at the Outer Harbour. On the basis of these throughputs, an overall area of 75 ha was suggested. However, Fremantle Ports is concerned that even an area of 115 ha that is recommended for 1.2m TEU per year throughput could be inadequate to handle the freight tasks required.

Although the import and export task is likely to account for only a small proportion of the freight (11%) handled by the intermodal terminal, recent changes are suggesting that a higher volume could find its way through a nearby intermodal terminal in the future. The port authority believes that what may have been understated in the Phase 1 report is the use of an intermodal terminal near to the port as a staging post for temporarily holding exports and imports.

Containerised grain is already being railed from the Metropolitan Grain Centre at Forrestfield to the North Quay terminal at the Inner Harbour and these container volumes are expected to grow as a total proportion of the state's grain exports, and there are plans for import containers to move in the opposite direction. Although this freight traffic would be moving to and from Forrestfield rather than Kwinana, there are signs that other rail or logistics operators could adopt the same practice for international trade between both the Outer and Inner Harbours and Kwinana, if for no other reason but to avoid congestion at the wharf. For example, ARG is exploring the option of receiving exports from the South West, Kalgoorlie and the Kwinana industrial area at their own intermodal terminal in Kwinana, consolidating them into containers which would then be railed (rather than trucked) to the North Quay terminal. On the reverse journey import containers would be transferred by rail to the intermodal terminal, where they would be deconsolidated and transported by road for use in Kwinana or the metropolitan area, or alternatively moved by rail to Kalgoorlie. These emerging trends lead the port to believe that it would be

wise for the terminal concept design to take into account a higher international freight task related to both the Outer Harbour and the Inner Harbour.

In addition to concerns about there being enough space to handle the international freight task, the port authority is also concerned to make sure that there is enough land set aside for logistics functions other than just a rail-road interchange. Because only a small proportion of the Latitude 32 land is owned by the state government it will be difficult to resume unless its use is clearly defined. Although the Phase 1 report allocated 31.5 ha of 75ha for warehousing and another 10.5 ha for container storage, the port authority believes that the intermodal facility should be designed to accommodate a broader range of interrelated logistics activities that are commonly co-located in an integrated design at a single site – and perhaps under a single management – along the lines of the freight village concept discussed in both reports that precede this one. One such function is the storage of empty containers. At the moment empties are transferred from Kewdale by truck back to the Inner Harbour. Not only is this movement contrary to the State Government's policy objectives of minimising unnecessary truck movements on Perth's roads, but storage of the empties at the Inner Harbour is a low value use of port land for which there is high demand for other purposes.

C 2.2 DPI project team

While this group emphasised the importance of ensuring that the concept design could properly handle interstate freight movements as the core function of the intermodal terminal, the general view was that the facility ought to be designed to also handle a broad set of logistics functions. Such a facility could be owned by the State Government and leased to operators as happens with the Kewdale Intermodal Terminal.

According to DPI's road transport planners, Stock Road/Rockingham Road is perceived to be the second route after the Kwinana Freeway for north south traffic movements between Fremantle and Rockingham. While the road is planned to be upgraded to six-lanes with grade separations at major intersections, traffic forecasts suggest that some of the intersections at the southern end of the road do not warrant being grade separated until 2030. This could be an issue if it includes Rowley and Anketell Road. Depending on which of the Outer Harbour locations (Option 1 or Option 4) is finally selected, one or other of these roads will be extended across Rockingham Road as a freight access route to the new Outer Harbour. Irrespective of which site is finally selected, however, both of these roads will at least connect with Rockingham Road and will be major freight routes for port related traffic and traffic related to the Kwinana Industrial Area.

Given these factors, and the fact that the proposed Fremantle Eastern Bypass and Roe Highway Stage 8 extension have been scrapped as a way of diverting freight traffic off Rockingham Road, DPI emphasised the importance of the concept design clearly defining required access points and grade separations.

C 2.3 Public Transport Authority

PTA emphasised that one of the key reasons a second intermodal terminal is needed to complement the Kewdale Intermodal Terminal is because the access roads around the existing terminal are heavily congested.

While import and export freight related to the planned Outer Harbour may make some use of the terminal its primary function is to handle interstate freight. This means that the site should be at least long enough to handle interstate trains of 1,800 metres. It will also need to be big enough to accommodate storage and maintenance of wagons.

As well as considering the most efficient types of container handling equipment and other technology including the choice of rail mounted or rubber tyred gantries, the concept design should also consider operating strategies that maximise efficiency – including 24 hour operations and the exploitation of off-peak traffic flows.

To avoid fragmented use of the site, the concept design needs to accommodate flexible use of spaces into the future.

C 2.4 Landcorp

From Landcorp's perspective, the highest priority for the project is to provide a clear direction for the future use of the 1400 ha Latitude 32 land and to minimise the area of land that will need to be resumed by the State Government.

Not all of the land is either available or suitable for use as an intermodal terminal. For example, Cockburn Cement has use of Precincts 10, 11 and 12 under an agreement with the State Government. This agreement has 26 years to run and the company has invested significantly in upgrading infrastructure on the site. Precincts 1 and 2 have already been released to the market, Precinct 9 is has been identified for eco friendly developments. The former use of Precinct 8 was as a rubbish dump means it can be used for only limited activities such as container storage.

Although Landcorp has designated different uses for each of the precincts, these can be varied according to the requirements of the intermodal facility. Two caveats on recommending changes in precinct use however are that the total area of land devoted to eco use must remain the same – which in effect means that if part of an eco use precinct converts to transport or light industry use then an equivalent area of land will need to be converted to eco use – and Latitude 32 must include a number of eco corridors to enable animals to move across it.

By contrast with the view that the concept design should plan for the maximum use of land for future uses, Landcorp's priority is to define an area of land that would support the core needs of an intermodal facility. The reason for this position is that although Landcorp is a redevelopment authority for Latitude 32, and therefore has the right to seek approval from the Planning Commission for how it is used, some of the land is still in private ownership (much of it as turf farms or market gardens) and Landcorp wishes to avoid unnecessary resumptions. It envisages two alternative models for securing land and then managing it in the interests of freight handling.

According to one of these models Landcorp would secure ownership of an area of land required for core intermodal activities and the Public Transport Authority would manage it, and in turn lease it to an intermodal operator. Additional land required for ancillary logistics functions would be secured by Landcorp by having it declared as a project control area. In effect this means that although the land would not be owned by Landcorp, if current landowners were to put parcels of it up for sale, they could only be used for purposes that are consistent with their designated use for transport, logistics or light industrial activities. With this model, the conversion of this land to its designated use would depend on a decision by current landowners about if and when to sell.

An alternative model would have the Public Transport Authority own a core footprint required for an intermodal interchange and Landcorp own an area adjacent to the core for ancillary activities, with the future use of a third area again being controlled by Landcorp through it being defined as a project control area.

To effectively address Landcorp's concerns that the size of the intermodal footprint should be no larger than is absolutely necessary, it is critical that the concept design clearly identifies a range of functions that could be reasonably defined as 'core'.

An appropriate basis for determining these core functions are the underlying principles and objectives of the Metropolitan Freight Network Strategy. One of the central planks of this strategy is the co-location of transport and other logistics facilities as a means of increasing the efficiency of freight distribution and minimising the impact of freight activity on urban sustainability. These principles are first articulated in the objectives of the policy which are to:

- facilitate the development and operation of an efficient freight network, based on strategic co-location of freight handling facilities services by an integrated network of freight transport facilities;
- protect the primary freight network from avoidable encroachment by any incompatible or noise sensitive development with the potential to compromise freight handling and/or transport operations;
- minimise adverse environmental and social impacts associated with the handling and movement of freight on noise sensitive development, such as housing; and
- inform local government and landowners of the designation of existing and proposed freight network.[11]

These principles emphasise co-location of related transport and logistics activities as a means of minimising unnecessary freight movements on public roads that are shared by passenger vehicles. To fulfil the strategy objectives the draft statement envisages that intermodal facilities should consist of a number of interrelated services:

"… typically include local delivery services, freight terminals and intermodal facilities with specialist warehousing services which manage goods distribution involving receiving, storage, re-packaging and transfer between delivery vehicles. The location of these centralised facilities will affect the overall efficiency of freight distribution and are an integral element of the freight transport network."

C 2.5 Department of Industry and Resources

A key priority for this stakeholder is to clarify the future use of the Latitude 32 area and in particular the specific freight tasks that would be handled by an intermodal facility located in it. In common with other stakeholders one of DOIR's concerns is to determine the relative importance of the facility in supporting the Outer Harbour by comparison with its role in handling interstate and intrastate freight.

It is also concerned to make sure that the facility makes efficient use of land for industrial purposes and protects the Latitude 32 area as a buffer between residential developments and the heavy industry activities of the Kwinana Industrial Area. The Latitude 32 area along with land covered by the Kwinana Industrial Area is in high demand for industrial purposes but if the concept design does not clearly identify the full range of functions that are required and the area of land that will be needed for these functions, there is a risk that the land could be lost to non industry uses. According to the DoIR spokesperson, this could happen because the Kwinana buffer zone is a residential restricted zone rather than a non-residential zone and as such permission could be gained to build a house on an existing vegetable garden property.

The importance of defining and securing a significant parcel of land for an intermodal facility in the short rather than the longer term is underscored by the synergistic relationship between the transport and logistic activities supported facility and the heavy industry activities of the Kwinana Industrial Area, the Outer Harbour, the Australian Marine Centre, and the planned East Rockingham Industrial Park all of which are expected to form part of the planned Tradecoast area.

[11] Western Australian Planning Commission, Statement of Planning Policy: Metropolitan Freight Network Draft Policy, May 2005, page 3

C 2.6 Westnet Rail

From Westnet's perspective, the land selected for the road rail interchange at an intermodal facility would need to be reasonably stable and have a gradient of no more than 1:500.

The facility should be designed so that containers can be unloaded and loaded while also servicing the locos at the same time and there should be at least 2 kilometres of stowage space. According to Westnet, Pacific National wants to handle the 1800 metre trains without breaking them up into smaller units at Kewdale. It is also not impossible that trains carrying interstate containers will be longer than 1800 metres. This is particularly important to keep in mind for the longer term capacity of the terminal. With this in mind it may be appropriate for the intermodal interchange to be 2.5 – 3.0 kilometres long. This part of the terminal as well as turnouts and crossovers (at each end) should ideally be straight track.

Road and rail access should be available at each end of the terminal and should be grade separated in order to avoid long truck queues and delays.

Westnet representatives believe that the railway lines are in good enough condition to handle interstate container traffic at 21 -25 tonnes per axle load. They describe the standard as the highest in the state but suggested that it could attract AusLink funding for further developments to suit an intermodal terminal. (A proposed project for building a rail linkage between the current line and the Outer Harbour container terminal is currently being assessed but it is uncertain whether this project includes an intermodal terminal at Kwinana).

Importantly, they pointed out that the railway line that would service the intermodal terminal in Kwinana is already very busy, currently handling about 30 to 40 movements per day, and probably the busiest part of the Westnet network. To handle an expanded task as an intermodal terminal as well as allowing current through traffic to flow efficiently, the railway would need to be double-tracked.

C 2.7 Australian Railway Group

ARG suggested that an efficient layout plan would place the rail road interchange to one side of the site, leaving the remainder of the site for container marshalling and other related activities. By contrast with Westnet, this stakeholder suggested that it may be appropriate to split 1800 metre trains into five packs of containers.

ARG is currently railing export containers from Bunbury to the Fremantle Inner Harbour and then carrying empties back to the Picton terminal at Bunbury on the return journey. The rail journey is 190 kilometres and takes 5 hours while the road journey is 145 kilometres and takes only 2 hours so if the rail service is to be competitive with the road alternative, it needs to carry high volumes, and according to ARG, be fairly priced by comparison with road. The same principles would apply to port related trade that originated in Bunbury and moved through an intermodal terminal at Kwinana on its way to either the existing Inner Harbour or the planned Outer Harbour.

C 2.8 Pacific National

Pacific National sees itself as a long-term tenant at Kewdale. Having recently spent $12m upgrading the facility, they are keen to make sure that they get a return on their investment.

Pacific National's views are that an intermodal terminal at Kwinana ought to be a multi-user facility. Ideally, it should be designed to maximise throughput efficiency through the use of rail mounted gantries that move along the track offloading containers and moving them to a temporary storage area away from the railway tracks (rather than next between tracks) so as to avoid a direct interface between the intermodal interchange area and customers.

Rail mounted gantries can only handle 900 metres at a time so the Pacific National spokesman believes that it is pointless to have an unbroken rail length of 1800 metres; either 900 metres or 600 metres is preferable.

In designing the main working area of the intermodal terminal, it is important to keep in mind that the arrival and departure roads must equal the maximum length of each train. On this basis, an operator such as Pacific National would want the terminal to be 2.5 kilometres long.

Like a number of other stakeholders, Pacific National envisages trains being 2000 metres long in the next 10 to 15 years. But if these trains were to be introduced the locos would need greater horsepower than the 1800 metre trains.

In commenting on current and future demand, Pacific National suggested that some of the east west freight task is being lost to coastal shipping: about one train per week is being lost.

Appendix D

Stakeholder workshop

Report on stakeholder workshop held 27 September 2007

KWINANA INTERMODAL TERMINAL SITE OPTIONS WORKSHOP

10:00AM 27TH SEPTEMBER 2007

Attendee	Organisation
Ivan Spanjic	Maersk
Dean Davidson	Fremantle Ports
Laurie Piggott	Manager of Property and Business, Public Transport Authority
Luke Willcock	Business Manager, Landcorp
Tom Grigson	Manager, Resource Infrastructure, Department of Industry and Resources
Chris Fitzhardinge	South West Group of Councils
Don Challis	Kwinana Intermodal Terminal Project Manager, Department for Planning and Infrastructure
Paul Hamersley	Strategic Policy Analyst, Department for Planning and Infrastructure
Mohsin Muttaqui	Team Leader, Network Planning, Department for Planning and Infrastructure
Alan Kleidon	Senior Transport Engineer, Department for Planning and Infrastructure
Cane Spaseski	A/Director, Infrastructure Planning and Coordination, Department for Planning and Infrastructure
Mark Brownell	Freight Logistics, Policy Specialist, Department for Planning and Infrastructure
Rick Leonhardt	Projects Director, WestNet Rail
Stephen Peers	Pacific National
Jeff Li	Sadleirs Transport
Robert Obst	Pacific National, Terminal Manager
Bob Wallace	ARG
Martin Baggott, Paul Fisher, Mike Ryan, Herve Calmy	GHD – Consultant to the study
Louise Meyrick	Meyrick – Consultant to the study

Key issues arising from the workshop included:

- Selection Criteria
  - Main access point: Critical as part of the overall road network
  - Buffers: Distances to existing land uses, inconvenience to the public/community
  - Interaction / Integration: with other land uses
  - Flexibility: Industry to be serviced, response to demand
  - Service infrastructure: Effect on existing, connection
  - Port access: efficient transport links to the proposed outer harbour
  - Extractive industries: Ability extract limestone (etc) before establishing the freight village
  - Staging: Ability to stage the development to its ultimate size.
  - Short term warehousing: A range of activities will require short term storage, interconnected with core terminal area

Five concept options were exhibited and discussed. Key issues arising from the discussion included:

- The freight task
  - The detail planning phase should take into consideration the need/possibility to provide specific spur lines for independent operators
  - Other types of freight to be considered other than just containers – cross-dock freight (rail vans that are unloaded direct into warehouses or waiting trucks) and 'ugly' freight (freight that is just tied onto the wagons i.e. trucks, machinery etc).
  - Current trends are aiming at minimum storage on site and a high focus on rapid distribution soon after arrival at the terminal.
  - Options to transit freight to and from the new port should be indicated (rail, road, dedicated conveyor etc…)
- Layout and rail issues
  - Location of container storage needs more thought – long distances to travel in all options. Containers also need to be in stored in strips for easy and quick access
  - The width of the loading/unloading area in all options needs to be clarified and possibly widened
  - All options (specifically #2) do not provide enough terminal track off the mainline to allow for the shunting and reassembly of trains without encroachment onto the mainline during this process
  - Option 3 requires 2 road bridges over rail, this may be prohibitive.
  - The dual gauge line continues south only to Kwinana. The dual gauge should be expanded all the way to Mundijong.
- Access & land planning issues
  - The long term land use issues associated with the landfill area makes the suitability for any of the terminals functions on that side unlikely at the outset.
  - Developing the section of the site west of the railway will be harder than developing the eastern section and options 4 and 5 are more favourable in that respect.

- An access point onto Rockingham Rd, while physically and logically possible, is unlikely to ever be supported.
- An issue with 'dead land' in all options which will pose development problems
- Consideration of future mining activities and their level of activity and also the return to the original ground level
- Consideration should be given to transport studies being undertaken as part of Latitude 32 Stage one. There is current proposal to relocate the intersection of Rowley Rd and Postans Road further west.

Appendix E

Concept Drawings

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