Main Roads Western Australia

Northern Transport Access Naval Base/Kwinana Port Site (Rowley Road Extension)

Report On

Alignment Definition Study

June 2003

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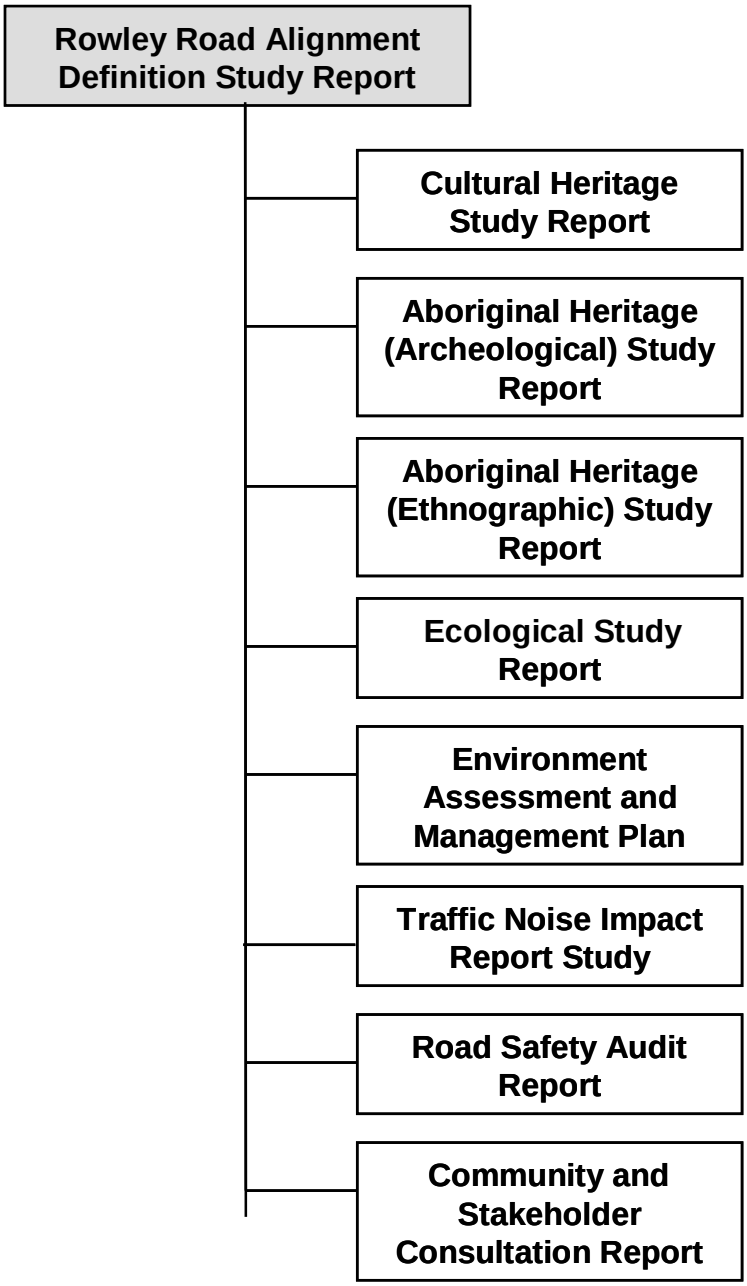
Document Status						
Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	Project team	B Hughes	*B Hughes*	B Hughes	*B Hughes*	-
1	Project team	B Hughes	*B Hughes*	B Hughes	*B Hughes*	14/9/01
2	Project team	B Hughes	*B Hughes*	B Hughes	*B Hughes*	28/3/02
3	Project team	T Truong		G Smith		10/6/03



Rowley Road Extension Alignment Definition Study Reports

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Introduction

GHD were engaged by Main Roads WA to undertake a study to define the future reservation requirements for a new east-west regional road route between Kwinana Freeway and Cockburn Road, and a railway route west of Rockingham Road in Wattleup / Naval Base. The new transport route, known as Rowley Road extension is to be protected by inclusion in the Metropolitan Region Scheme. This project refines a preliminary road alignment developed in earlier studies.

This study considered the context, determined a preferred horizontal and vertical alignment, defined the road reserve boundaries, identified the potential impacts and developed recommendations for implementation of the road.

The study considered the transport issues for the road including social, environmental and financial effects. Key engineering issues include suitable road geometry, planning for a rail spur, connections with other roads and integrating adjacent land use. Comments from the general public and agency stakeholders were also considered.

This report is supplemented by separate reports providing more detailed information.

Study Area

The area for the study surrounded the Planning Control Area declared by the WA Planning Commission as an interim protection area for the route. The road route extends from the Rowley Road western approach to the Kwinana Freeway interchange in the east to the future port site in the west, immediately north of Alcoa in the Kwinana Industrial Area. The study also covered the interchange with the Fremantle - Rockingham Controlled Access Highway and intersections with side roads. The study also developed a rail alignment from the Midland - Kwinana Railway line east of Rockingham Road.

Previous Studies

Planning for Rowley Road Extension has been previously done in conjunction with land use planning to serve the resultant travel demand. Several previous studies have identified the strategic need for a road and rail route in the vicinity of Rowley Road. Several alignments have been investigated with a preferred route endorsed by the WA Planning Commission.

Land use for the area has been the subject of intensive investigation through the Fremantle Rockingham Industrial Area Regional Strategy (FRIARS) study.

Rowley Road Extension will provide necessary access to the northern section of the Kwinana Industrial Area, residential development and expanded industrial area expansion confirmed by the FRIARS report for the Wattleup and Hope Valley areas.

Study Objectives

The purpose of this study is to define the road reservation for Rowley Road Extension consistent with the alignment endorsed by key stakeholders and the WA Planning Commission. The study is to provide sufficient information for a road and rail reserve to be protected in the Metropolitan Region Scheme. The road reserve width is justified with the following supporting information:

- a preliminary road and rail design,
- assessment of environmental and social impacts,
- a description of the need for the road and rail,
- land requirement drawings.

Land Use Planning Context

Currently there are several diverse land uses in the study area, including:

- heavy industrial development in the west, particularly Alcoa,
- regional parks in the west (Mt Brown) and east (Frankland Park),
- quarries in the central sections,
- market gardens, other primary production and associated facilities, and
- residences,

There are several major trunk utilities which cross the route.

Strategic planning in the area around Rowley Road Extension proposes significant land use changes which may require due consideration in the final design of the proposed route alignment corridor. Planned developments include:

- Fremantle Port Outer Harbour expansion,
- residential development to the north and south of Rowley Road Extension, (west of the Kwinana Freeway),
- the expansion of general industrial land uses between Rockingham Road and Mandogalup Road, and
- continuing use of the Kwinana Industrial Area for heavy industry.

Recently strategic land use planning has been completed under the FRIARS study which has confirmed the need for and alignment of the regional road. However, local planning for the area remains uncertain as implementation of the FRIARS recommendations is yet to occur to define the area in more detail.

The proposed alignment impacts predominantly upon extractive industry operations (quarrying), environmentally sensitive areas, land held in ownership by statutory bodies, private residences and market gardens.

The Need for Rowley Road Extension

Rowley Road Extension has developed to meet several significant transport demands including:

- the future port,
- surrounding future urban areas,
- surrounding existing and future industrial areas.

Rowley Road Extension provides a strategic east-west regional route providing direct connections with:

- the Kwinana Freeway in the east, and
- Rockingham Road in the west and further west to Cockburn Road.

Traffic forecasts anticipate up to 25,000 vehicles per day would use the road by 2021. More importantly, the road is expected to carry a high proportion of freight vehicles which represent high value traffic.

The demand for the rail is less certain, but it is essential to plan for rail access as a strategic option for transport to the port.

General Description of Rowley Road Extension

Rowley Road Extension is to be planned as a four lane divided road linking the Kwinana Freeway in the east through to an interchange at Rockingham Road and to the future port site in the west. The road will have no property access and limited side road access and will be planned as a high standard regional road route. The route was developed using agreed road planning standards and to minimise the impact on the identified social, environmental and engineering constraints. At the western end a rail connection will be provided from the existing freight line to service the port.

The major constraints to the design of the route are:

- connections to the Kwinana freeway interchange in the east and the future port site in the west,
- a suitable interchange with the Fremantle - Rockingham Highway, and grade separation of the railway,
- environmentally sensitive areas at Mount Brown and Frankland Park,
- topography past Mt Brown and through quarries,
- major utilities,
- minimising other social and environmental effects, while maintaining road design standards.

The route starts at the western end to service the new port expansion site, just north of the existing Alcoa refinery. At this point both road and rail are adjacent. A connection is retained for Cockburn Road to the north. The two alignments curve south as far as possible to minimise the impact on Mount Brown. The road and rail are in cuttings of approximately 12m and 24m maximum depth respectively with a maximum width of approximately 160m. The road connects with a realigned Rockingham Road to the

south. Road and rail bridges are proposed over the planned Fremantle - Rockingham Highway, the Rockingham - Fremantle Transitway and the Midland - Kwinana Railway line. A grade separated interchange with the Fremantle - Rockingham Highway provides a connection to the proposed Rowley Road Extension.

Further east the route curves north through quarries before aligning with the existing Rowley Road alignment. Through the quarries the road and ground height are uncertain depending on when the quarries are excavated and when the road is to be constructed. Through this section a connection is planned for a realignment of Postans Road or an alternative connection with the existing Postans Road (depending on the result of future planning in the area) . The route travels eastwards through existing market gardens, past residences and commercial properties and a connection at Mandogalup Road. Further eastwards the route rises past Frankland Park and another quarry before falling to join the existing interchange at the Kwinana Freeway. Through this section Rowley Road Extension is planned to have connections at Mandogalup Road and the planned Hammond Road.

There are major services in the vicinity including high tension power lines, gas mains, water mains and oil lines, some of which will require relocation.

There is a significant, but manageable, environmental impact on the Mount Brown area, but little social or environmental impact elsewhere along the route. The alignment has been pushed as far south as possible to minimise the impact on Mount Brown. The slopes of the roadsides have been planned to minimise the extent of cut into the southern slopes of Mount Brown, while minimising the visual intrusion and allowing for revegetation.

Maps illustrating particular aspects, road concept plans and land requirement plans are included in the appendices. Detailed assessments of specific issues are contained in separate supplementary reports.

Stakeholder and Community Consultation

The project has progressed with several stages of consultation with the community and other stakeholders. Overall, the responses by the residents directly affected by the route were positive. The acceptance of the project and its necessity as part of the future progress of the area was very high. The concerns raised by local residents tended to be focussed on issues of individual compensation and areas of land that would need to be resumed. Many of the residents also wanted to know further information regarding the implications of the FRIARS Report on their landholding.

Other key stakeholders have endorsed the proposed alignment definition through the Steering Committee which oversaw the study. Only issues of detail remain to be addressed during subsequent planning and design phases prior to construction of the route.

1. Introduction

GHD were engaged by Main Roads WA to undertake a study to define an extension to Rowley Road for inclusion in the Metropolitan Region Scheme. This project refines a preliminary road alignment developed in earlier studies.

The extension of Rowley Road has been identified as providing an east-west regional road link for the proposed new port at Naval Base and to provide access to the northern end of the Kwinana Industrial Area. It also provides a regional transport route for surrounding areas especially to the Kwinana Freeway. Strategic land use planning confirms the need for and location of the road. A general location of the proposed road is shown in Figure 1.1.

The study builds on previous strategic land use and transport planning for the region. This study considered the context, determined a preferred horizontal and vertical alignment, defined the road reserve boundaries, identified the potential impacts and developed recommendations for implementation of the road.

The study considered the transport issues for the road including social, environmental and financial effects. Key engineering issues include suitable road geometry, planning for a rail spur, connections with other roads and integrating adjacent land use. Comments from the general public and agency stakeholders were also considered.

This report is the summary of the Rowley Road Extension Alignment Definition Study. During the course of the project several other reports wee produced to provide background and more detailed information on specific issues.

1.1 Purpose of the Study

The purpose of this study is to define the road reservation for Rowley Road Extension consistent with the alignment determined by the WA Planning Commission. This study was required to prepare a design concept for the proposed northern road and freight rail access to the Naval Base/Kwinana Port site from the Kwinana Freeway, and to define road and railway reservations for inclusion in a future amendment to the Metropolitan Region Scheme (MRS). A report, engineering concepts and land protection plans for the route are to be produced to define and support the reservation requirements. Reports on the inter-relationships between the proposed road and railway and the social and natural environments along the route are also required.

1.2 Study Objectives

The objective of this study is to provide sufficient information for a road and rail reserve to be protected in the Metropolitan Region Scheme. The road reserve width is justified with the following supporting information:

- a preliminary road and rail design,
- assessment of environmental and social impacts,
- a description of the need for the road and rail,
- land requirement drawings.

The Rowley Road Extension planning must be in context with other land use plans, transport plans and the transport network.

1.3 Background

This study follows the *Northern Road and Rail Access; Naval Base / Kwinana Port Site; Alignment Selection Study (Rowley Road)* (Main Roads WA 1998) which investigated and determined a preferred alignment for Rowley Road extension. The following excerpt from the Main Roads WA report describes the context.

> *The Inner Harbour at Fremantle currently caters for the movement of containerised and break-bulk cargo through the Perth metropolitan area. The Fremantle Port Authority port development planning shows that the Inner Harbour has the capacity to efficiently cater for up to three times the current trade levels. Based on trade growth forecasts, it is expected that this level of trade will be reached by about 2015-2020 and beyond this time the Inner Harbour would continue to operate at this level of activity. Beyond this level of trade there are limits to the capacity of the Inner Harbour in terms of land availability, constraints imposed by the road and rail system and the intensification of urban development around the periphery of the harbour area. Therefore another site is required to accommodate the long term growth in the container and break-bulk trade through the metropolitan area.*
>
> *After several studies, the Fremantle Outer Harbour at Naval Base/Kwinana was selected as the preferred location for development of port facilities to accommodate long term growth requirements for container and break-bulk cargo. Subsequent port development planning undertaken by the Fremantle Port Authority has resulted in a concept plan for the future expansion of port facilities in the Outer Harbour as shown indicatively at Figure 2*[1].
>
> *To avoid a repetition of the road and rail access problems and urban development pressures which will ultimately limit the capacity of the Inner Harbour at Fremantle, it is essential that efficient road and rail routes to the Naval Base/Kwinana port site be identified and protected. Planning*

[1] Figure 2 refers to the original report and is not reproduced here.

work has therefore been carried out by Main Roads, in consultation with State Government agencies and Local Government, to achieve this objective.

Therefore more detailed planning is required to examine the agreed Rowley Road Extension alignment and prepare a preliminary design concept to define the future road reservation requirements.

Figure 1.1 Locality Plan

1.4 Study Area

The study area extends from the Rowley Road intersection with the Kwinana Freeway westwards to the coast, a distance of about 7.7km. The study is generally confined to the alignment endorsed and reflected in the FRIARS study and the connecting local roads as shown in Figure 1.1. The study area lies within the City of Cockburn and the Town of Kwinana in the South West Corridor of the Perth Metropolitan Region.

Study Area Context

The South West Corridor is quite different to other areas of the Perth Metropolitan Region. The area includes the heavy industrial area of Kwinana which occupies a very large area and imposes a larger footprint by way of buffer zones. The area is bounded by the coast which also requires interaction by way of port facilities. A new port site has been earmarked at the north end of the Kwinana Industrial Area (KIA). The Alcoa refinery at the north of the KIA and at the western end of Rowley Road Extension is a major site relevant to this study.

There are urban areas to the north across Cockburn, Fremantle and Melville Councils and to the south in Rockingham and Kwinana. The area to the east has been generally constrained by underground water mound protection areas. Urban development is slowly infiltrating the area and planning for urban development is continuing.

There are significant environmentally sensitive and valuable areas in the vicinity, including Beeliar Regional Park.

There are a variety of other land uses in the area which are significant, including sand and rock quarries, industrial outfall (the red mud lakes) and major utilities associated with the industrial area.

Demand for heavy industrial land in the area continues and requires support from services located in surrounding light industrial areas. The recently initiated Jervoise Bay project in the north of the corridor demonstrates the varied and continuing land use demand in the region.

The study area comprises a mix of land uses including industrial, open space, rural, residential, extractive industry, and parks and recreation. This is reflected in the FRIARS study, the MRS and Town Planning Scheme land use zonings.

2. Related Studies

The route is consistent with strategic transport planning for the region as described in:

- the *Metropolitan Transport Strategy*,
- the *Metropolitan Freight Strategy*, and
- *Future Port Options Study* (1994)

The study builds on previous strategic land use and transport planning for the region which most recently include:

- *South West Corridor Land Requirements; Rowley Road Final Report (BSD, 1996),*
- *Northern Road and Rail Access; Naval Base / Kwinana Port Site; Alignment Selection Study (Rowley Road) (Main Roads WA, 1998),* and
- *Fremantle Rockingham Industrial Area Regional Strategy (FRIARS) (WA Planning Commission, April 2000).*

2.1 South West Corridor Land Requirements; Rowley Road Final Report

The *South West Corridor Land Requirements; Rowley Road Final Report* (BSD 1996) was undertaken for the then Ministry for Planning. The study examined alternative east - west road and rail alignments in the Wattleup area between the Kwinana Freeway and the coast to service the proposed port expansion at Naval Base/Kwinana. The study concluded that:

- any alignment to the north of Mt Brown would be environmentally unacceptable,
- an alignment to the south of Mt Brown would impact on the Alcoa refinery land which is covered by the Alumina Refinery Agreement Act, and
- the preferred alignment put the road in a deep cutting over Mt Brown and the railway in a tunnel through Mt Brown for the western section of the route between Rockingham Road and the coast.

It was subsequently resolved that the options investigated were unacceptable due to the impact on the Mt Brown area and the Beeliar Regional Park and that options to the south of Mt Brown should be examined in more detail.

2.2 Northern Road and Rail Access; Naval Base / Kwinana Port Site; Alignment Selection Study (Rowley Road)

Following the lack of resolution of an alignment from the BSD study government agencies led by Main Roads and the Ministry for Planning undertook the *Northern Road and Rail Access; Naval Base / Kwinana Port Site; Alignment Selection Study (Rowley Road)* in 1998, which considered alignments further to the south in the Mt Brown area, including land under Alcoa control.

This study examined alternative alignments for a new road / rail reservation and identified several important constraints for the alignment including:

- Beeliar Regional Park,
- Mt Brown,
- Alcoa Alumina refinery,
- Western Power transmission line easement,
- Wattleup townsite,
- basic raw materials extraction areas,
- flyash disposal pit,
- significant regional bushland,
- Wattleup and System 6 linkage,
- Frankland Park,
- future urban development, and
- Kwinana air quality buffer zone.

The study concluded there was a need for a future regional road connecting the future Naval Base - Kwinana Port development with Rockingham Road and the Kwinana Freeway. Between the future port and Rockingham road the proposed road and rail were proposed on the south side of Mount Brown. This avoided environmentally sensitive areas north of Mount brown and minimised impact on Alcoa's refinery operations. A future interchange was planned for Rockingham Road and the Fremantle - Rockingham Hwy. East of the railway line the alignment moved north and followed the Cockburn / Kwinana council boundary, joining the existing Rowley Road west of the Freeway.

Several other alignment options were considered but the preferred alignment was considered to have the least environmental impact and offer greater potential for future urban development south of Rowley Road in the Mandogalup area.

The preferred alignment selected was subsequently protected by a Planning Control Area and was the basis for the road defined in this study.

2.3 Fremantle-Rockingham Industrial Area Regional Strategy

The most significant and recent land use planning in the area was undertaken to produce the *Fremantle Rockingham Industrial Area Regional Strategy (FRIARS) (WA Planning Commission, April 2000)*. FRIARS was prepared to provide a strategic land use planning direction for the Rockingham-Fremantle region over the next 20-25 years. The strategy defined the future land use of the study area, with an expansion of the "General and Light Industrial" zone eastwards from the Alcoa site to Mandogalup Road. The "Urban Deferred" zone and the "Rural" zone on either side of the proposed road alignment are retained. Removal of the Fremantle-Rockingham Highway between Russell Road and Rockingham Road is proposed. Other parts of the transport network are consistent with the MRS but could be redefined during implementation

The recommendations of the study in respect of the route alignment corridor include:

- delineation of a "Rowley Road Infrastructure Corridor" for the length of the proposed alignment corridor between the Kwinana Freeway and Rockingham Road,
- identification of a proposed extension of the regional road (from Rockingham Road to the proposed port facility) with a parallel rail route,
- retention of a "Rural" zone over the land immediately south of Rowley Road, east of Mandogalup Road,
- retention of the "Urban Deferred" zone over the land immediately north of Rowley Road, west of the Kwinana Freeway,
- zoning of all land between Mandogalup Road and Rockingham Road (both north and south of proposed alignment corridor) for "General and Light Industrial". This is to include resource extraction area,
- indicative rezoning of industrial zone on the southern slopes of Mount Brown to "Parks and Recreation Reserve". Identification of Bush Forever site over this land and abutting Beeliar Regional Park",
- identification of Bush Forever site over on lots 3 and 5, Mandogalup Road.

FRIARS has recently been formalised into the *Hope Valley-Wattleup Redevelopment Act (2000)*, with the effect of transferring development control within the identified area to the WA Planning Commission. This Act supersedes the Metropolitan Region Scheme and Council's Town Planning Schemes. Planning for the area is proposed by the FRIARS study is shown in Map 1 in Appendix A.

2.4 Rail Planning

Rail planning in the area, including access to the new port site has generally been undertaken by Government agencies in conjunction with the strategic land use planning.

The port is required to be provided with efficient and effective rail service. The rail connection to the north will provide access to the eastern railway via Forrestfield and will cater for:

- container traffic to the eastern seaboard,
- direct connection to the Kewdale intermodal (road - rail) transport facility, and
- consumables for the Eastern Goldfields mineral fields.

Previous planning has determined the need for rail to be aligned on the north side of the road for efficient logistics operations at the port. This arrangement also suits the Fremantle-Rockingham Hwy interchange to minimise the impact on Beeliar Regional Park to the north.

2.5 Summary

Planning for Rowley Road Extension has been previously done in conjunction with land use planning to serve the resultant travel demand.

The strategic need for Rowley Road Extension and rail access has been considered conceptually as land use planning for the corridor has occurred, and more specifically as the new port site concept has developed.

Previous studies have confirmed the need for and the preferred alignment of the Rowley Road Extension route, together with a preferred rail alignment as reflected in FRIARS. The planning concludes that more detailed work is required to define the future road reservation and ensure it is protected for the long term future.

Planning has confirmed the need for Rowley Road Extension as a strategic route in the South West Corridor. It is to be planned as a high standard route which provides for efficient heavy freight access for east-west movements.

3. Need for the Rowley Road Extension

The Fremantle Outer Harbour at Naval Base/Kwinana has been selected as the preferred location for development of port facilities to accommodate long term growth requirements for container and break-bulk cargo. In order to ensure good access to the port site, and more generally to the northern end of the Naval Base industrial area, it is essential that efficient road and rail routes be identified and protected. Existing and planned transport infrastructure surrounding the route is shown in Map 2.

3.1 Strategic Road Linkage

The surrounding regional road network is generally quite old in most locations but continues to be upgraded when justified. The latest development is the extension of the Kwinana Freeway south of Thomas Road and the construction of Freeway interchanges including Rowley Road.

The major north-south road in the area is Rockingham Road which follows a very old alignment which has been improved in several places and is now a dual carriageway. Cockburn Road has carried significant traffic north - south for many years but its function will change as Jervoise Bay develops and Cockburn Road is realigned. Rockingham Road will continue to serve the Kwinana Industrial Area in its southern section. A new Controlled Access Highway (Fremantle-Rockingham Highway) has been planned to the south of Rowley Road Extension and will continue north of Rowley Road Extension along the existing Rockingham Road. This highway requires a major interchange at Rowley Road Extension.

There are few major east west roads in the central part of the corridor. To the north and south of Rowley Road Extension are Russell and Anketell Roads which carry moderate traffic.

As land use intensifies, as proposed in the corridor, higher standard east west roads will be required to provide more direct connections to the area.

Rowley Road Extension is the only significant road in the northern part of the south west corridor which does not have a defined alignment. This road will service the Kwinana Industrial Area, new industrial areas proposed by FRIARS, urban development, the future port expansion site and other areas in the vicinity. In a regional context Rowley Road Extension provides a strategic east-west regional route, especially for heavy freight traffic because:

- it connects to the Kwinana Freeway in the east,
- it is between other east-west routes - Russell Road to the north and Anketell Road to the south, and
- it connects to Rockingham Road in the west and further to Cockburn Road.

As such it provides access for surrounding land uses including:

- the new port,

- the northern section of the Kwinana heavy industrial area, including Alcoa,
- potential and planned urban areas in Wattleup and Mandogalup, and
- potential light industrial areas in Wattleup and Hope Valley.

Rowley Road Extension provides opportunity for an appropriate road hierarchy in the area allowing connections to district distributor roads serving the adjacent areas and also provides a strategic freight route which will be the preferred route in the area for all freight vehicles, some heavy haulage (out of gauge) and hazardous goods.

Main Roads WA has identified heavy haulage routes for out-of-gauge vehicles in the area. These vehicles operate under permit and are overmass, overwidth, overheight or overlength. The routes include the Kwinana Freeway, Anketell Road, Rockingham Road, and Cockburn Road. The future Fremantle - Rockingham Hwy will be included and the section of Rowley Road between Cockburn Road and Rockingham Road south. Rowley Road extension will be used by 'as of right' freight vehicles, but not generally by out-of-gauge vehicle operating under permit, except for the western section identified.

3.2 Rail Linkage

Assessment of rail requirements or alignments have been undertaken as part of port and regional land use planning. Various connections between the future port and the rail network have been investigated including:

- a northerly alignment through Henderson which would adversely affect Beeliar Regional Park and the Henderson Industrial Area,
- a southerly connection which requires trains to travel more than 5km south and reverse to travel north, which is inefficient and ineffective for port and Alcoa rail operations,
- a tunnel through Mt Brown.

Previous studies into the Rowley Road Extension alignments considered the rail alignment in conjunction with the road alignment.

Rail lines service the Kwinana area for bulk goods transport which FRIARS notes form a major link between Kwinana and both Kewdale and Fremantle. Also freight rail services have great economic significance and are likely to become more important as services increase. Consequently these lines must be maintained and new lines planned for major locations which may warrant rail services in future.

Generally rail transport demands would be served by a shuttle train operation to Kwinana or Kewdale. The rail connection to the south will cater for industrial products for the Kwinana Industrial Area such as Alcoa.

The rail alignment determined by the WA Planning Commission provides effective rail connection to service the port.

3.3 Transport Demand

There are three basic independent drivers for transport in the area which translate to traffic forecasts. These are:

- urban development,
- the new port, and
- the surrounding industrial areas (including the Kwinana Industrial Area and other areas earmarked by the FRIARS study).

The timing of development in the area is uncertain. Urban development may start increasing around 2006. The new port is not expected for at least 15 years until Fremantle port reaches capacity. The industrial areas immediately surrounding the port expansion site are likely to develop without the port but will occur much more with the new port. Other industrial development in the KIA, Jervoise Bay and other locations will continually develop and increase traffic demand, especially for freight transport.

Road Traffic

As a result of the land use traffic is anticipated to gradually increase over coming years. Traffic movements will increase substantially after the port is constructed. Forecast traffic volumes from Main Roads traffic model indicate that the Rowley Road Extension would carry between 12,000 and 25,000 vehicles per day by the year 2021.

A significant proportion of traffic will be freight vehicles and the route will be designated as a hazardous goods route and a strategic freight route. The proportion and number of freight vehicles depends on the port and general land use development which is not quantifiable. It is possible the freight traffic proportion could be amongst the highest on Perth regional roads at up to 20% of total traffic.

Rail Traffic

Rail traffic will depend on the growth of goods over the capacity of Fremantle Port which is expected to treble in the next 15-20 years. There are no forecasts for freight through the new port. Altered logistics (goods handling) arrangements or freight economics could significantly alter rail demand in the future.

3.4 Summary

The need for a regional road alignment in the vicinity of Rowley Road Extension has developed from strategic land use and transport planning for the corridor.

The needs are defined by transport demands to service:

- the future port,
- surrounding future urban areas,

- surrounding existing and future industrial areas.

Rowley Road Extension provides a strategic east-west regional route providing direct connections with:

- the Kwinana Freeway in the east, and
- Rockingham Road in the west and further west to Cockburn Road.

Traffic forecasts anticipate up to 25,000 vehicles per day would use the road by 2021. More importantly the road is expected to carry a high proportion of freight vehicles which represent high value traffic.

The demand for the rail is less certain, but it is essential to plan for rail access as a strategic option for transport to the port.

4. Route Elements and Standards

Rowley Road Extension is to be planned as a four lane divided road linking the Kwinana Freeway in the east through to an interchange at Rockingham Road and to the future port site in the west. The road will have no property access and limited side road access and will be designed as high standard regional road route. At the western end a rail connection will be provided from the existing freight line to service the port.

4.1 General Requirements

The principal elements of the road are:

- both road and rail must link to the port at the western end,
- a four lane divided road with no frontage access suitable for a strategic freight route and general traffic,
- minimised impact on the area controlled by Alcoa and the environmentally sensitive areas of Beeliar Regional Park,
- a major interchange at Rockingham Road and Fremantle-Rockingham Highway,
- a practical vertical alignment for road and rail,
- incorporation of a possible alignment for a future Rockingham - Fremantle Transitway.

4.2 Rowley Road Extension Planning Principles

The following principles were adopted to guide planning for the road.

Objectives

Safe, efficient and effective transport routes will be provided to the port and for other regional transport which minimise any adverse effects on the community or the environment. Local community access will also be provided.

General Principles

Transport route planning will be consistent with strategic planning for the area including the Metropolitan Region Scheme, the Metropolitan Transport Strategy, Fremantle Rockingham Industrial Area Regional Strategy (FRIARS), Fremantle Port Outer Harbour expansion (Kwinana / Naval Base), regional, district and local structure land use plans, and environmental plans.

Planning will be consistent with government and professional legislation, policies, standards and practices where possible.

The principal port access will be provided by Rowley Road Extension which connects to the regional road network at Kwinana Freeway, Rockingham Road, and the future Fremantle - Rockingham Highway.

Secondary port access will be provided via rail and other roads where required.

All modes of transport will be provided for where appropriate.

All financial, environmental and community costs and benefits will be considered during planning, design and construction.

Specific Principles

Rowley Road Extension will be designed as a regional road with two carriageways, each of two lanes separated by a median to protect turning and opposing traffic, and for a zoned speed limit of 80km/h. This arrangement suits the function of the road to provide a strategic freight and regional traffic route which is safe and effective for trucks and cars.

Rowley Road Extension will have sufficient width for oversize vehicles and for cyclists. The road will be unkerbed, except at intersections, with an open drainage system discharging into retention basins along the route. Special provisions (such as lined drains and basins, or piped drains) may be required adjacent to environmentally sensitive areas.

Interchanges at will be provided at the proposed Fremantle - Rockingham Highway and the Kwinana Freeway (existing) allowing through vehicles to continue on these roads without stopping.

The number of intersections on the route will be kept to a reasonable minimum to ensure freight vehicle safety and efficiency while serving surrounding land use via distributor roads. Connections will be required at Cockburn Rd, Rockingham Rd, Mandogalup Rd, Hammond Rd, and Postans Road (or and alternative).

Rowley Road Extension will be a controlled access route with no frontage access from adjacent properties and limited side road access.

The efficiency, effectiveness and safety of the proposed Rockingham - Fremantle Transitway will be maintained.

Local and regional cycle routes will be provided.

A dual track rail spur will be planned from the Kwinana - Midland rail line to the port. Minimum serviceable standards for grade and curvature may be used at the junction.

4.3 Road Standards

Rowley Road Extension is to be designed to current Main Roads and Austroads standards and guidelines. These provide for efficient movement of most vehicles. Road standards have been adopted based on the strategic role of the route, future traffic volumes, the use of the route to ensure future transport, transport efficiency and traffic safety. The following specific standards have been adopted:

- a four lane divided road,
- dual 7.0m wide carriageways, unkerbed,

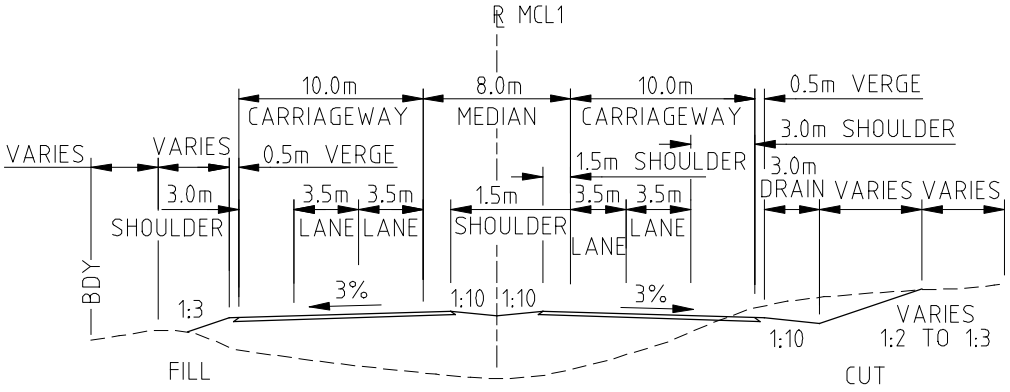
- 8.0m median,
- 3.0m outer shoulders,
- 80 km/h design speed,
- 4% maximum grade,
- minimum vertical clearance 6.5m,
- access restricted to intersections, and
- drainage is to be open drainage with retention basins along the route; special provisions (such as lined and piped drains) may be required in particularly sensitive locations.

The road is designed as a 4 lane divided road, typically with a cross section as shown in Figure 4.1. Specific clearances are required for out-of-gauge vehicles.

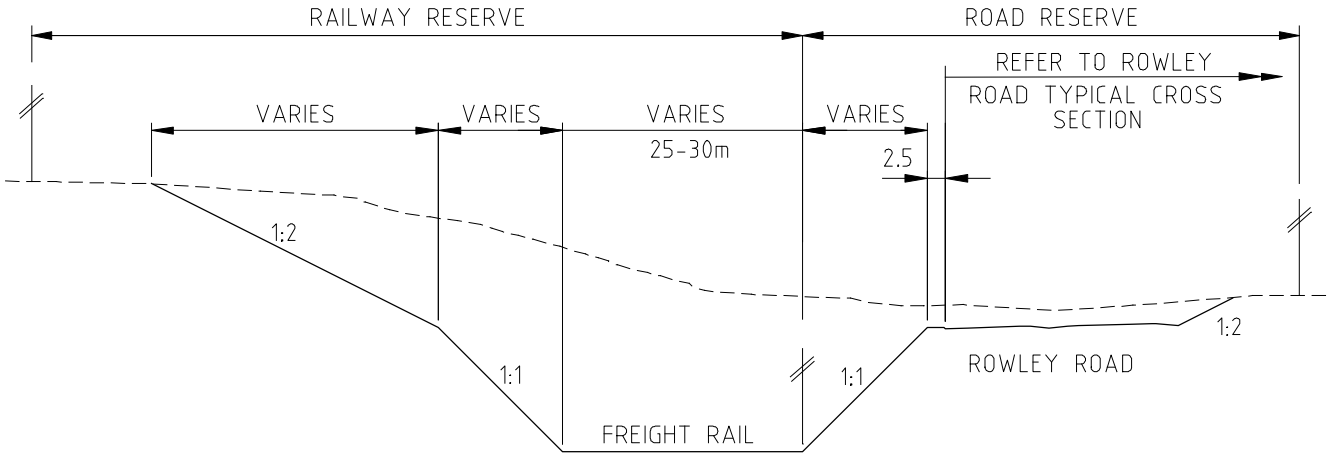
The vertical alignment is the major difficulty in planning for Rowley Road Extension. At the west the road and rail must be close to sea level to service the port. Immediately to the east the land rises abruptly then falls away to the south of Mount Brown. The low maximum grade allowable for rail results in significant excavation in this area. Both Rowley Road Extension and the rail cross over the Fremantle-Rockingham Highway at the interchange which requires clearance for bridges and ramp connections. Rowley Road Extension must then rise to provide clearance over the existing freight railway.

Drainage and Stormwater

Rowley Road Extension will be unkerbed throughout with sumps (retention and compensating basins) provided along its entire length. Possible sumps have been proposed, but, because this is only at the route alignment definition stage, a drainage design has not been done to confirm sizes and locations. The drainage system must be planned so as to cater for accidental spills following a traffic incident and eliminating run off of pollutants into surrounding environmentally sensitive areas. Batter slopes must be carefully designed so as to manage run off and limit impact on underground water, especially in the vicinity of Mount Brown.



TYPICAL CROSS SECTION
ROWLEY ROAD



TYPICAL CROSS SECTION SOUTH OF MT BROWN

FIGURE 4.1
ROWLEY ROAD-TYPICAL CROSS SECTIONS
NOT TO SCALE
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4.4 Rail Standards

It is expected that single track capacity will be required to service the port for the foreseeable future. However it is prudent to plan for two tracks because future demand is very uncertain to maintain flexibility for future rail operations. The following standards have been adopted for the preliminary design of the rail alignment:

- 40m nominal reservation width (25m minimum width where constrained) which allows for two tracks,
- 1 in 200 (0.5%) desirable maximum grade,
- 1 in 150 absolute maximum grade (or at ruling grade for Midland - Kwinana line),
- 300m minimum horizontal radius curve for the line to the port,
- 200m minimum horizontal radius curve for the line to Alcoa, and
- 7.1m vertical clearance of road over rail.

4.5 Other Transport Requirements

In addition to the arterial road function which prescribes certain standards, Rowley Road Extension must take account of several other factors.

Rockingham - Fremantle Transitway

The Department for Planning and Infrastructure has developed proposals for a transitway between Rockingham and Fremantle. The recommended alignment for the transitway is on the eastern side and parallel to Rockingham Road from Russell Road to Wattleup. The alignment then continues on the eastern side of the future Fremantle-Rockingham Highway south of Wattleup. Provision is to be made for the future Transitway through the Fremantle - Rockingham Highway interchange.

Bicycles and pedestrians

Bicycles will be permitted along Rowley Road Extension within the paved shoulders. Off road routes for cyclists and pedestrians are planned to be provided along the south side of Rowley Road Extension for the entire length and on the north side for the section east of Frankland Park.

Hazardous goods vehicles

Rowley Road Extension will be a preferred route for east - west movement of hazardous goods on road. The route must be planned to minimise vehicle conflicts and to allow for management of any incidents which may occur (eg drainage for spills).

Out of gauge vehicles

Part of this route will be designated a permit vehicle route allowing for out of gauge vehicles (over width, over length, over height or over mass). Through this area the Main Roads' high wide vehicle load route is intended to include parts of Anketell Road, Rockingham Road, Rowley Road, and Cockburn Road to Jervoise Bay. In this section Rockingham Road (south), Cockburn Road (north) and the section of Rowley Road between will form the high wide vehicle load route. The standards for these roads are:

- 45m long vehicle,
- clearance width of 10.5m,
- clearance height of 10m,
- mass allowance of 400T (based on heavy load platform HLP 400).

5. Route Opportunities and Constraints

A series of investigations examined specific social, environmental and engineering issues for the Rowley Road Extension route which are summarised in the following sections.

5.1 Social

5.1.1 Land Use

The proposed Rowley Road Extension alignment is within the City of Cockburn and the Town of Kwinana. Council Town Planning Schemes generally define the future land uses for the area. In the section between Rockingham Road and Mandogalup Road the Town Planning Schemes are superseded by planning described in FRIARS which is yet to be defined and implemented. Land use planned under the Town Planning Schemes is shown in Map 3 in Appendix A.

Development in the City of Cockburn

The City of Cockburn Town Planning Scheme No. 3 identifies an 'Urban Deferred" zone for a length of 2.2km west of the Kwinana Freeway. A "Rural" zone extends to Wattleup townsite, proceeded by "Regional Parks and Recreation Regional Reserve".

The predominant land use zone within the City of Cockburn in the vicinity of the proposed road alignment corridor is rural, with a variety of market garden and rural-residential land uses within this area. Extractive industry operations are located in this area but their location at a distance from the proposed road alignment does not necessitate further investigation. A future urban area is defined for the eastern portion of Rowley Road Extension, with Frankland Park local parks and recreation reserve located to the west of Frankland Avenue.

The location of the Wattleup townsite north of the proposed alignment does not have a direct impact on the proposed route alignment.

The Regional Parks and Recreation Reserve associated with Mount Brown is identified and aligns with the southern boundary of the City of Cockburn.

Development in the Town of Kwinana

The Town of Kwinana Town Planning Scheme No. 2 identifies a predominance of "Rural" zoning between Kwinana Freeway and Rockingham Road. "Regional Parks and Recreation Reserve" and "Industrial" zones comprise the western section of the study area.

A "Rural" land use zone predominates in the vicinity of the route alignment, extending from the Kwinana Freeway to Rockingham Road. The eastern section of this area is quarried, as is the western area approaching Rockingham Road. The final levels of the extractive industry operations have been determined from management plans supplied by Council.

The western land use zones within the Town of Kwinana are dominated by regional and local parks and recreation reserves and the Alcoa Industrial zone. The MRS Regional Parks and Recreation reserve encroaches into the northern sector of the Town of Kwinana, with a local parks and recreation reserve continuing south from the MRS Regional Parks and Recreation Reserve.

The existing and proposed land uses abutting the proposed alignment corridor have the potential to impact upon the proposed route alignment corridor. The significant impacts can be categorised as direct and indirect as discussed below.

Direct Impacts

Those existing and proposed land uses which have the potential to influence the physical extent of the route alignment include:

- natural resource extraction operations (sand and limestone mining) abutting the route alignment corridor. While the Management Plans for these operations indicate setbacks from boundaries, it is the final level of extraction which will have a greater influence on the route alignment and will necessitate detailed consideration in road design,
- the Alcoa operations are protected by the Alumina Refinery Act 1967 which will require agreement between the State and Alcoa to allow for an alignment through Alcoa landholdings. Fortunately, this does not require any amendment to the Act itself,
- private landowners abutting Rowley Road Extension along its eastern section have the potential to seek development approvals for land uses extending to the edge of their properties, thus restricting the extent of the alignment. Fortunately, the Councils involved have been cognisant of the proposed alignment and have ensured minimal impact of development proposals on the alignment itself. The western section of the proposed alignment traverses land in the ownership of natural resource extraction companies where quarry operations have the potential to impact upon route alignment. The statutory authorities retaining ownership in the western section of the alignment are unlikely to adversely impact upon the route alignment. The WA Planning Commission have purchased a property containing two houses in anticipation of the route alignment requiring this land,
- the future land use zoning as proposed in FRIARS identified a “Planning Control Area” for the length of the proposed alignment. This will in effect provide a safeguard for the alignment from any incompatible land uses.
- the Draft Jandakot Structure Plan proposes residential land uses in the medium term adjacent to the southern boundary of the route alignment. There is the potential to impact upon the route alignment at this location with incompatible residential land uses abutting the route alignment. It is considered, however, that setbacks implemented by Council will minimise any potential impact on the route alignment corridor.

Indirect Impacts

Those land uses which have the potential to exert an indirect impact upon the alignment corridor include:

- a rezoning approval for Lot 602 Mandogalup Road for "Transport Depot and Related Uses" may require that an access be created from the site to Rowley Road Extension.
- FRIARS proposed a significant extension of the "General and Light Industrial" zone in the vicinity of the route alignment between Rockingham Road and Mandogalup Road. The increased number and movement of freight traffic generated in this area may have an impact on the number and location of north-south access routes across the proposed Rowley Road Extension corridor.
- FRIARS proposed to retain the "Urban Deferred" zoning north of Rowley Road Extension, as reflected in the MRS and Town Planning Scheme. The staging and density of residential development at this location may impact upon the volume and movement of traffic in the vicinity of Rowley Road Extension. Traffic movement may necessitate consideration of north-south access roads across Rowley Road Extension at this location.
- The Draft Jandakot Structure Plan proposes an urban zoning in the medium term for the area south of Rowley Road Extension, extending to Anketell Road. The development of urban centres and associated facilities such as schools may impact upon the traffic volumes generated and the north-south movement of traffic in the vicinity of Rowley Road Extension.

Land Ownership

Land ownership in the vicinity of the proposed road corridor alignment is dominated by private landowners between Kwinana Freeway and Rockingham Road. Statutory agencies, including Main Roads WA, Western Australian Planning Commission (WAPC), the Water Corporation and the Crown (administered through DOLA) have interests in land to the west of Rockingham Road, with the exception of that land owned by Alcoa.

A total of 80 land owners in the vicinity of the alignment have been identified. CSR Ltd and Questdale Holdings Pty Ltd are significant private land owners in the study area, with their landholdings associated with resource extraction. Alcoa's refinery is located in the south west of the study area and Alcoa has waste ponds south of the study area which influence distributor road network planning.

Severance

Severance occurs when landowners operations or development potential is impacted by a road which divides a site or several sites. Issues of severance have been identified for a number of owners resulting from the proposed route alignment. These are contained predominantly to the western section of the proposed alignment where the private land affected is currently used for mineral extraction. CSR Ltd and PMR Quarries Pty Ltd are the landowners most affected by severance.

The northern-most section of the Alcoa land holdings are also affected by the route alignment, although it is understood that this will not affect the operations of the refinery in any way.

5.1.2 Ethnographics

Aboriginal Heritage

An Aboriginal heritage study was carried out in accordance with the requirements of the Aboriginal Affairs Department under the relevant legislation.

R & E O'Conner Pty Ltd undertook ethnological field research over a period in late April, 2000. The aim of this research was to locate Aboriginal people who maintained cultural links with the Naval Base area and to consult with them in order to assist Main Roads WA in fulfilling any obligations which it may have under the *Aboriginal Heritage Act (1972-80)*. [Refer to Document: *Report on an Ethnographic Survey of the Proposed Naval Base/Kwinana Port Site Road and Rail Access Route*, R & E O'Conner Pty Ltd].

The objectives of the survey were to:

- identify any Aboriginal sites and their significance,
- determine if any areas are under native title claim, and
- determine if any sites will be disturbed by the proposed road and rail.

The findings will go to the Aboriginal Affairs Department in order for them to:

- determine whether there is an Aboriginal site within the designated area, and
- evaluate the importance and significance of any such site.

Significance is attributed by Aboriginal people to areas in the Perth-Mandurah region on the basis of domestic usage, or relevance to traditional ritual or mythology. These interests cover historical, mythological, human, supernatural, mundane and sacred areas. No areas of significance to the Aboriginal people have been previously recorded within the project area.

The project area is covered by two overlapping Applications for Determination of Native Title, namely the Ballaruk Claim (WC95/86) and the Gnaala Karla Booja Claim (WC98/58). Details show that the Ballaruk claim has failed to satisfy the requirements of Section 190A of the *Native Title Act*. The Gnaala Karla Booja claim satisfied those requirements on 5 March 1999, however that decision was set aside by the Federal Court on 16 November 1999.

Aboriginal elders and representatives inspected the project area and were satisfied that the proposed works will not disturb any areas of Aboriginal significance. Statements to this effect were signed by all Aboriginal parties consulted during the study.

Archaeology

An archaeological investigation was undertaken by Quartermaine Consultants to investigate Aboriginal sites in the Rowley Road Extension area so that Main Roads WA can comply with the provisions of the WA *Aboriginal Heritage*

Act, 1972. [Refer to Document: *Report on an Archaeological Investigation of Aboriginal Sites, Northern Road and Rail Access Project for the Naval Base/Kwinana Port Site (Rowley Road Extension)*, Quartermaine Consultants, May 2000].

The archaeological survey involved an investigation of previous research in the area, a sample field survey of the project area, and the locating of any archaeological sites. As a result of the research, it was found that the project area does not conflict with any registered sites.

The field survey involved an inspection using meandering traverses through the project area with particular emphasis on any potential site locations. No further archaeological sites were located as a result of the field survey. Much of the area has been disturbed by previous work for agricultural and other developments.

The consultants concluded that since there are no archaeological sites within the alignment corridor (based on the research and field inspection), the development may proceed. However, if sites of Aboriginal significance are found before or during roadworks then appropriate protection and management must occur.

5.1.3 Non-Aboriginal Heritage

European Heritage Municipal Inventories are maintained by both the City of Cockburn and the Town of Kwinana. Discussions with officers from these local government authorities indicates that there are no European heritage locations along the proposed alignment.

5.1.4 Summary

Generally there are few social constraints to the selected route. There are few properties directly affected, and no identifiable impact on heritage.

As the area develops the road will service the surrounding area providing good transport linkages for communities that will develop. The existing local community supports development of the road as it will encourage development in the area. Unfortunately planning for the surrounding area is still in the early stages due to the implementation of the recently completed FRIARS study. Some minor changes to the Rowley Road reservation may be required as the planning for the FRIARS area is progressed. In particular, there may be changes to the existing and proposed local road connections.

5.2 Environment Issues

5.2.1 Regional and Local Parks and Conservation Reserves

Detailed environmental assessment of the study area has been carried out to identify possible environmental impacts and factors identified by the EPA for planning purposes. Significant environmental features are summarised on Map 4 in Appendix A. The extent of the study corridor superimposed on an aerial photograph is shown on Map 5.

Although there are generally limited specific conservation values attached to the land, there are some high values due to the location of some of the land.

The eastern part is on private property. The alignment has been designed to minimise impact on the only vegetated reserve (Frankland Reserve) which is a recreation reserve vested in the Shire of Cockburn and used for conservation. This reserve is also on the new listing of Nominated Additional Bush Forever Areas recommended by the Western Australian Planning Commission. The inclusion of this reserve on the Bush Forever Plan is pending the results of the detailed assessments currently being undertaken. The landforms, flora, vegetation and fauna in this area are conserved elsewhere and do not represent a major constraint on the development of the road.

The central area is mainly disturbed with little native vegetation and limited remnants of native vegetation on private property. The road will result in the removal of a number of Tuart (*Eucalyptus gomphocephala*) trees but these are common locally and are mainly scattered trees in degraded land. Part of the proposed alignment passes through the Wattleup Lake Bush Forever site at a point where it has been extended to provide a tenuous link with much larger reserves to the north (see WA. Planning Commission (1998) Bush Forever Site Map 74). Wattleup Lake is separated from the road alignment by a cleared paddock, the vegetated block where the alignment is placed is partly degraded, and the vegetated block is also isolated to the north by houses. The proposed alignment just falls within the 200m zone of secondary influence around Wattleup Lake (Hill *et al*. 1996) but with appropriate design the road need have no impact on the lake. The proposed alignment will increase the degree of separation of Wattleup Lake from the reserves to the north, but the connection is already very poor and the additional impact will be small and no specific remedial actions in this respect, such as fauna underpasses, appears to be warranted. The impacts on Lake Wattleup and environs will require careful consideration by the Environmental Protection Authority. Whilst the proposed road does not particularly impact on the current uses of Lake Wattleup, it will make it difficult to enhance the conservation status of the lake in the future.

The western part is within the Mount Brown Bush Forever site. This includes the existing Beeliar Regional Park, which extends from roughly Mount Brown north. The Bush Forever site extends south to include all vegetated land not part of previous recommendations for conservation (Map 1 and WA. Planning Commission (1998) Bush Forever Site Maps 73 and 80). This land to the south is privately owned or held by government agencies for industrial purposes and includes the proposed road and rail alignment. This land includes a major industrial facility at the southern end.

The Bush Forever scheme is intended to be a whole of government approach to provide a comprehensive system of conserved land in the metropolitan area where there are many and strong competing interests, and the potential for land reservation is either already severely constrained or has already been lost. Bush Forever has identified areas of regionally significant vegetation, which provide an adequate and representative set of the ecological communities and habitats. This land is held in a variety of tenures and it is not practical for government to simply acquire control of all this land, and in recognition of the complexity of the issues Bush Forever allows for a wide variety of mechanisms to achieve the desired outcome. Specific allowance is made for existing

landowner rights, for trade-offs, and for the necessity for regional infrastructure. In all cases the emphasis is on achieving the desired outcomes as far as possible.

Bush Forever identifies all of this land as regionally significant. Although the Cottesloe Complex - Central and South is extensive with 36% of the original vegetation remaining, the Bush Forever scheme will result in 19% of it being reserved and this does not necessarily cover all the variation within this vegetation complex (WA Planning Commission 1998).

Bush Forever and previous studies of the Beeliar Regional Park identify the following values attached to the land:

- a large limestone ridge,
- limited rare species,
- a variety of vegetation types including vegetated limestone cliffs along the ocean,
- significant wetlands (not relevant near Rowley Road Extension),
- a complete sequence of vegetation across the Spearwood dunes from the coast to wetlands,
- an area large enough to provide viable vegetation and habitats, and a buffer to the wetlands, and
- a partial corridor to the south although this has already been severely disrupted (see Bush Forever Map 80).

The proposed road and rail alignment is partly on an existing road reservation and partly within land, which is privately owned or held by government agencies for industrial purposes. The site has unresolved issues typical of those discussed by Bush Forever, and the mechanism for achieving the possible implementation of the Bush Forever scheme needs to be resolved. The road and rail cannot be moved southward out of the Bush Forever site because of the existing industrial facility, and the major objective then becomes that the impacts of the proposed road and rail need to be considered and minimised as far as possible.

The impacts of the proposed road and rail alignment will be:

- direct removal of vegetation and the associated flora, fauna and fauna habitat,
- minimal impact on Department of CALM gazetted Priority flora species,
- creating a cut into a large hill south of Mount Brown, which will be visually intrusive at least from the south,
- isolation of bushland south of the road, and
- further severing of the corridor to the south, although this is already broken up and the additional impact will be small.

There will not be any impact on the sequence of vegetation across the Spearwood dunes from the coast to wetlands as only the southern edge of the Bush Forever site will be lost.

It is difficult to estimate the fraction of each vegetation type which will be removed from the total Bush Forever site because the entire site has not been mapped, but from the mapping in this study the proposed road and rail area reserved through the Bush Forever Site 346 is 28 hectares out of the entire 616 ha. This represents approximately 5% of the entire Bush Forever Site. An additional Bush Forever area of 16.5 ha is cut off to the south of the road and rail reserve. In total, 44.5 ha of Bush Forever Site 346 are affected by the road and rail reserve, representing 7.5% of the entire site.

This degree of impact will not result in the loss of any rare species or vegetation type and from this point of view can be considered to be acceptable, but the road and rail alignment will effectively become the southern boundary of the final Bush Forever site. The main constraints are therefore identified as:

- limiting the impact as much as possible by keeping the alignment as far south as possible, and
- reducing the extent of the cut into the elevated land.

It happens that part of the proposed alignment cuts into a large hill in the Bush Forever site on a steep slope, so the exact placement of the cut makes a great difference.

Whilst the environmental impacts on Mount Brown can be rationalised in this manner, it is important to note that this proposal has been developed as the least impact solution within the context of the brief, which, constrained by previous planning outcomes, has reduced the alignment options towards the coast, to a limited area and required a joint corridor for both road and rail. This amendment will, inevitably require formal assessment with a public consultation phase.

5.2.2 Geology

Regionally, the site is located over the central portion of the Perth Basin which forms a linear trough containing a thick pile of sedimentary deposits. The proposed alignment itself traverses Quaternary superficial formations, which are underlain at depth by Mesozoic sediments comprising of interbedded sandstones, shales, and siltstones. Details of the geology and distribution of the superficial formations that mantle the proposed alignment are provided in separate reports.

This assessment has been based upon a desktop study of the proposed route and limited surface geological mapping and sub-surface drilling (primarily at Mount Brown). The proposed route covers geological formation as summarized in the following table.

Table 5.1 Underlying Geological Formations

Geological formation	Length and location
Swamp and Lacustrine Deposits	Adjacent to the alignment for about 600m in

	central parts of the route.
Tamala Limestone (formerly known as the Coastal Limestone)	About 2700m in the western half of the route
Sand Derived from Tamala Limestone	About 4600m in the western half of the route.
Bassendean Sand	About 1700m in the eastern part of the route.
Fill Materials	A sand capped waste landfill is located immediately adjacent to the proposed alignment at CH5700.

Drilling investigations of the Tamala Limestone at Mount Brown encountered typically moderate to weak limestone sand layers throughout the profile with some voids. At the water table, carbonate minerals have been completely removed from the profile leaving a residual quartz sand throughout which it is inferred that the groundwater flows laterally. This zone is some 10m below the proposed maximum cut line at/or adjacent to the locations drilled. Underlying this zone are well-cemented limestones of medium to high estimated rock strengths.

Preliminary drilling investigations through Sand Derived from Tamala Limestone conducted at Mount Brown found that their distribution was quite variable, the maximum depth encountered through sub-surface drilling ranged up to 9m. These unconsolidated sands abut both abruptly and variably to outcrops of limestone throughout the site (particularly through areas of topographic highs). Where in situ density tests (SPT's) were carried out within these materials, their relative density was found to vary from medium dense to very dense.

5.2.3 Hydrogeology

The hydrogeology of this area is relatively well understood. Water migrates in an East to West direction from the Jandakot mound towards the sea. The geology through which it passes has been described and is relatively homogenous within units. However, there are some differences in permeability between the well-rounded and clean Bassendean Sands and the less well sorted Spearwood Sands. The presence of calcareous material in the Tamala Limestone also presents a reduction in permeability, although these terms are relativistic, all of this geology has extremely good permeability which causes corresponding low gradients in groundwater level across the study area. The most significant alteration to this occurs at the boundary of the Bassendean and Spearwood sands, which causes the groundwater to rise to the surface and produce the North South Chain of Lakes of which Lake Wattleup is a part. This "short circuiting" occurs along a relatively short East West stretch and the groundwater level quickly drops below the surface as it progresses West. The next sign of the groundwater is found in interdunal areas immediately East of the last dune formation before the ocean. Thus Lake Mount Brown is one of these lakes and acts as a regional discharge point during the summer months when evaporation exceeds rainfall.

The Perth Groundwater Atlas describes the groundwater level dropping from above sea level to just 1m above sea level at Mount Brown. However, it is known that the same dune formation further North at Lake Coogee acts as a local mound during the winter months and there was some concern that a similar phenomenon would occur under Mount Brown. Were it to occur, this might present significant dewatering problems for any proposed cut. However, drilling along the alignment and subsequent monitoring appears to confirm that the groundwater remains relatively low at Mount Brown throughout the winter months. Monitoring is ongoing.

Due to the generally East West direction of the proposed road it is not expected that it will present any obstacle to the East-West migration of groundwater.

5.2.4 Geotechnical

Ripability/Excavatability

It is considered likely that some pre-treatment (blast to loosen/rock breaking) will be required throughout the western parts of proposed cut sections that traverse the Tamala Limestone south of Mount Brown. However, investigations suggest that the degree of pre-treatment required is unlikely to be extensive throughout the majority of these cuttings. It is unlikely that pre-treatment will be required in the remaining sections and excavation should be attained using conventional excavation equipment.

Use of Cut to Fill Materials

Materials derived from the proposed western cut sections are considered suitable for use within the proposed sections of fill providing that any oversize product is discarded. A fill subgrade design CBR of 15% is considered appropriate. Materials derived from cut sections towards the eastern section are considered suitable for use within proposed fill sections. In this case a fill subgrade design CBR of 12% is considered appropriate. In all instances fill batters should not exceed 3H:1V (18°) without reinforcement.

Slope Stability

Throughout the proposed western cut section it is evident from the preliminary drilling that steep unsupported batters will not be appropriate. Indeed, as a preliminary design it is envisaged that all cut slope batters should not exceed 1.6H:1V (32°). For planning purposes, if unsupported batters without benches are proposed, then slopes of between 1.6H:1V (32°) and 1H:1V (45°) should be adopted as a maximum.

Within the proposed cut sections in other sections of the route it is recommended that that all cut slope batters should not exceed 1.6H:1V (32°). Indications are that steep batters may suffice, say 1H:1.5V (56°) or steeper. However without sub-surface investigations detailed recommendations for batter slopes are considered inappropriate.

Implications for the Route

Whilst caves as such were not encountered throughout the sub-surface investigations, other karstic features such as voids, dissolution features and laminated calcrete deposits were encountered throughout the investigated

profile. However the risk of construction difficulties occurring as a result of karstic features is considered low.

Shallow groundwater (less than 2.5m below natural ground surface) occurs between at several locations. Construction difficulties may be encountered within these areas particularly during the wetter months.

The road alignment traverses varying ground types which will require specific consideration during design. There are no major impediments for construction but the pavement design, earthworks and drainage will require particular attention.

5.2.5 Noise Assessment

Noise Assessment was undertaken by Herring Storer and Associates whose report is provided separately. The Main Roads policy provides an acceptable criteria of an $L_{A10(18hour)}$ of 63 dB(A) where the existing noise level is less than 60 dB(A). Where the existing noise level is 60 dB(A) or more, an acceptable increase is 3 dB(A). These acceptable levels apply 15 to 20 years into the future; the year 2021 in this instance.

The proposed road meets acceptable criteria at the majority of residences in the year 2021. At all residences alongside the proposed road, the predicted noise level is less than 63 dB(A), with some residences experiencing decreases in noise levels. As the land adjacent the road is predominantly zoned for residential use, it is possible for a residence to be built closer to the road in future. The list below shows the required buffer distances to meet the Main Roads criteria for sections of Rowley Road Extension. Noise control or residential planning could be implemented to reduce these distances if required.

Table 5.2 Noise Buffer Distances

Section of Road	Distance from the nearest Carriageway to achieve an $L_{A10(18hour)}$ of 63 dB(A) (without noise barriers)
Kwinana Freeway to Frankland Avenue	40 m
Frankland Avenue to Mortimor Road	50 m
Mortimor Road to Mandogalup Road	5 m
Mandogalup Road to Pearse Road	40 m
Pearse Road to Rockingham Road	30 m

5.2.6 Wetlands

Wetlands of the Swan Coastal plain provide a number of unique ecological, environmental and social conditions. In seeking to develop a new road it is important to consider, balance and conserve all of these functions.

Fortunately the proposed alignment does not impact on any wetlands of high conservation significance. The most significant impact will occur at Lake Wattleup where the road will pass within 200m of the wintertime water margin.

Lake Wattleup is a highly degraded Wetland within a north south wetland system, but with few of its pre-European functions remaining. The wetland appears to be ephemeral, drying out completely in summer. On three sides, the lake margins appears to have been cleared to allow for pasture and it would seem unlikely that it is providing much benefit in terms of habitat. There are however some important considerations as the road is developed including:

- allowing for continuing fauna migration,
- minimising groundwater impacts, and
- minimising clearing impacts.

5.2.7 Biological Assessment

Biological assessment was undertaken by Hart Simpson and Associates who investigated both Flora and Fauna issues. The results are provided in the biological survey report (Hart, Simpson and Associates, 2002).

Flora

All plant species recorded are listed in Appendix 1 of the Hart Simpson Report. The weed species are also identified.

Weeds are a major element of the flora, with 69 species recorded and others will be present and identifiable in spring. These weeds are all common or widespread locally and regionally. Many other weed species were present in adjacent pasture and horticultural areas.

The list is not complete due to the seasonal constraint, but probably includes the great majority of the perennial native flora and a large part of the spring flora. Most of the species are common or widespread. The only previously known occurrence of a rare flora species in or near the study area considered here was *Hibbertia spicata* ssp. *leptotheca* which is a Priority 3 species recorded in the Mount Brown Bush Forever site (WA Planning Commission 1998).

No Declared Rare Flora species were found. The only Priority species found was *Hibbertia spicata* ssp. *leptotheca* which is a Priority 3 species. It is a small shrub known from limestone areas from Jurien south to Yalgorup and may be more extensive. It is present as scattered plants in the limestone heath area.

In addition, two other species of possible interest were found. *Hemigenia barbata* (this population appears to be the southern edge of its range), and *Petrophile serruriae* is assumed to be the limestone variant which may be a different species. It is widespread.

There are no Declared Rare Flora species likely to be present. The nearest recorded species is the orchid *Caladenia huegelii* known from east of the Freeway. A few other Priority species have been recorded regionally of which the most likely to be present are *Jacksonia sericea* (Priority 3) found on sand and limestone and *Dodonaea hackettiana* (Priority 4) found on limestone and around wet areas. Such flora are under consideration for declaration as 'rare flora' but are in need of further survey or require monitoring.

Vegetation

The vegetation was mapped into convenient sections derived from the natural units present, blocks of vegetation in different condition and land boundaries. The flora recorded in each of the four major areas is listed in the Biological Report and includes:

- Jarrah-Banksia woodland with Sheoak on Bassendean dunes,
- disturbed Tuart-Jarrah-Banksia woodland over a shrub understorey on Spearwood dunes,
- Tuart-Jarrah-Banksia woodland over a shrub understorey on Spearwood dunes in the Mount Brown Bush Forever site, and
- Limestone heath on shallow sand and limestone.

The results of the quantitative vegetation study of plots in the Mount Brown Bushland for three replicate sites were recorded in each of the woodland and heath. The results are provided separately in the biological survey report (Hart, Simpson and Associates, 2002).

Vegetation Condition

In general much of the Bassendean dune vegetation in the east is in excellent condition, most of the central area has little or no native vegetation, and the Mount Brown Bush Forever site has vegetation in generally good condition but with significant disturbance.

There were scattered tree deaths in many sites but no evidence was found for the presence of dieback anywhere in the study area. Most of the damage seen was due to physical disturbance for a variety of reasons, a long history of grazing particularly in the central and western parts, considerable wood cutting over many years, rubbish dumping and excessive burning. This has resulted in extensive weed invasion in the central and western part including in the Mount Brown Bush Forever site. Although grazing by stock has stopped there is continuing grazing by rabbits which is severe in places and is probably continuing the cycle of disturbance, weed invasion and excessive fires.

The area in the Mount Brown Bush Forever site is the most complex. Much of the area in the south around the Alcoa facility has been completely disturbed and rehabilitated but with mainly non-indigenous species and the resulting vegetation does not qualify as native vegetation.

There are the remains of an old house north of Mount Brown, and old aerial photographs show a considerable area of houses opposite the present Naval Base settlement. These have affected the surrounding areas and caused some localised severe disturbances.

The area in the west is the most disturbed. Apart from some excavations, much of the understorey appears to have been removed from some areas at some time in the past. Many of the Banksia trees may have been removed as well. This damage may have been caused by grazing many years ago but is localised and may also have been caused by rubbish dumping or some other direct disturbance. There are areas of rehabilitation scattered throughout this western

area, including evidence of hydro-mulching and tree planting. Much of the planting has been unsuccessful.

Although this area has been disturbed in part, it is now regenerating and in the long term can be expected to return to something like the original native vegetation.

Fauna

Trapping was limited in the Banksia woodland near the Freeway, the woodland near Mount Brown and the heath near Mount Brown and produced only mammals. Full details of this survey are given in the Biological Study (Hart Simpsons and Associates, 2002). Only House Mice were caught in the Elliott traps, and Bandicoots in the cage traps. The House Mouse was caught in all sites and was most common in the Mount Brown area, which would be expected because it is more disturbed. The Bandicoots were marked before release so that the total number of individuals could be counted. The trapping of Bandicoots suggests that there is a large population in the Mount Brown area, but a sparse population near the Freeway.

Opportunistic searching produced a range of species, mainly lizards but numbers were low. Kangaroos are common near the Freeway but apparently absent from the Mount Brown area. Kangaroos have been found to be present in small numbers in the Beeliar area to the north of Mount Brown, but it is not known if this species still survives there or ever occurs south of Mount Brown. It may be declining due to increasing development of the land.

A total of 34 native bird species was recorded, and three introduced species. In addition, three incidental aquatic species were observed overhead: the Pelican, White-faced Heron and Australian Shelduck.

Most of the vertebrate fauna species which may occur in the study area are common or widespread. The Short-billed Black-Cockatoo (*Calyptorhynchus latirostris*) and the Peregrine Falcon (*Falco peregrinus*) may be present

In addition to these species which have a formal gazetted conservation status, the Department of Conservation and Land Management also lists Priority species which are restricted, vulnerable or too poorly known to be considered for gazetting. These species have no special protection, but their presence is normally considered. The quare-tailed Kite (*Lophoictinia isura*), which is a Priority 4 species may be present during hunting and the Southern Brown Bandicoot (*Isoodon obesulus*), which is a Priority 4 species is present as indicated.

5.2.8 Summary

Compared to many road alignments the proposed Rowley Road Extension generally has only minor environmental impacts. The proposed road will have little impact on flora, fauna, noise or wetlands. The road traverses areas which are suitable for road construction without significant impacts to surface or underground hydrology.

The major issue is the cut into Mt Brown and the loss of environmentally and visually attractive areas. There will be some degradation of 'Bush Forever' sites

and Frankland Park which are necessary if the road is to be constructed on the alignment agreed by previous strategic planning. The clearing of areas can be effectively managed as shown in the Environmental Management Plan.

5.3 Engineering Issues

Constraints to the design of the road are summarised in Map 6 in Appendix A. There are several locations where infrastructure represents a significant impediment to the road or design requirements are difficult to achieve. These are summarised in the following table.

Table 5.3 Engineering Issues

Topographical features	Mt Brown limestone quarries sand quarries
Major utility services	Western Power high tension transmission line immediately west of Rockingham Road trunk sewer and water main - to be relocated through Fremantle - Rockingham Highway interchange BP high pressure lines (heavy and light oil) - to be relocated in Fremantle - Rockingham Highway interchange two gas mains at Postans Road - probably to be relocated in conjunction with other land development works in the area Telstra trunk line - to be relocated through Fremantle - Rockingham Highway interchange Telstra mobile phone tower facilities - to be avoided by proposed alignment Telstra optic fibre along Frankland Ave - to be relocated
Other services	Telstra, Western Power and water near Cockburn Road gravity flow water pipe from Mount Brown - to be relocated Telstra distribution line between Frankland Ave and Barfield Road - to be relocated Western Power east of the railway line Western Power and Telstra along Postans Road
Basic raw materials extraction areas (existing, disused, or approved for future extraction)	limestone quarries between Rockingham Road and Postans Road, sand quarries to the west of the proposed future Hammond Road
Regional road connections	Kwinana Freeway, Fremantle - Rockingham Highway (including a major grade separated interchange), Rockingham Road, Cockburn Road, the proposed future Hammond Road,

Other road connections	Postans Road, Mandogalup Road, Frankland Ave, Cockburn Road connection to Alcoa, providing connection to the surrounding area while minimising intersections provision for the proposed Rockingham - Fremantle Transitway,
Connection between the proposed railway and the existing railway	location, level and grade constraints,
Road geometric requirements	grades and alignments suitable for a high standard strategic regional road route substantially used by heavy freight vehicles.

The quarries are a particular issue because the timing of road construction compared with the timing of resource extraction is not known. Therefore it is not clear whether the road will be constructed before quarrying (at a similar height to existing surface levels), or after quarrying (at a much lower level).

All of these issues can be overcome, but many may have significant cost implications (especially trunk services) or other impacts. These issues represent significant challenges for design of the road.

6. Refinement of the Route

6.1 Road Alignment

The specific elements of the road alignment are as follows:

- connection at the western end to the proposed port, just north of the existing Alcoa refinery with road and rail adjacent, and a connection with Cockburn Rd to the north,
- alignments curved south as far as possible to minimise the impact on Mount Brown with road and rail in cuttings of approximately 13m and 32m maximum depth respectively, and a maximum width of approximately 160m, and connection to a realigned Rockingham Road to the south.
- an interchange with road and rail bridges over the planned Fremantle - Rockingham Highway, the Rockingham - Fremantle Transitway and the Midland - Kwinana railway line.
- east of the railway the route curves north through quarries where the road and land height are uncertain depending on when the quarries are excavated and when the road is to be constructed.
- a connection is planned for a realignment of Postans Road or an alternative connection with the existing Postans Road and also at Mandogalup Road.
- east of Mandogalup Road the route rises past Frankland Park and another quarry before a possible interchange at Hammond Road and joining the existing interchange at the Kwinana Freeway.

There are major services in the vicinity including high tension power lines, gas mains, water mains and oil lines. Most of these will require relocation.

There a major environmental impact on the Mount Brown area, but little social or environmental impact elsewhere along the route. The alignment has been pushed as far south as possible to minimise the impact on Mount Brown. The slopes of the roadsides have been planned to minimise the extent of cut into the southern slopes of Mount Brown, while minimising the visual intrusion and allowing for revegetation.

6.2 Interchanges

An interchange is planned at the proposed Fremantle - Rockingham Highway. Prior to construction of this controlled access highway this interchange could be constructed with the existing Rockingham Road. The interim interchange does not meet normal road engineering design standards, but the horizontal alignment is no worse than the existing road at that location.

An interchange has recently been constructed at the Kwinana Freeway which provides the eastern tie in for this section of Rowley Road.

An interchange is planned at Hammond Road which is reserved in the MRS as an Other Regional Road. It appears that Hammond Road will not fit within the land reserved in the MRS (due to earthworks envelopes) and further work should occur to define the road and reserve adequate land. Hammond Road will carry regional traffic and is the major north - south road in the western end of the study area. It will service developing and planned urban areas. A grade separated interchange has been defined but there has been no investigation of the operational requirements of this arrangement.

Grade separation has been planned conceptually for the Rockingham – Fremantle Transitway immediately east of the current Rockingham Road. The alignment of the Transitway is not yet defined, but it can be accommodated within the planned interchange. The arrangement allowed for is consistent with current planning for the Transitway.

Table 6.1 Grade Separation Arrangements

Intersecting Road	Planned Connection Arrangement
Fremantle - Rockingham CAH	Interchange
Kwinana Freeway	Connection to existing interchange
Hammond Road	Interchange
Postans Rd	Potential interchange (see below)

6.3 Intersections

Intersections are planned for the various roads as shown in the following table. T junctions are intended to operate under priority sign control. Four way intersections and the major interchange will require traffic signals.

Table 6.2 Road Connection Arrangements

Intersecting Road	Planned Connection Arrangement
Mandogalup Road	Either staggered T junctions or a four way intersection, depending on requirements at different stages.
Postans Road	T junction for Postans Road north which could remain long term or be replaced by a major Postans Road realignment. The realignment would result in a 4 way intersection, or an interchange.
Rockingham Road south	T junction with traffic signals to maintain access to the northern end of the KIA.
Cockburn Road north – alternative 1.	T junction with adjacent level crossing.
Cockburn Road north – alternative 2.	T junction with road extended to the east to provide a grade separated crossing over the railway line.
Sutton Rd	T junction reclaimed land providing access to Alcoa refinery.

6.4 Rail Design

The alignment planning allows for dual rail tracks. Operational effectiveness is provided by direct connections to the Midland – Kwinana line in both directions. Track safety and efficiency is provided by adhering to WAGR rail design standards and requirements. Track speeds are limited by grades and curve radii, but minor improvements would result in significantly increased land acquisition, environment and construction cost impacts.

7. Options and Evaluation

Concepts were developed for critical areas as described below:

7.1 Alignment Options

7.1.1 Cockburn Road to Rockingham Road

The cross sections between Cockburn Road and Rockingham Road (past Mt Brown) are a critical issue. There is little opportunity to adjust the horizontal alignment, however alternatives for the vertical alignment and cross sections were considered. Alignments were adjusted to minimise the impact on the Mount Brown area while maintaining acceptable road and rail geometry and a suitable interchange for Fremantle - Rockingham Highway.

The vertical geometry could allow either road and rail at the same height or at different levels. Several cross section options are possible depending on batter slopes, which could be different for sections adjacent to road and rail, including:

1. standard 1:3 batter slopes generally used for arterial roads,
2. steepened 1:2 batter slope for restricted locations (which could include some steeper sections with stone pitching or staggered low retaining walls),
3. steep 1:1 slopes with stone pitching,
4. near vertical retaining walls.

The first three of these alternative cross sections are shown in Figure 7.1 and are compared in Table 7.1.

Table 7.1 Alternatives for Cut South of Mount Brown

Slope	Type	Effects
Vertical	Retaining wall	Expensive and difficult to construct. Minimum width of cut. Poor aesthetics.
1:1	Stone pitching or crib wall	Narrow cut. Poor aesthetics.
1:2	Planted or with low retaining walls and other sections at 1:3	Can be planted but is often poor at 1:2. Planting can be acceptable with some sections at 1:3 and the remainder steeper. Medium width cut.
1:3	Standard slope for road verges	Cheap to construct. Good aesthetics. Good for planting. Very wide cut width

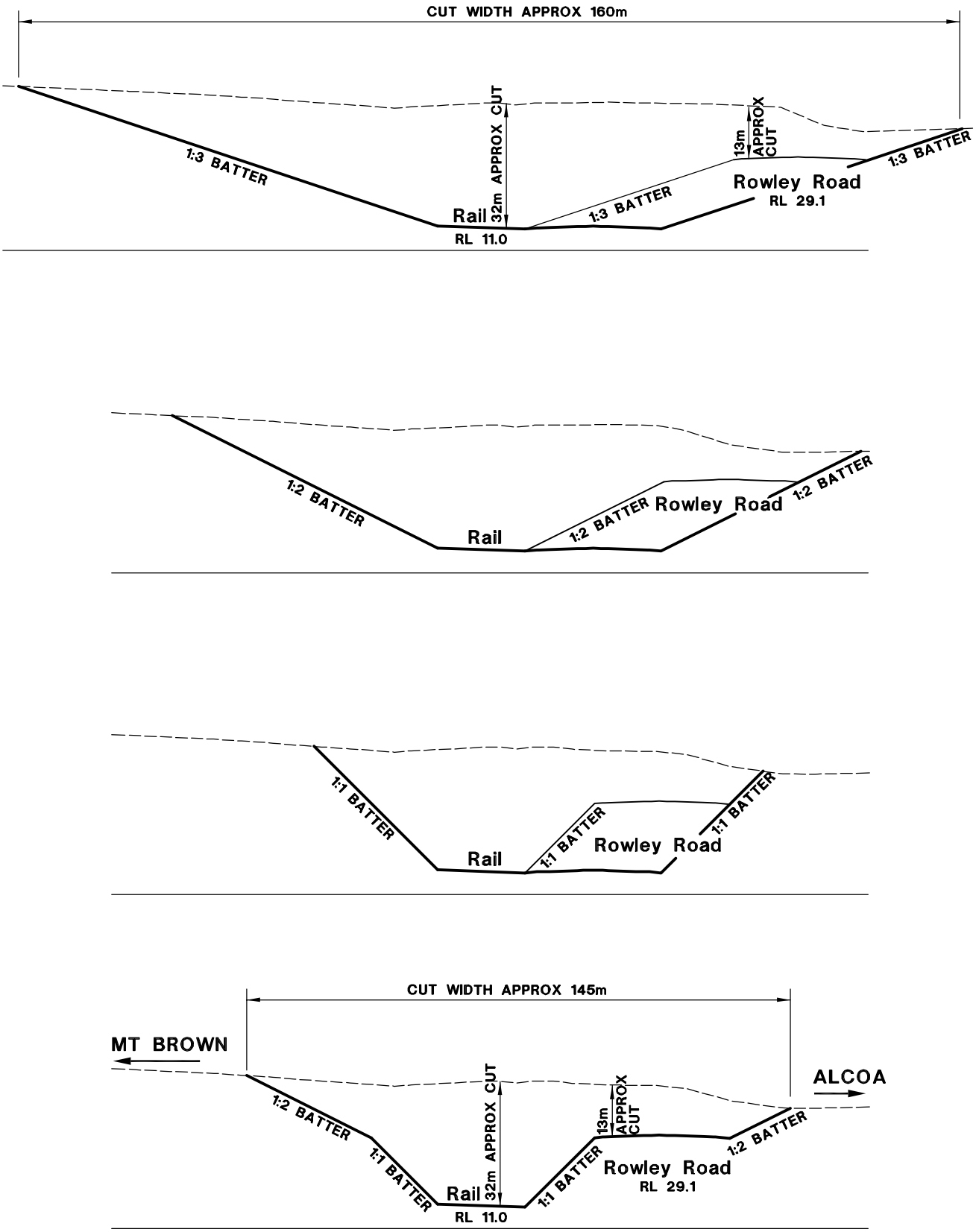

FIGURE 7.1
ROWLEY ROAD - CROSS SECTION OPTIONS SOUTH OF MT BROWN
NOT TO SCALE (DIMENSIONS INDICATIVE ONLY)

It is clear that different alternatives have different advantages and disadvantages. It is likely that 1:3 batters will result in such an excessive cut width the option will be unacceptable. It is also likely that 1:1 batters would be too expensive and restrictive for construction and are therefore unacceptable for planning.

A range of mixture of batter slopes can be used at different parts of the design. After careful consideration it was agreed that a mixture of slopes would be proposed as the preferred option for consideration. The preferred option is for 1:1 slopes for the rail up to the level of the road and 1:2 average batter slope upwards from the road height. Road and rail design standards would be maintained.

7.1.2 Rockingham Road to Postans Road

The section between Rockingham Road and Postans Road through the quarries is uncertain for road planning because it is not known whether this section will be built near existing ground level or near the level of the final quarry excavation. The vertical alignment options are limited by other constraints including crossing the rail at the west and crossing the gas mains at the east, providing side road access and minimising other land acquisition. The road reserve boundaries have been set to accommodate the earthworks for both possibilities. Eventually it is possible that excess land may exist and could be returned for other land use. As for the section immediately to the east it was accepted that the existing land use should not be considered an overriding impediment to the road design. In addition it is likely that the quarries, the Postans Road realignment and other factors will result in the gas mains being relocated. Alternatively the cost of relocation would be less than the cost savings in road construction, land and other development in the area. Consequently the gas mains may not represent a significant impediment to the road alignment.

Two vertical alignments were investigated in detail:

- a low option to suit future quarry levels, based on existing ground levels, resulting in considerable cut, and
- a high option to suit the existing ground levels and adjacent development, resulting in considerable batter width down to the future quarry level.

Both of these options result in very similar roadworks envelopes, and hence similar road reservations. The preferred arrangement shows the first of these options, but the other could be constructed depending on the timing of the road construction and quarry operations.

7.1.3 Postans Road to Mandogalup Road

The section between Postans Road and Mandogalup Road is constrained by several features including:

- commercial properties (a transport depot and market gardens),
- a grove of tuart trees,
- side road connections,

- gas mains,
- safety (sight distance), and
- earthworks.

Several alignments were considered through this section. An important consideration is that the future land use will eventually be quite different to the current land use. In planning terms it was accepted that the existing land use should not be considered an overriding impediment to the road design.

The alignment has been chosen to avoid impact on major building and generally share the land acquisition between the market garden properties.

7.1.4 Mandogalup Road to the Kwinana Freeway

East of Mandogalup Road there are few options for altered route alignment. Constraints through this section include:

- commercial properties (a fresh produce facility, poultry sheds and quarries),
- a Telstra mobile phone tower,
- Frankland Park,
- Lake Wattleup and other Bush Forever linkages to the north,
- Future Hammond Road regional road.

All alignments would have some impact on commercial properties and will cross a Bush Forever linkage. A more northern alignment affects private residential properties, and future urban areas. A more southern alignment affects the Telstra tower and makes a poorer tie in to the Freeway interchange.

The selected alignment avoids the Telstra tower, Lake Wattleup, the fresh produce facility and quarries, and has little impact on Frankland Park but impacts on the poultry property. However, given that the land is zoned 'Urban Deferred' in the MRS, the poultry property is not considered a long term constraint. Some land will also be required from residential properties east of Frankland Avenue.

7.2 Intersection Options

Alternative arrangements for various intersections were considered including

- T-junctions or four way intersections,
- interim stage prior to traffic signals, and
- possible grade separation at Hammond Road and Postans Road.

7.2.1 Rockingham Road

First stage (connecting with existing Rockingham Road)

It is proposed to provide an arrangement which allows for the construction of Rowley Road Extension (including necessary bridges over the rail and Rockingham Road). Several versions of a single alignment were devised and

refined. These require avoiding bridge piers and abutments while maintaining the best possible road geometry and safe sight distance. A high standard road alignment could not be developed for this location. However, an interim stage alignment was developed which would provide an acceptable geometric standard at least as good as the existing Rockingham Road.

Ultimate stage (connecting with future Fremantle - Rockingham Highway)

While the concept initially proposed for the Rockingham Road interchange has not fundamentally changed there were several subtle road engineering alternatives considered in this location. These included road grade, ramp dimensions, road spacings and so on.

7.2.2 Rockingham - Fremantle Transitway alignment

The alignment of the Rockingham - Fremantle Transitway has not been specified in this section. It is intended to ensure that an alignment is practicable, but definition and protection of the preferred Transitway alignment is not included in this study and is not required for the Rowley Road Extension land requirements.

Alternatives for Transitway alignments were investigated but the only reasonable option found was immediately to the east of the interchange, consistent with previous planning for the route.

7.2.3 Cockburn Road and Alcoa Connections

A connection of Cockburn Road north with Rowley Road is provided with either a rail level crossing or grade separation over the rail.

Efficient and effective access to Alcoa must be maintained, including for heavy vehicles which currently use Sutton Road. Alternative options for heavy vehicle access to Alcoa were considered including:

- Widening and strengthening the existing bridge to connect to Cockburn Road.
- Extension of Sutton Road to connect with Rowley Road west of the redesigned rail spur.

Following discussions with Alcoa, it was determined that the extension of Sutton Road was the preferred option because it refined two accesses to the refinery which are required for operational and safety reason.

7.2.4 Postans Road Connection

Information from Local Government and LandCorp indicated that Postans Road was likely to be realigned to the west to suit changes to land use to the south and future development to the north.

The southern section is likely to be disconnected by extensions to the Alcoa red mud waste lakes. Consequently Abercrombie Road is likely to become the north-south distributor road in the area. However Abercrombie Road does not extend to Wattleup Road.

The northern section of Postans Road does not extend north of Wattleup Road so there is not a good distributor road connection to the north. Therefore the northern distributor is likely to be provided by Phillips Road, Power Road or

another road, none of which extend south to the Rowley Road Extension alignment.

Consequently a new distributor road is likely to be eventually constructed on a yet to be defined alignment. In terms of planning for Rowley Road Extension there are few locations where a new intersection can safely be provided while minimising earthworks. A preferred location is shown approximately 350m west of the existing Postans Road.

This location has the advantage that it may be possible to provide the opportunity for a grade separated interchange in the long term to maintain the effectiveness of the route as a strategic road link. The road levels would allow such an arrangement and sufficient land would be available based on the earthworks boundaries resulting from the proposed road design. A concept for a grade separated interchange at this site is shown in Figure 7.2. However, in light of the uncertainty of local planning, provision has not been made for this in the concept and land reservation.

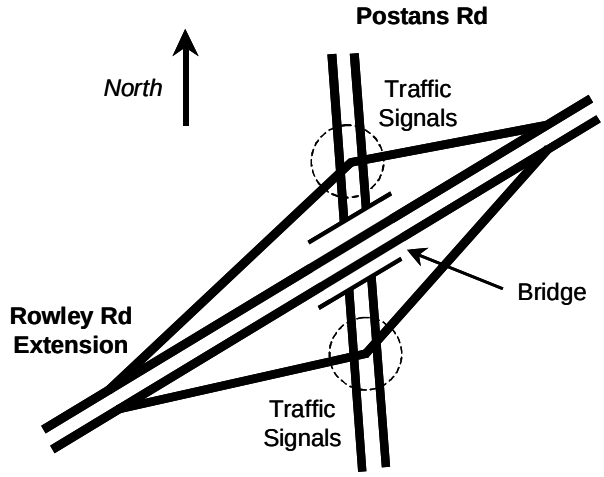

Figure 7.2 Possible Postans Road Interchange Arrangement

7.2.5 Hammond Road

Due to the difference in levels between Rowley Road Extension and to the future Hammond Road, there is an opportunity to plan for a simple grade separated interchange at this location. Such an opportunity is dependent on reconsideration of the Hammond Road alignment. Various interchange arrangements may be possible based on connections in one or more quadrants. A possible two loop connection is illustrated in Figure 7.3.

The strategic role of Rowley Road Extension is a regional route for heavy freight vehicle. Therefore it is appropriate to plan for grade separation at

Hammond Road. Grade separation will minimise conflicts with heavy vehicles, ensuring maximum safety and transport efficiency.

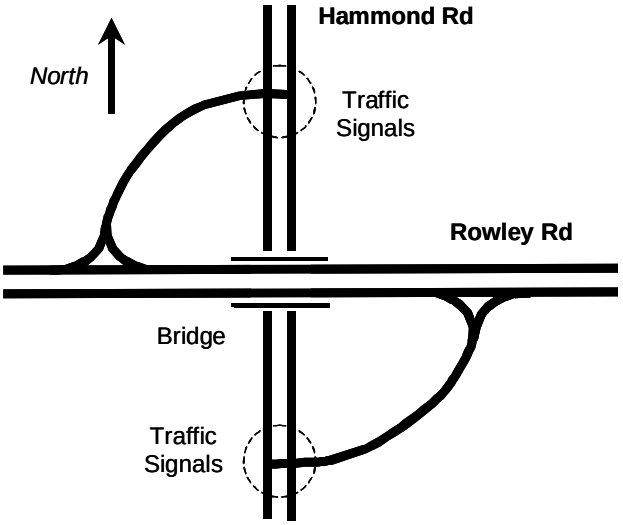

Figure 7.3 Possible Hammond Road Interchange Arrangement

7.3 Land Requirements

The proposed Rowley Road extension requires a road reserve area of some 1248 hectares. The proposed alignment impacts predominately on market gardens in private ownership, extractive industry operations (quarrying), and land owned by Alcoa and Government agencies in the Mount Brown area.

A total of 80 land owners in the vicinity of the alignment have been identified. CSR Ltd and Questdale Holdings Pty Ltd are significant private land owners in the study area, with their landholdings associated with resource extraction.

The proposed alignment will sever or divide several private properties in the western section. CSR Ltd and PMR Quarries Pty Ltd are the landowners most affected by the road severing their land. The northern-most section of the Alcoa land holdings is also affected by the route alignment. Resumption of Alcoa land will require agreement between the State and Alcoa as the Alcoa operations are protected by the Alumina Refinery Act 1967.

The western part of the route is within the Mount Brown Bush Forever site and includes the existing Beeliar Regional Park which extends from Mount Brown north. South of this is land owned by Alcoa or held by Government agencies for industrial purposes. The alignment through this section was selected to minimise the impact on Mount Brown by keeping the road and rail as far south as possible while avoiding Alcoa's existing refinery operations, and by reducing the size of the cut batters. The proposed road and rail reserve will provide an opportunity to rationalise the boundary between the industrial area

and Beeliar Regional Park, allowing the majority of Mount Brown to be incorporated into the park.

The section between Rockingham Road and Postans Road affects a number of quarry operations. The land requirements in this section are governed by the vertical alignment which is constrained by the need to bridge over the freight railway and match the proposed finished level of the quarries. The uncertain vertical alignment through the quarries does not greatly affect land requirements. The proposed land requirements allow for the road to be built at either the finished level of the quarries or nearer the existing ground levels. Once the road has been constructed or the quarries fully excavated, it is possible that excess land may exist and could be returned for other land use.

The section between Postans Road and Frankland Avenue has been located to avoid Lake Wattleup, two major commercial developments and to minimise the impact on Frankland Reserve. The proposed reservation impacts mostly on the rear portion of market garden properties.

The section between Frankland Avenue and Kwinana Freeway aligns with the existing Rowley Road with the second carriageway proposed to the south of the existing road, impacting undeveloped land. Some additional widening of the road reserve on the northern side is also required to accommodate earthworks and a future shared path, impacting on three rural residential properties.

8. Consultation

8.1 Extent of Consultation

Consultation has occurred at several levels throughout this project and a summary is provided in a separate report. Information has been provided on several occasions allowing a full understanding of the project and opportunities for feedback to improve the project. The results of community and stakeholder consultation are provided in a separate report.

A total of 544 businesses and 1778 residences, were provided detailed information. Community consultation occurred through brochures, local newspapers and personal meetings with potentially affected landowners.

Other groups and individuals with interests in the area were contacted including community and environmental organizations, business groups and members of parliament.

The project Steering Committee was comprised of representatives from transport and land use agencies, including:

- Main Roads WA,
- City of Cockburn,
- Town of Kwinana,
- Department for Planning and Infrastructure,
- LandCorp,
- Department of Environmental Protection,
- Mineral and Petroleum Resources,
- WA Government Railways.

8.2 Issues Arising

The discussions and meetings with various stakeholders identified a number of issues to be considered during definition of the preferred concept. Issues were raised by only a few people and are summarised below.

The key issues are:

- impact on Mount Brown, and other environmentally sensitive locations, and
- commercial and residential property impacts (including land acquisition, severance and accessibility).

There was considerable support for Rowley Road extension which is seen as being necessary for development of the area.

Landowners who raised the issues, were subsequently contacted by individual letter to advise of the consultant's recommendation regarding these constraints.

The final plan took account of stakeholder's concerns wherever possible while balancing conflicting community, economic, environmental, transport and road engineering requirements.

Individuals and groups with environmental interests were generally concerned about the impacts on Bush Forever sites and particularly on Mount Brown. Not all of Mount Brown is reserved under the Metropolitan Region Scheme but it is identified in Bush Forever. Consequently some people in the community believe that none of the remaining undeveloped parts of Mount Brown should ever be developed. Therefore no alignment of either road or rail through the southern slopes of Mount Brown was considered to be acceptable. One important issue is that some people believe that the neither the road nor the rail is justified and alternative access should be provided. It was agreed that if a road and/or a rail was to be planned then the preferred location would be as far to the south as close to Alcoa as possible.

Information arising from consultation included:

- two houses are very close to the alignment, but possible noise impacts could be mitigated by moving alignment further south at this location.
- mature Tuart trees and steep incline on property may affect the alignment,
- an unapproved rubbish tip (possibly a contaminated site) adjacent to the route,
- Bush Forever sites at Mount Brown, Lake Wattleup and to the north,
- private access road to properties to be retained, battleaxe access to business property and private landowner's property.
- a Telstra cable inside private property boundary on the north side of Rowley Road between Frankland Ave and the Kwinana Freeway,
- eight Water Corporation sampling bores along existing Rowley Road Reserve,
- the retention of Rowley Road for local access to three properties is not a priority, as the land is likely to be subdivided with a new local road network formalised,
- Main Roads WA to note a potential "land swap" has been requested by a landowner (Main Roads WA would acquire a small triangle portion of the property in exchange for a section of the current Rowley Road alignment that is no longer road reserve as a result of the amendments to the Rowley Road Interchange).

Many of the issues raised during consultation are consequences of the alignment decided during previous planning. Previous studies considered these issues when selecting the alignment which is refined and detailed in this study. Subsequent design of the road will also address some detailed issues.

- minimise land requirements from individual owners as far as possible,
- minimise the impact on Mount Brown, Lake Wattleup, Frankland Park and tuart trees between Mandogalup Road and Postans Road,

- avoid impacts on the transport depot adjacent to Mandogalup Road, Alcoa, and the fresh produce processing facility east of Mandogalup Road,
- provide access to adjacent areas by retaining and improving local distributor road access.

Some issues remain which could not be avoided, including:

- impact on the area immediately to the south of Mount Brown (although environmental assessment indicates effects can be managed),
- property acquisition, and
- impact on the poultry farm on the north side, east of Mandogalup Road..

8.3 Consultation Conclusions

Based upon the extensive area reached by the dissemination of project information, the extent of community interest regarding the project has been reasonably low. This may have resulted from release of information regarding the FRIARS Report at a similar time to the current study being undertaken. The implications upon the local community of the outcomes of this report are potentially more significant and widespread than those of the proposed road project.

Overall, the responses by the residents directly affected by the route were positive. The acceptance of the project and its necessity as part of the future progress of the area was very high. The concerns raised by local residents tended to be focussed on issues of individual compensation and a request to know the actual amount of land that would need to be resumed. Many of the residents also wanted to know further information regarding the implications of the FRIARS Report on their landholding.

The recommended design concept and land reservation requirements have been agreed in principle by the Project Steering Committee, the community, key stakeholders and Alcoa.

9. The Recommended Route

The key elements of the preliminary design concept is described below. The concept is shown in Map 7 and detailed plans of the route are shown in Appendix B.

The road route provides connections to the regional road network, serves the surrounding area and results in minimal social impact. Some environmental impacts may occur to the south of Mount Brown. The road will require substantial engineering for construction due to the quarries, utilities and interchanges. For these reasons the road will be costly and difficult to construct.

The proposed road concept provides a four lane dual carriageway from the future port site in the west to the Kwinana Freeway in the east.

The rail concept provides a connection from the future port site to the Kwinana - Midland freight line in both directions.

Road interchanges are proposed at:

- Rockingham Road/Fremantle – Rockingham Highway,
- a realigned Postans Road,
- Hammond Road, and
- Rockingham - Fremantle Transitway (no connection).

Minor road connections may change due to land use planning in the area, and are currently planned for:

- Sutton Road,
- Cockburn Road (with a level crossing or grade separation across the rail),
- Mandogalup Road,
- Frankland Avenue, and
- Barfield Street.

The route requires a significant cut to the south of Mount Brown (up to 32m deep and 145m wide) which has been minimised as far as possible by aligning the road and rail towards the south and reducing the depth of cut.

Between the railway line and Postans Road the proposed road is to be low compared with current ground levels to suit excavation proposed for quarries.

East of Mandogalup Road the proposed road avoids a transport depot and a fresh produce facility. The route crosses a Bush Forever site and impacts on a poultry property and traverses market garden properties.

The road rises to a high point past Frankland Park and connects to the existing Kwinana Freeway interchange.

10. Conclusions

This study has defined a preferred road concept for the extension of Rowley Road between the Kwinana Freeway and the future port site at Naval Base. It also provides a preferred rail alignment between the existing freight rail and the future port site. The drawings define road and rail arrangements and land requirements for reservation in the Metropolitan Region Scheme.

The extension of Rowley Road provides an east-west regional road link for the proposed new port at Naval Base and to provide access to the northern end of the Kwinana Industrial Area. It also provides a regional transport route for surrounding areas especially to the Kwinana Freeway. Strategic land use planning confirms the need for and location of the road.

This study determined a preferred horizontal and vertical alignment and defined the road and rail reserve boundaries which provide for regional transport while minimizing a variety of adverse effects. The study considered the transport issues for the road including social, environmental and financial effects.

Key engineering issues include suitable road geometry, planning for a rail spur, minimising impacts (especially on the Mount Brown area) , connections with other roads and integrating adjacent land use. Comments from the general public and agency stakeholders were also considered.

Plans of the land requirements are shown in Appendix C.

The most significant aspects of the rail and road alignments are as follows:

- minimised impact on the environmental area south of Mount Brown achieved by a southern alignment and reducing the cross section by steepened batters, reduced widths and offset heights of road and rail,
- meeting road and rail design criteria,
- maintaining alternative options for connection of Cockburn Road north
- providing an interim arrangement for Rowley Road Extension over Rockingham Road prior to the Fremantle - Rockingham Highway construction,
- minimising impacts on various buildings, and
- maintaining alternative options for connection of Postans and Mandolagup Roads, including a new alignment for Postans Road to serve as a distributor road in the area.

Carriageway Patterns and Profile Plans are included in Appendix D.

The proposed Rowley Road extension impacts predominately on market gardens in private ownership, extractive industry operations (quarrying), and land owned by Alcoa and Government agencies in the Mount Brown area.

The alignment through the western section was selected to minimise the impact on Mount Brown by keeping the road and rail as far south as possible while avoiding Alcoa's existing refinery operations, and by reducing the size of the cut batters. The proposed road and rail reserve will provide an opportunity to rationalise the boundary between the industrial area and Beeliar Regional Park, allowing the majority of Mount Brown to be incorporated into the park. The rest of the route has been located to minimise impacts on existing developments, Lake Wattleup and Frankland Reserve and generally impacts the rear portion of most market garden properties.

The recommended design concept and land reservation requirements have been agreed in principle by the Project Steering Committee, the community, key stakeholders and Alcoa.

Appendix A

Maps

Map 1 FRIARS Plan

Map 2 Transport Infrastructure

Map 3 Existing Statutory Land Use Zoning

Map 4 Environmental Site Plan and Vegetation Map

Map 5 Aerial Photograph

Map 6 Constraints Plan

Appendix B

Concept Plan

Appendix C

Land Protection Plan

Appendix D

Carriageway Pattern And Profile Plans