

Greater Geraldton Infrastructure Assessment Report

Greater Geraldton Growth Plan

Prepared for
LandCorp

3 November 2016



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Executive Summary

The Greater Geraldton Infrastructure Assessment Report is a review of existing infrastructure within the Greater Geraldton Area and considers the potential to allow for growth in specific areas of the City of Geraldton and the greater area.

Through close liaison with the City of Greater Geraldton, Midwest Development Commission, LandCorp and other relevant Stakeholders, Cardno has conducted research into the current capacity of the infrastructure and services within the Greater Geraldton area.

This assessment involved:

- > Review of all available infrastructure documents and policies.
- > High level stakeholder engagement.
- > Constraints and opportunities analysis.

Stakeholder Engagement

Targeted stakeholder engagement was undertaken to ensure the desktop assessment for this project was based on the most current information available.

Stakeholders contacted included; Local Government, Mid West Development Commission, Main Roads WA, Department of Transport and other local infrastructure providers.

Key constraints emerging from the consultation were; power infrastructure limitations, the price of headworks and relocation/upgrade of services, the lack of key heavy vehicle transportation routes, airport landing capacity for larger aircraft, over reliance of potable water for use in mining and agriculture, relocation of heavy industry from residential areas to Oakajee Industrial Area and poor internet connection in rural areas.

Stakeholder comments were used as an input to both constraints and recommendations for infrastructure within the region.

Key Findings

Challenges for the Region

Increased demand for; energy, transport, digital communication, water and waste water services will be driven by population growth, tourism, agriculture, mining and business demand. Existing infrastructure such as electricity assets are constrained and infrastructure networks serving Greater Geraldton needs significant public and private investment.

Energy

Power

The bulk transmission system servicing the Mid-West region north of Three Springs terminal operates at 132 kV and is considered weak. Constraints on power transfers currently apply under condition of high generation north of Three Springs and there are considerable ageing assets in the area. Western Power is investigating the expansion of the bulk transmission system north of Three Springs as part of the MWEF Northern Section.

The Greater Geraldton area is currently serviced by an overhead 33 kV network, this network is constrained by voltage capacity. This is due to the relatively large distances required to transfer power from zone substations to supply customers. Western Power has been working on the MWEF South (Stage 2) and MWEF North projects to strengthen the NCLA network. Improving the MWEF is critical for economic growth for the region.

Renewable Energy

The area surrounding Geraldton is one of the windiest regions in Australia. Wind speeds average 20-25 km/h during the cooler months and 25-35 km/h from October to March; a result of the strong seasonal sea breeze coupled with a consistent easterly breeze in the morning. These are ideal conditions for wind power generation.

There are currently two wind farms to the south of Geraldton – Alinta Wind Farm and Mumbida Wind Farm. However, the transmission network to Geraldton is currently at capacity, constraining the opportunity to expand the existing wind farms, or create additional wind farms in the region. This renewable energy source could be utilised to generate additional power to feed back into the grid to supply Perth with an additional power source.

Communications

The City of Greater Geraldton was one of the first towns in Western Australia to gain access to NBN. However, the capacity of the network is unknown and at present there is limited access to the internet for rural towns within the Midwest Region.

The MWDC has been investigating the option of expanding a fibre network into regional areas via a co-operative fibre-optic service. This is an opportunity to provide high speed internet access to the regional town centres without the reliance of the big telco networks having to build the infrastructure.

Transportation

Geraldton Airport

Geraldton Airport is a major hub for fly-in fly-out (FIFO) services for mining operations in the region. The Geraldton 2012 to 2030 Airport Master Plan indicates the following planned upgrades for the airport:

- Increasing the runway length to 2,400m
- Upgrading current runway PCN from 34 to >42
- Investment in arrival lounge capability

The CGG has formed several relationships with hotel chains and other distributors within the Asian market. There is potential for Geraldton Airport to export a number of fresh products directly to Asia such as:

- > Fresh fruit, vegetables and flowers
- > Rock Lobster
- > Fresh fish and packed meat
- > Geraldton wax

CGG have given consideration to the upgrade of Geraldton Airport to provide an alternative to Perth for wide-bodied domestic and international operations.

Geraldton Port

Geraldton Port currently has seven berths, ranging in use from mooring of small vessels, loading of livestock to shiploaders for iron ore and other minerals. There was 17 million tonnes of product exported from the Port in 2015, with a capacity of exporting up to 25 million tonnes per annum.

There are current limitations of the use of Berths 2-5 due to long period wave surges affecting their use throughout the year.

Cruise ships currently stop at Geraldton as part of their journey along the west coast of Australia. However, they cannot currently dock at the port so need to drop anchor in deeper water and bring passengers to shore by tender craft. Due to inclement weather conditions, several ships have had to bypass Geraldton due to not being able to anchor at sea. To retain Geraldton as a cruise ship destination Mid West Ports is currently investigating an additional berth at the Port dedicated to cruise and naval ships.

Roads

Currently the only route for heavy vehicles travelling north/south through Geraldton is Brand Highway/North West Coastal Highway. This forces the interaction of light and heavy vehicles through the City, particularly through commercial and residential areas. There are several proposed options currently tabled to control or alleviate this interaction. The section of the NWCH through Geraldton cannot accommodate 53.5m (triple) road trains which is a major impediment to industry and a significant negative impact on the efficiency of the State's transport infrastructure network. The inability of 53.5m road trains to travel from Muechea to Carnarvon is highlighted as a major issue in the WA Regional Freight Transport Network Plan.

Main Roads WA are currently planning a \$250M upgrade of North West Coastal Highway to full dual carriage way with controlled intersections to better manage the light/heavy vehicle mix, as well as a future Outer Bypass route to allow for triple road trains to ultimately get as far south as Muechea.

However, the City of Greater Geraldton believe the proposed North/South Highway would better serve the community as it would take a majority of heavy vehicles off North West Coastal Highway, as well as open up land for transportation based industry as zoned under the current scheme.

Water and Waste Water

At present, water is transported to the region via two water supplies. The Geraldton Regional Water Supply (GRWS) Scheme provides potable water supplies to Greater Geraldton and adjoining rural areas such as Dongara – Port Denison, in the south, to Buller in the north and Mullewa in the east. The Arrowsmith Water Supply Scheme (AWSS) services the Wheatbelt towns of Morawa, Arrino, Perenjori, Caron, Bunjil and Latham.

Over Reliance

The Mid-West region is dependent on groundwater for its water needs. An estimated 75 GL/year of water is currently abstracted for consumption in the region.

Department of Water (DoW) modelling indicates that there will be increased temperatures and decreased rainfall across the Northern Perth Basin for each of three future climate scenarios (wet, median and dry). Recharge to aquifers will reduce under these scenarios so the total volume of water available today in the Mid-West region may change in the future.

Waste Water

The Water Corporation operates several wastewater treatment plants throughout the Mid-West region. It is currently planning to almost double the capacity of Narngulu Wastewater Treatment Plant, as well as spend \$140M over the next 10 years reinforcing its current wastewater network.

Oakajee Industrial Estate

Due to the indefinite postponement of Oakajee Port, servicing of the Oakajee Industrial Estate as a stand-alone project, while certainly plausible, is a costly exercise, and one that would need numerous discussions with several key Stakeholders to determine the best path forward to enable proponents to utilise the site with key heavy industry to help bolster the Mid-West economy and labour market.

Geraldton CBD

There are several issues hindering development within the CBD, including:

- > High cost of headworks charges due to aging infrastructure requiring upgrading/realigning
- > Lack of water pressure to meet firefighting requirements set out in the Building Code of Australia and AS2419 for buildings with a floor area greater than 500m², forcing developers to have to install costly tanks and pumps
- > Access and mobility around the CBD for patrons and tourists

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1 Introduction

1.1 General

LandCorp is assisting the State Government in delivering the *Regional Centres Development Plan Phase Two – Regional Centres (RCDP2)*. Part of this involves the preparation of growth plans for nine regional centres and their catchment areas – one of these being Greater Geraldton.

To provide assistance to LandCorp in the delivery of the growth plan for Greater Geraldton, Localise has been appointed as the Lead Growth Plan Consultant. To help meet their deliverables, Cardno (WA) Pty Ltd has been engaged by LandCorp to undertake an Infrastructure Assessment of the Greater Geraldton Region to be incorporated into the Growth Plan. The assessment focuses on the following:

- > Energy
- > Transportation
- > Communications
- > Water
- > Waste Water
- > Central Business District

1.2 Regional Growth

The “*Mid West Regional Blueprint*”, produced by the Mid West Development Commission in August 2015 (“*the Blueprint*”) has been produced to establish a vision for growth in the Mid West. The aim of the *Blueprint* is determine what constraints need to be overcome to allow the region to grow and diversify.

The *Blueprint* includes details of several population growth scenarios for the Greater Geraldton area. The organic-growth scenario in the *Blueprint* projects a population of approximately 165,000 people by 2050.

The transformational-growth scenario given in the *Blueprint* is an increase of around 132,000 people by 2050 to bring Greater Geraldton population to 190,000; this represents the region’s Aspirational Growth Challenge.

The *Blueprint* lists various regional advantages that would help drive the high-growth scenario, which is why the strategies of the *Blueprint* aim to increase investment and high growth. These advantages are listed as:

- > Sophisticated training and education infrastructure;
- > Diverse strategic infrastructure and utility provision;
- > Diverse region with populations, economies, attractions and challenges ranging significantly across its 17 local governments;
- > Advanced telecommunications infrastructure;
- > Natural resources; and
- > The most diverse regional economy in WA.

1.3 Aim of Report

This aim of the report is to discuss the issues related to energy, transport infrastructure, water, and waste water and communications and to identify the improvements required to achieve and accommodate the desired growth for the Greater Geraldton area.

2 Stakeholder Engagement

2.1 Project Stakeholders

LandCorp and Lead Consultant (Localise) identified key project stakeholders to be consulted for this report. The key stakeholders identified are highlighted in **Table 2-1** below.

Table 2-1 **Stakeholder Contacts**

Company	Contact	Position
Aurizon Rail	Phil McAuliffe	Customer Service Manager Mid West Operations
Brookfield Rail	Geoff Brook	Manager Network Planning
Dampier Bunbury Pipeline	Robert Malabar	Manager Project Development
Department of Planning	David Sands	Senior Planning Officer
Department of State Development	Gerard Treacey	Project Manager – Project Development
Department of Transport	Bradley Mitchell	Regional Director Central
Mid West Ports	Peter Klein	CEO
LandCorp	Kasey Green	Project Manager
Main Roads WA	Bernie Miller	Regional Manager – Mid West
Water Corporation	John D’Arcy	Stakeholder Relationships Manager
Western Power	Dave Shelton	Regional Community Engagement Bus Partner
City of Greater Geraldton	Ross McKim	Director Infrastructure Services
City of Greater Geraldton	Bob Davis	Director Corporate and Commercial Services
City of Greater Geraldton	Phil Melling	Director Development & Community Services
City of Greater Geraldton	Pieter Vorster	Coordinator Economic Development
Mid West Development Commission	Rob Smallwood	Project Manager – Digital Communications Strategy

2.2 Individual Meetings/phone discussions

Meetings, emails and phone discussions were held with stakeholders to determine current infrastructure capacity and constraints. An additional aim of engagement with stakeholders was to identify opportunities for improved infrastructure capacity, renewal or expansion which could contribute to economic and social development within the Greater Geraldton area.

2.3 Consultation Summary

Targeted stakeholder engagement has been undertaken to ensure the desktop assessment for this project is based on the current understanding of the context and the most current information available.

Additional information contributed by stakeholders has been reviewed and considered in the preparation of this report into the report. Other issues raised which may have an impact on the project have been noted and included therein.

3 Energy

3.1 Electricity

3.1.1 Current Infrastructure

The Greater Geraldton area is connected to the Western Power North Country Load Area (NCLA). The NCLA extends from Pinjar and Muchea at the northern edge of the Neerabup terminal load area to Kalbarri at the northern extremity of the Western Power Network. The load area extends inland approximately 150 km to service the northern Wheatbelt.

The network has evolved over time, primarily supplying relatively small loads distributed over a large geographical area. To ensure Western Power can continue to provide reliability of supply to customers and facilitate future generation connections, it is anticipated that the NCLA will be subject to considerable network development over the coming decade.

In 2015 Western Power completed the Mid West Energy Project (MWEP) Southern Section (Stage 1). Primarily driven by a demand to service the Karara mine site, Western Power carried out the following upgrades to strengthen the existing NCLA network:

- > Dismantling a 132kV wood pole line between Pinjar and Eneabba
- > Incorporating a 70 kilometre transmission line from Eneabba to Three Springs to power Karara's iron ore mine (the line was then purchased by Karara Mining Ltd)
- > Connecting the two new transmission lines
- > Upgrading the existing Neerabup to Pinjar line from 132 kV to 330 kV
- > Constructing a new 330kV line circuit bay at Neerabup
- > Upgrading various 132kV substations on the line route to accommodate 330kV
- > Constructing a double circuit 132kV pole line from Three Springs Terminal to Three Springs Substation
- > Undergrounding approximately 30 sections of smaller lines beneath the new 330kV line
- > Undergrounding the existing double circuit 132kV line at the crossover with the new 330kV line north of Pinjar
- > Significant upgrades to the Western Power communications networks between Neerabup and Three Springs.

3.1.2 Constraints

The bulk transmission system servicing the Mid-West region north of Three Springs terminal operates at 132 kV and is considered weak. Constraints on power transfers currently apply under condition of high generation north of Three Springs and there are considerable ageing assets in the area. Western Power is investigating the expansion of the bulk transmission system north of Three Springs as part of the MWEP Northern Section.

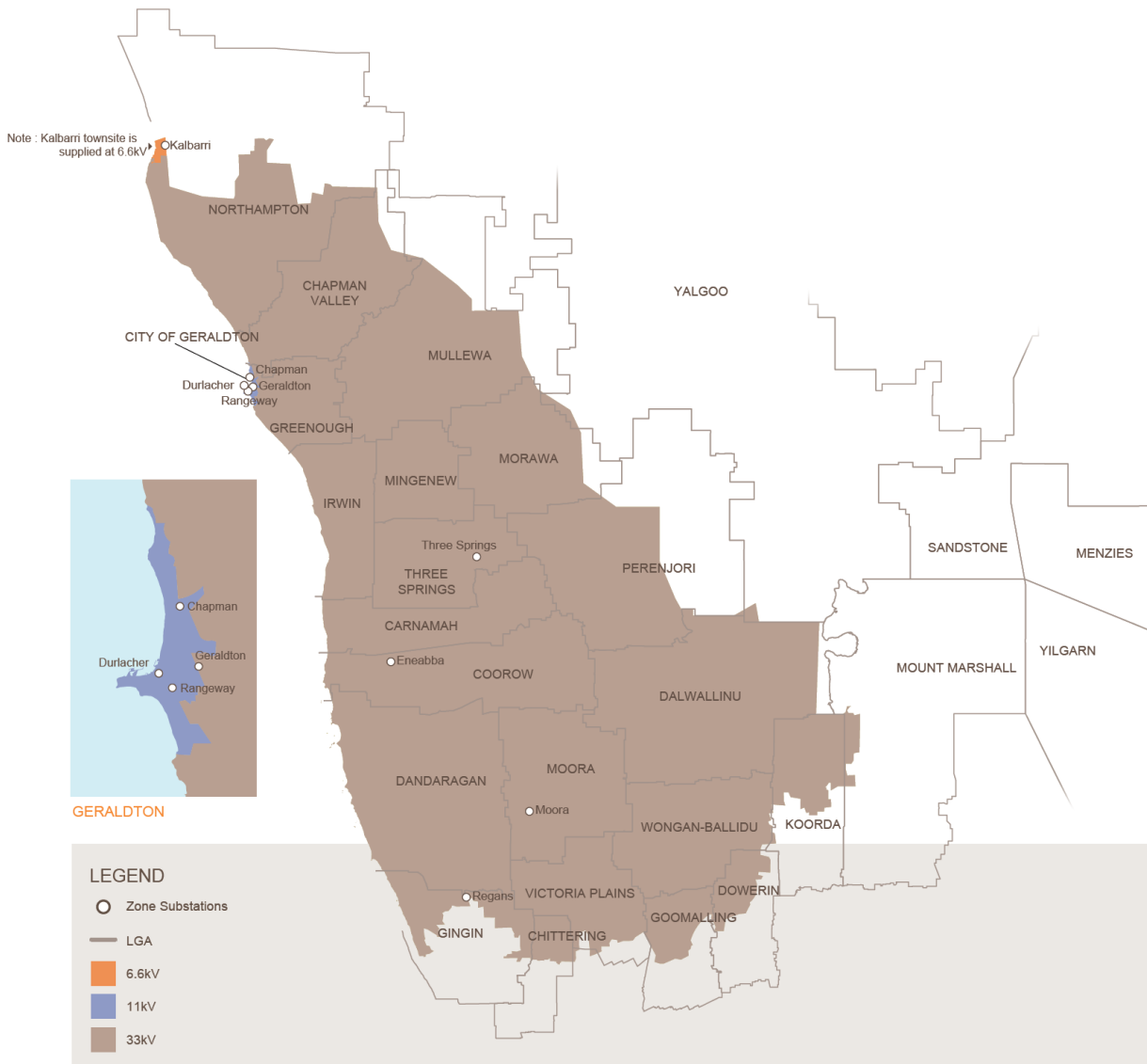
The Greater Geraldton area is currently serviced by a predominantly overhead 33kV network, supplying a range of mining and industrial loads, as well as many rural centres. The 33 kV network is constrained typically by voltage capacity rather than the thermal capacity of existing power lines. This is due to the relatively large distances required to transfer power from zone substations to supply customers. Generally, the 33 kV network in Country North has adequate capacity to supply the forecast natural load growth.

The distribution networks supplying the City of Greater Geraldton (CGG) consist of three phase 11 kV feeders. The primary constraint on the 11 kV network, in this case however, is thermal capacity. There is limited distribution transfer capability between the 11 kV zone substations. This is due mainly to thermal capacity constraints and limited physical interconnection points between feeders.

The area surrounding Geraldton is one of the windiest regions in Australia. Wind speeds average 20-25 km/h during the cooler months and 25-35 km/h from October to March; a result of the strong seasonal sea breeze

coupled with a consistent easterly breeze in the morning. These are ideal conditions for wind power generation. There are currently two wind farms to the south of Geraldton – Alinta Wind Farm and Mumbida Wind Farm. However, the transmission network to Geraldton is currently at capacity, constraining the opportunity to expand the existing wind farms, or create additional wind farms in the region. This renewable energy source could be utilised to generate additional power to feed back into the grid to supply Perth with an additional power source.

Figure 3-1 North Country Planning Region (Source: Western Power)



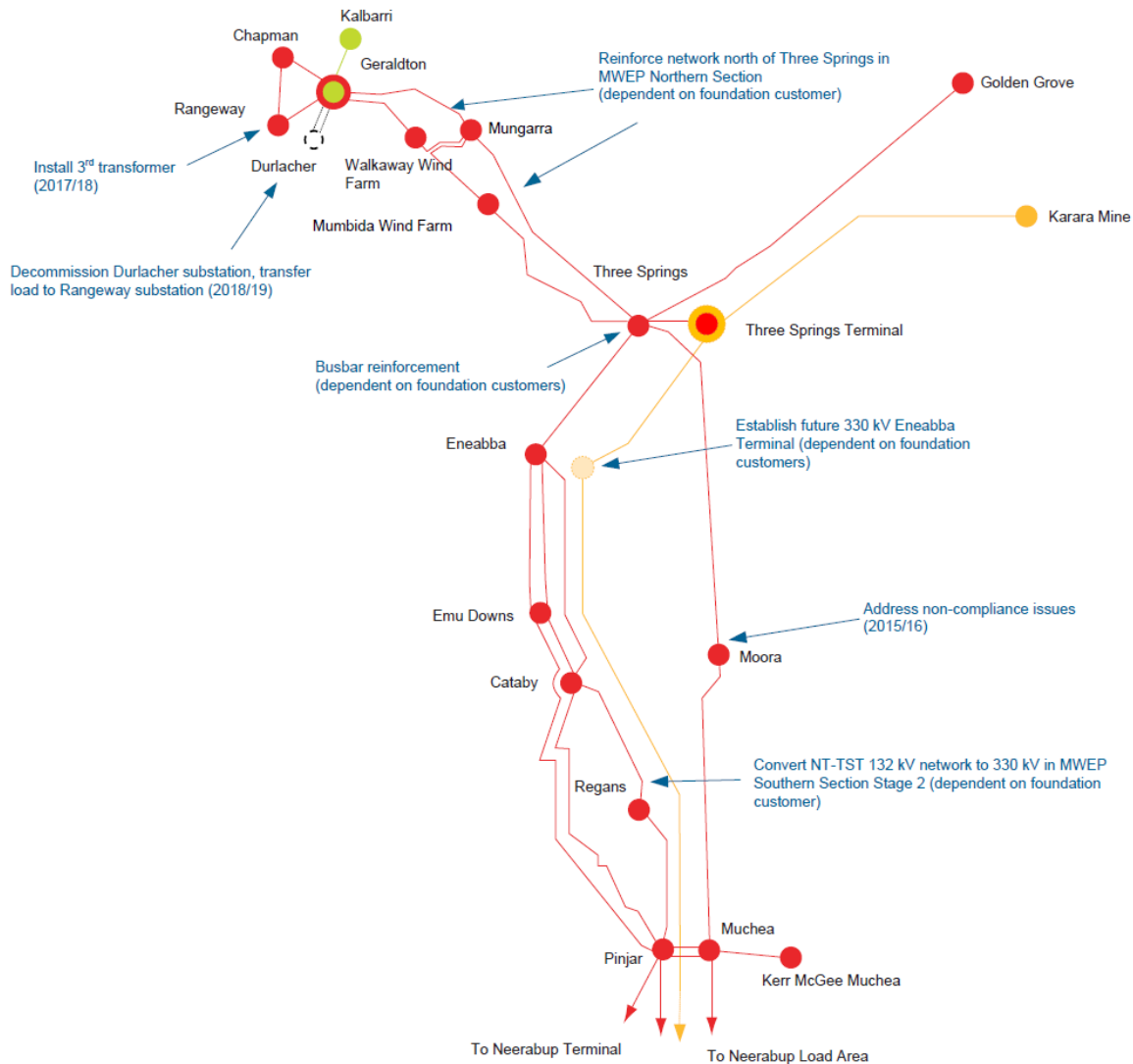
3.1.3 Upgrades and Opportunities

Western Power has been working for some time on the MWEP South (Stage 2) and MWEP North projects to strengthen the NCLA network. The MWEP Southern Section Stage 2 involves:

- > Energising the second side of the double circuit 330 kV line (constructed as part of Stage 1) to 330 kV
- > Reinforcement works at Three Springs terminal
- > Resupply of Regans substation
- > 132 kV reinforcements in the Neerabup load area.

The MWEP Northern Section will increase the transfer capacity between Three Springs and Geraldton. This supports potential connection of new entrant generators and load north of Three Springs.

Figure 3-2 Western Power Preferred Transmission Solutions for NCLA (Source: Western Power)



EXISTING TRANSMISSION LINE	FUTURE TRANSMISSION LINE	TERMINAL/SUBSTATION
33 kV	33 kV	Existing 33kV terminal/substation
66 kV	66 kV	Existing 66 kV terminal/substation
132 kV	132 kV	Existing 132 kV terminal/substation
220 kV	220 kV	Existing 220 kV terminal/substation
330 kV	330 kV	Existing 330 kV terminal/substation
Decommissioned		Substation to be decommissioned/converted to switching point
		Future 132 kV terminal/substation
		Future 330 kV terminal/substation
		Normally-open switching point

The timings for these projects are mainly dependent on foundation customers. However, strong asset condition related drivers exist for certain stages of the MWEP. The condition of numerous wood pole assets between Muchea and Geraldton, for example, will require extensive reinforcement and replacement over the short and medium term. Investigations are currently underway to establish the optimal timing of certain stages of the project with consideration to revised load and generation projections, as well as long-term wood pole management costs.

Within the City of Greater Geraldton, Western Power are planning a staged load transfer from Durlacher substation to Rangeway substation. To accommodate the additional load at Rangeway substation, a third transformer and reconfiguration of the congested distribution exits from the site are proposed. This will allow for decommissioning of a majority of the infrastructure at Durlacher substation. Western Power expect the transfer to be complete by summer 2018/19. A future new substation could be constructed on the Durlacher site should demand reach requirements in the future (anticipated demand for such a requirement is currently beyond Western Power's 10 year forecasts).

3.2 Gas

3.2.1 Current Infrastructure

CGG is well reticulated with gas by ATCO from the Mid-West and South-West Gas Distribution Systems (MWSWGDS) - the natural gas distribution networks that serve the Geraldton, Perth metropolitan, Bunbury, Capel and Busselton areas. The ATCO Gas distribution network supplies over 80% of the City with natural gas as shown in Figure 3-3.

ATCO Gas has confirmed that they have spare capacity in their network. At present their assets run at 280 kPa but the maximum capacity of their network is 370 kPa. ATCO Gas have confirmed that there are projects in place to boost the pressure and increase capacity in Geraldton as needed.

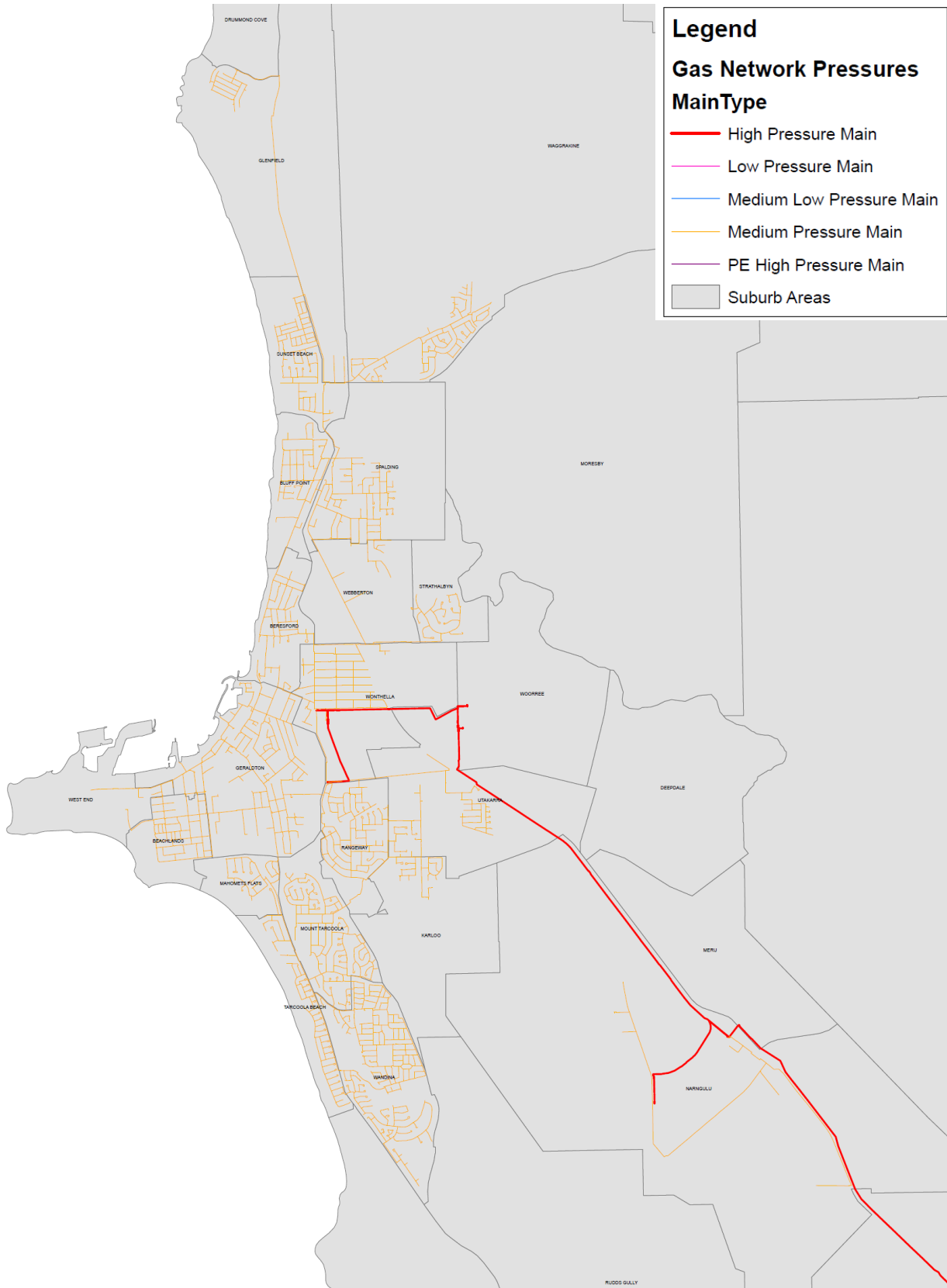
3.2.2 Constraints

Should a proponent who is a major consumer of gas wish to develop within CGG, ATCO would need to assess the demand to determine if any upgrades to their current network would be required.

3.2.3 Upgrades and Opportunities

ATCO have confirmed that they are looking to expand their infrastructure within the City. ATCO Gas works on an "organic growth" model to increase capacity in its network as demands increase.

Figure 3-3 ATCO Gas Geraldton Reticulation (Source: ATCO Gas)



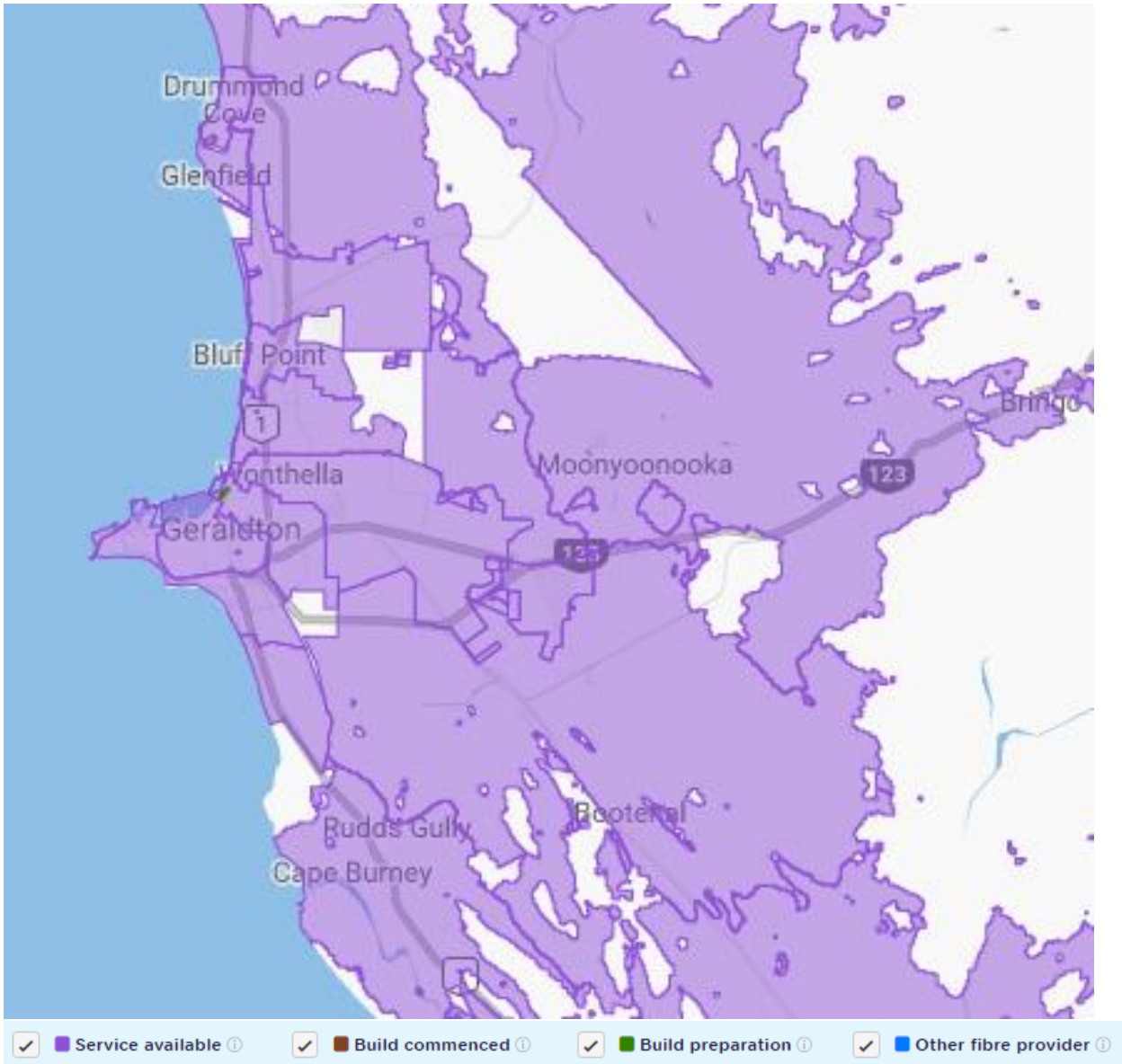
4 Communications

4.1 Current Infrastructure

The City of Geraldton is one of only a handful of regional centres around Australia that has NBN fibre to the home. As per Figure 4-1 the majority of the City shall be serviced by NBN by the third quarter of 2016/2017. This gives Geraldton unparalleled access to high speed internet.

However, there is limited access to high speed internet for a majority of the Mid-West.

Figure 4-1 NBN Network for Geraldton and Surrounds (Source: NBN.com.au)



4.2 Constraints

Whilst NBN has launched Sky Muster to service regional Australia with high speed satellite broadband, a number of towns within the Mid-West are yet to have NBN connection capabilities. With the launch of a second satellite in early October 2016, it is forecast that this scenario should improve in the short to medium term. However, as more users come on board to utilise the satellite service, it is unknown how much capacity will be in the network to service all of regional Australia.

4.3 Upgrades and Opportunities

The MWDC has been investigating the option of expanding a fibre network into regional areas via a co-operative fibre-optic service. This is an opportunity to provide high speed internet access to the regional town centres without the reliance of the big telco networks having to build the infrastructure (which may never happen in a majority of the region).

Trends for reliance on the internet for business can be defined in the following categories.

Global Trends

The technology-enabled mobile workforce is already an integral part of most developed and many developing economies in the world. Employees working at home and in other remote locations, self-employed contractors and home-based businesses are the primary participants in this trend. The global rate of mobile working was approximately 1.3 billion (37 per cent of the global workforce) in 2015.

Australian Trends

Many Australian businesses have embraced the use of digital technology to enable employees to work from home or other locations. This can be used in a variety of ways, including through a formal work from home arrangement, enabling casual working from home on days when needed, accessing emails and data from client offices or other work locations, or to catch up on work after normal office hours. Other businesses use digital technology as a core part of their business model, particularly through internet-based delivery of goods and services but are constrained by band widths and download speeds.

Regional Trends

There is little variation in the distribution of businesses by employee size when businesses in regional Western Australia are compared to the Perth metropolitan area. This means that any variation between regional businesses and metropolitan businesses is more likely to be related to issues such as capacity to offer remote ICT access, the type of work undertaken by the business, or reluctance to enable remote working due to other factors.

Following on from recent models in the United States of America, it is possible to service regional areas with state of the art telecommunications technology, and make it profitable for the community owned co-op. The model used for funding such a co-op is based on the local governments applying for seed funding to loan the co-op that becomes subordinate to other private investors, including local banks. As long as the network hits its financial targets, no taxpayer dollars will be used. The co-op will repay its loans to the local governments with revenues from the network, but local taxes will make up the difference if it falls short.

One example of this could be to initially set up a Fixed Wireless backhaul from areas like the North Midlands and Chapman Valley back to Geraldton. Within a year or two of this being in place, a co-op would roll out fibre to the Access Points and then, depending on the cost and distance from the main route, in some cases, even fibre directly to the premises. This fibre could be continually extended to more and more distant locations, until eventually there is fibre across virtually all of the Mid West.

5 Transportation

5.1 Geraldton Airport

Geraldton Airport currently has in the order of 125,000 annual domestic passenger movements. These include fly-in, fly-out (FIFO) services operate from Geraldton Airport to mine sites.

5.1.1 Current Infrastructure

There are three main runways in operation at the airport (as shown in Figure 5-1 with the largest being Runway 03/21 which is able to receive unrestricted 3C aircraft and restricted 4C aircraft in its current capacity).

Figure 5-1 Geraldton Airport 2012 (Source: Geraldton Airport Master Plan 2012)



The existing runway requires rehabilitation and an asphalt overlay due to its current condition. The City has submitted grant funding applications to the State for 50% of the cost, hoping to undertake at least the overlay works in 2016-17.

5.1.2 Constraints

The existing runway 03/21 is 1,981m x 45m. The current runway enables restricted operation of A320/B737 types, and is used as a Perth alternate by domestic carriers and some internationals inbound to Perth. The other available alternate is currently Kalgoorlie Airport.

The CGG have advised pavement deterioration potentially threatens on-going use of runway by some current users. Preliminary cost estimates for the necessary rehabilitation and asphalt overlay for the existing pavement is approximately \$13M. It is essential this work is carried out before 2018, having regard to the 18-year age and degrading state of the existing runway pavement.

To be able to accept unrestricted Type 4C aircraft (eg B737-800, A320-200) the runway would need to be extended to 2,400m in length. Should a runway extension be done in addition to the rehabilitation works detailed above, it would cost a further \$7M. This would have a significant benefit for flights diverted from Perth (particularly international flights) as currently the nearest alternative for these planes is Adelaide.

To become an International standard airport, most airlines require Aviation Rescue Fire Fighter Service (ARFFS) to be provided. Current Commonwealth Regulations require provision of ARFFS by Airservices to accommodate 500,000 annual passenger movements, combined with a risk appraisal process. The Federal Government is proposing changes to current regulations to enable providers other than Airservices to provide services related to ARFFS, without requiring CASA approval.

5.1.3 Upgrades and Opportunities

Geraldton and the surrounding region has a rich and vibrant local economy based on mining, agriculture, fishing, tourism, minerals processing, light industry and manufacturing, professional and government services and a busy export shipping seaport. There is an opportunity to unlock even more exporting capacity through becoming an international airport. This would give rise to the capability of direct export of a number of fresh products directly to Asia such as:

- > Fresh fruit, vegetables and flowers
- > Fresh fish and packed meat
- > Geraldton wax

The CGG has already formed several relationships with hotel chains and other distributors within the Asian market. This would provide a direct link for local growers and suppliers, and boost the local economy.

International services at Geraldton would require only relatively modest investment in arrival lounge capability, without need to expand capacity of the inbound baggage handling facilities, or extend the existing terminal building and provide border agency facilities.

The CGG have advised capacity for international arrivals is likely to be deliverable for under \$250K. No change is needed to the current departures capacity, with recent investment in a new sterile departure lounges, with full security screening facilities having already been undertaken.

Ultimately the Geraldton Airport Master Plan plans for a new 2,700m x 45m runway adjacent to runway 03/21 is to be built. This will give the airport capabilities of landing Type 4E aircraft, including restricted landing of A380's. However, this upgrade would not be required until after at least 2025, or earlier only if the Government deemed it essential for alternative landing support for Perth Airport.

5.2 Geraldton Port

5.2.1 Current Infrastructure

Geraldton Port is currently managed by the Mid West Ports Authority. The port has developed a niche market for the export of iron ore in smaller ships to shallow draft ports in China. Geraldton Port is able to cater for ships up to Panamax size with a 12.8m draft and a maximum cargo capacity of up to 66,000 tonnes. The proximity of Geraldton to Asia has also made the Port an attractive option for exporters.

The Port currently has seven berths, ranging in use from mooring of small vessels to loading of livestock to shiploaders for iron ore and other minerals. There was 17 million tonnes of product exported from the Port in 2015, with a capacity of exporting up to 25 million tonnes per annum.

5.2.2 Constraints

Geraldton Port experiences the effects of long period wave surge, and as such Berth 2 can be closed for up to 50% of the year, with Berths 3-5 losing 30 days access per year. This reduces the amount of product that can be exported from the Port, as well as forcing ships to hold in deeper water until the Port can accept them.

The Port is on a curtailable power supply, and as such, has the potential to lose power with little to no warning. This has an effect on users of the port, particularly the local fishing industries who rely on refrigeration for their product, as well as mining clients who rely on being able to load ships on time.

5.2.3 Upgrades and Opportunities

Mid West Ports are currently investigating new technology to protect ships against surge within the Port. Should their research prove successful, this would then allow Berths 2-5 to remain functional year round, giving additional export capacity for the Port.

Mid West Ports have also advised focus is currently being given to a proposed new Cruise Vessel Berth (new Berth 8) located off the Eastern Breakwater in the Geraldton inner harbour (adjacent/part of the Esplanade). Mid West Ports are keen on this site as a preferred location for a cruise vessel berth, which also provides for efficient and convenient access to the main Geraldton Foreshore, Geraldton Visitor's Centre, etc. There is also the possibility this berth could be utilised by naval vessels as part of crew exchanges, servicing, etc.

5.3 Roads

5.3.1 Current Infrastructure

The current route for major transportation to and through Geraldton is via the Brand Highway and North West Coastal Highway (NWCH) to the south and north respectively, with some transportation of mining and farming produce along Geraldton Mt Magnet Road to the east.

There is a mix of light and heavy vehicles along the north-south route, including oversized loads carrying construction equipment to the north-west of WA. The section of the NWCH through Geraldton cannot accommodate 53.5m (triple) road trains which is a major impediment to industry and a significant negative impact on the efficiency of the State's transport infrastructure network. The inability of 53.5m road trains to travel from Muecha to Carnarvon is highlighted as a major issue in the WA Regional Freight Transport Network Plan.

There are several options currently being looked at to improve driveability particularly aiming at the separation of light and heavy vehicles. The three main options with serious consideration from both Main Roads WA (MRWA) and the CGG are:

- > Upgrading of NWCH;
- > The North/South Highway;
- > The "Outer Bypass".

The three options are shown in Figure 5-2

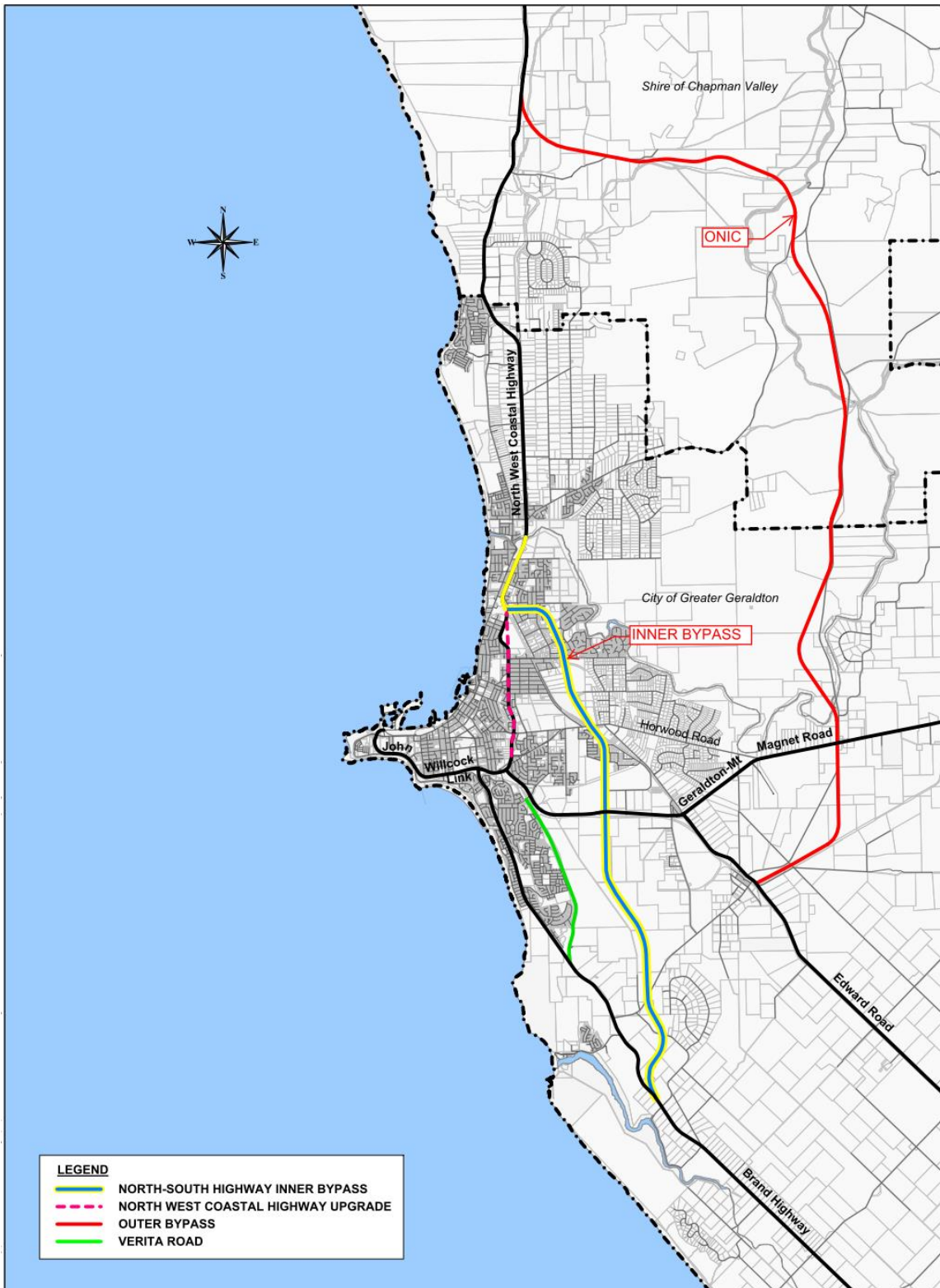
5.3.2 North West Coastal Highway

MRWA are currently planning the upgrade of NWCH from Utakarra Road to potentially Chapman Valley Road to a dual carriageway, with signalised intersections at select locations, and rationalisation of other intersections along the route. This will require widening of the current road reserve in locations. MRWA have indicated the cost for the upgrade will be in the vicinity of \$250M.

5.3.3 North/South Highway

CGG believe some funding for the upgrade of NWCH would be better spent constructing the North/South Highway to help segregate heavy vehicles from light vehicles for a large portion of the City’s residential/commercial area, as well as open up new land for transport based industry. Likely costs are in the order of \$40M for the northern portion of the North/South Highway (from Horwood Road to NWCH), or \$60M for the complete North/South Highway. The remainder should still be spent on the NWCH on strategic widening, intersection rationalisation and improvements.

Figure 5-2 Road Upgrade Options (Source: City of Greater Geraldton)



The proposed route of the northern portion is already gazetted road reserve, with land appropriately zoned under the current Scheme. The southern section requires land acquisitions, re-zonings and associated compensation issues to be addressed.

MRWA has advised they are concerned that the proposed route is over 20 years old, and that development to the north of the proposed tie-in to NWCH now means that heavy vehicles will be re-entering the highway within residential areas. It is recommended CGG review the current alignment at the northern end and investigate the possibility of extending the route further north (potentially through the golf course) to provide a greater bypass around residential/commercial areas. A full SIDRA analysis should also be carried out to determine the net benefit the bypass would produce in diverting heavy vehicles off NWCH. A demand forecast for the land which will become available as part of the North/South Highway should also be completed to build a business case for the proposed route.

5.3.4 Outer Bypass

The Outer Bypass is proposed to follow the Oakajee Narngulu Infrastructure Corridor (ONIC) route and was initiated as part of the previously proposed Oakajee Port project. The main objective for the Outer Bypass is to completely remove heavy vehicles not servicing Geraldton from the local road network, bypassing the town completely. MRWA advised an indicative cost of \$500M for the construction of the Outer Bypass.

CGG have advised the following concerns in relation to the Outer Bypass over the North/South Bypass:

- > Benefit/Cost ratio of the Outer bypass. Costs in the \$100's of millions (interim to ultimate), traffic volumes unknown and anticipated to be largely comprised of heavy vehicles. Limited local benefit.
- > Outer Bypass does not address expected traffic growth in Geraldton's built-up area, whereas the North-South Highway does.
- > Outer Bypass does not facilitate new development, traversing largely rural holdings, whereas the North-South Highway would facilitate a variety of industrial and service commercial developments which currently has very limited accessibility.
- > The North-South Highway would be purpose-built for the carriage of Heavy Vehicles and therefore would address MRWA re-routing issues.

5.4 Rail

5.4.1 Current Infrastructure

Brookfield Rail is the manager and operator of the State's 5,500 kilometre open access rail network, including the rail through the Mid-West region.

Brookfield Rail recently spent \$550M upgrading 184km of the rail network and related infrastructure from Morawa north through Mullewa and west to Geraldton Port, increasing rail capacity from an initial 3mtpa to 25mtpa, and potentially well beyond to 75mtpa. The rail upgrade was done not only to service Karara Mine Site, but to become the backbone for growth and development in the Mid-West region, connecting mining and agriculture customers to export markets through Geraldton Port, and ultimately the proposed new deepwater Oakajee Port.

5.4.2 Constraints

A major constraint with the rail network throughout the Mid-West region is the lack of standardised rail gauge. Brookfield Rail has installed narrow-gauge rail as part of the 184km upgrade. However, to allow for future standard gauge rail along this network dual gauge sleepers were installed.

The existing rail has capacity for 21T axle loading, which can be upgraded to 26T should there be a demand from other mining proponents. However, the rail within the Port can only take 19T axle loads. Should the Port wish to increase output of iron-ore there would need to be an upgrade to the rail network within the Port itself.

The other constraint restricting volume of product through the Port via rail is the single rail from Narngulu. This restricts access to the Port to one train at a time. It can take over an hour to receive, unload and depart a train at the port, which usually means other trains park at Narngulu and wait. Should industry demand

increased turnover, there is the potential for either longer trains (which could have an effect on the existing level crossing at Marine Tce) or the construction of a passing line nearer the Port.

5.4.3 Upgrades and Opportunities

Brookfield have no foreseeable upgrades planned for the rail network in the Mid-West region.

6 Water and Wastewater

6.1 Water

6.1.1 Current Infrastructure

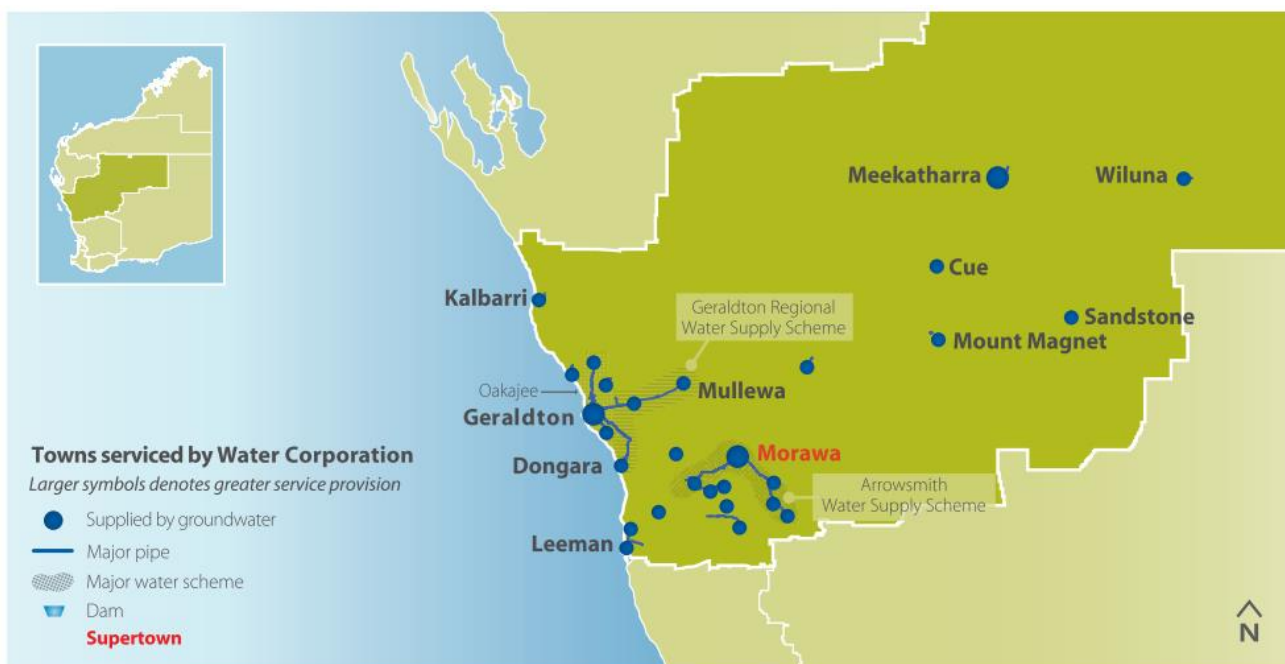
The Water Corporation is the only licensed water service provider for Geraldton and surrounding areas. A plan showing the extents of their coverage is shown in Figure 6-1.

There are two main water supply schemes within the Mid-West Region. The Geraldton Regional Water Supply (GRWS) Scheme provides potable water supplies to a total area of approximately 1,000 km² (375 km² of Greater Geraldton and 625 km² of adjoining rural areas) extending 80 km along the coastline between Dongara – Port Denison, in the south, to Buller in the north. In the east, the scheme boundary extends as far as Mullewa. The Arrowsmith Water Supply Scheme (AWSS) services the wheatbelt towns of Morawa, Arrino, Perenjori, Caron, Bunjil and Latham.

Currently most of the GRWS supply is drawn from the Allanooka, Mt Hill and Wye Farm borefields. These areas are centred approximately 50 km southeast of Geraldton. They withdraw water from parts of the locally unconfined Yarragadee Formation. Minor supplies are also drawn from the Wicherina Borefield to supply part of the Yuna Farmlands Rural Water Supply Scheme. The Allanooka Borefield was initially commenced in 1967 in the area adjacent to Allanooka Swamp, whilst the newer Mt Hill subarea was established in 1985. Further expansion occurred in the Allanooka – Mt Hill Borefield (Geraldton Groundwater Scheme) during the late 1990's and early 2000's and now consists of a total of 19 production bores.

The AWSS is supplied with water from two Water Corporation bores located in the Arrowsmith Water Reserve, 26 km north-west of Three Springs. The bores are drilled into the Parmelia Formation, which consists of interbedded sandstone, claystone, siltstone and shale. The bores are screened between 40 and 60 metres (m) in clayey and gravel sands. Water abstracted from the bores is pumped into the Arrowsmith Collector Tank located at the wellfield, then pumped into the Arrowsmith supply main to Billeranga Tank. From the Billeranga Tank water is supplied to Arrino, Morawa, Perenjori, Caron, Bunjil and Latham reticulation systems and farmlands via gravitation with boosting at pump stations on route.

Figure 6-1 Water Distribution in the Mid-West (Source: Water Corporation)



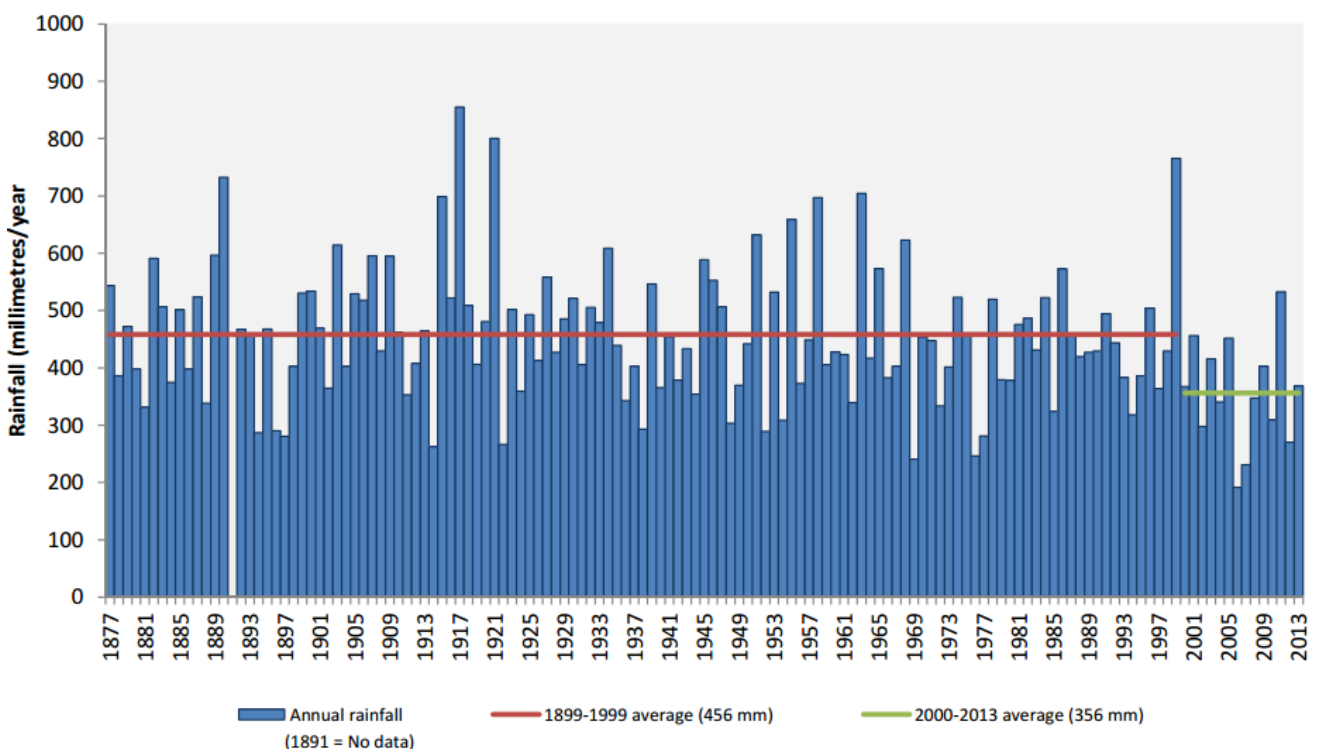
6.1.2 Constraints

The Mid-West region is almost entirely dependent on groundwater for its water needs. An estimated 75 GL/year of water is currently abstracted (almost entirely from groundwater) for consumptive use in the region.

Coastal areas of the region generally receive an average of 400 to 500 mm of rainfall per year, with most rain falling during May to September. Since the year 2000, Geraldton has exceeded the long-term average rainfall only once (see Figure 6-2).

Department of Water modelling indicates that there will be increased temperatures and decreased rainfall across the Northern Perth Basin for each of three future climate scenarios (wet, median and dry), which are based on twelve global climate models and four emissions scenarios (Marillier et al, in press). Recharge to aquifers will reduce under these scenarios so the total volume of water available today in the Mid-West region may change in the future.

Figure 6-2 Historical Rainfall for Geraldton (Source: Bureau of Meterology)



6.1.3 Upgrades and Opportunities

The Department of Water has reviewed information across government and industry to project water demand in the Mid-West over the next 30 years, taking into account the potential for the following trend-breaking growth:

- > Proposed and planned mining projects
- > A potential new port and industrial estate at Oakajee
- > Developing new areas for irrigated agriculture
- > Urban expansion, particularly in Geraldton and the towns of Jurien Bay and Morawa, which are involved in the Regional centres development plan ('SuperTowns') initiative.

Forecasts by Department of Water indicate demand could grow to more than 180 GL/year by 2043 under a medium growth scenario, as shown in Table 6-1. Much of this projected water demand relates to industries that are not yet established in the region, so there is a wide range of possible growth scenarios.

Mining is the major consumer of water in the region, with forecasts showing a tripling of consumption could occur. As the Arrowsmith groundwater area nears full allocation of groundwater supply, miners will need to investigate the development of lower cost methods to use water that is more readily available, but of poorer quality. This includes treating or adapting production processes to use lower quality local groundwater. To support the anticipated growth of magnetite mining, a major initiative is the Department of Water's investigation of palaeochannel aquifers within the vicinity of magnetite projects. The project aims to define the Murchison palaeochannels in terms of their extent, water storage, yield, water quality and viability for abstraction.

The Department of Water assigns drinking water for human consumption as the highest-value use of water for consumptive purposes. Reserves are therefore set aside to secure future town water supplies. Currently a further 28.5 GL/year (in addition to the current 22 GL/year allocation) is reserved for future public water supply in the Mid-West region.

Table 6-1 **Projected water demand by sector in the Mid-West region (Source: Department of Water)**

Sector	Water licensed (GL/year)	Water taken (GL/year)	Water quality required*	Projected water demand range† by 2043 (GL/year)	Projected water demand range† by 2043 (GL/year)
Mining	111	32	Fresh to hyper-saline	52–130 (93)	Egerton, Meekatharra, Mullewa/Byro
Industry	1	1	Fresh to brackish	1–37 (18)	Casuarinas, Dongara, Kalbarri/Eurardy
Agriculture	48	15	Fresh to marginal	28–74 (35)	Dongara, Eneabba Plains, Twin Hills
Unlicensed stock and domestic	0	8	Fresh to brackish	11–14 (12)	
Town water supply schemes	22	13	Fresh to marginal	20–35 (23)	Allanooka, Cervantes, Dongara
Urban – self supplied	Licensed	4	Fresh to brackish	6–9 (7)	Casuarinas, Dongara
	Non-licensed	0			
Total	186	75		118-299 (188)	

† Medium demand in brackets

6.2 Wastewater

6.2.1 Current Infrastructure

Wastewater in Geraldton is currently treated at the Narngulu Wastewater Treatment Plant (NWTP), located off Place Road, Narngulu. The existing plant treats approximately two million litres of wastewater per day via existing infiltration ponds.

Treated effluent is reinjected into the sub-aquifer for water reuse at the local race course, bowling club, golf club, sporting oval and cemetery. Through this process approximately 23% of wastewater is recycled.

6.2.2 Constraints

There are currently no constraints at the NWTP.

6.2.3 Upgrades and Opportunities

As most of the population growth in the Mid-West region will occur in Geraldton, the Water Corporation is focusing most of its expenditure over the next 10 years within the City. A \$3.5M upgrade of NWTP was announced in September 2016, and will provide 4 additional infiltration ponds, as well as refurbishment of the existing ponds. This will increase the capacity of NWTP to 3.5 million litres of wastewater treatment per day.

The Water Corporation is planning on spending \$140M on wastewater infrastructure throughout the Mid-West region over the next 10 years to ensure predicted growth rates are accounted for.

Figure 6-3 Narngulu Wastewater Treatment Plant (Source: DM Civil)



7 Oakajee Industrial Estate

Due to the indefinite postponement of Oakajee Port, servicing of the Oakajee Industrial Estate as a stand-alone project, while certainly plausible, is a costly exercise, and one that would need numerous discussions with several key Stakeholders to determine the best path forward to enable proponents to utilise the site with key heavy industry to help bolster the mid-west economy and labour market.

All required services can be brought to the site through various corridors including ONIC for power, Dampier Bunbury Natural Gas Pipeline corridor for gas, existing North West Coastal Highway for water and on-site treatment for wastewater. However, the costs to get the services to the site are potentially in the 100's of millions of dollars (although there are options to stage the delivery of services at a smaller cost), and without a major mining proponent wanting to establish the port and other infrastructure there, it makes the site near impossible to consider for other proponents if they are expected to cover all of the costs up front. This will be a critical decision to be made if Oakajee is to be established before the next mining boom commences.

A detailed infrastructure assessment of the Oakajee Industrial Estate can be accessed at <http://www.landcorp.com.au/Documents/Projects/Industrial/Oakajee%20Industrial%20Estate/OIE---Engineering-Services-Report.pdf>

8 Geraldton City Centre

The City of Geraldton aims to maintain and improve its assets for the community and to create opportunities for development. The process to meet those objectives in a built environment creates several issues in particular for the City Centre.

8.1 Upgrading of Aging Infrastructure

A major issue facing developers particularly within the CBD area is the requirement to upgrade aging infrastructure due to capacity constraints and authority requirements. In particular, water mains are requiring realignment, in some cases from private property, at a developer's expense. Overhead power lines are to be placed underground in narrow verges, also at a developer's expense.

Costs associated with asset relocations and upgrades can sometimes be too expensive, precluding development from proceeding. Other times it can cause significant delays to developments while costs are negotiated with the relevant authorities.

Figure 8-1 Limited Road Verges and Multiple Services Under Existing Roads (Source: Google Maps)



CGG has indicated they would prefer to have a process in place in which upgrades are carried out in advance of projects, and that a developer contribution scheme, headworks investment fund or similar is put in place to make development equitable for all proponents.

8.2 Fire Water Service

There is currently an issue in the CBD area in regards to water pressure for fire services to developments with a floor area greater than 500m². Buildings with greater than 500m² floor area are often required to have internal fire hydrants and sprinklers as part of their fire protection, as contained within the Building Code of Australia (BCA) and Australian Standard 2419 – *Fire hydrant installations – System design, installation and commissioning*.

The Water Corporation design their systems for domestic, commercial and industrial use. Their operating licence stipulates a minimum pressure of 13 metres in regional areas. The Water Corporation will only accept modifications and extensions to its water reticulation scheme to meet building firefighting demands, where it can be demonstrated that the works have minimal impact on the schemes operational and long term planning objectives.

The capacity of water supplies in regional WA towns, Geraldton included, are such that most significant commercial buildings are required to install tanks and pumps or other supplementary measures to meet the specific flow and pressure requirements for fire system compliance with the BCA. While common practice across the state, these requirements can be expensive and cumbersome on developers, and in some instances make developments unachievable, either from a financial or spatial problem.

Water Corporation has advised they are working in conjunction with the Department of Water to compile a report on this issue in which they are reviewing alternative sources, which is due for release in the coming months.

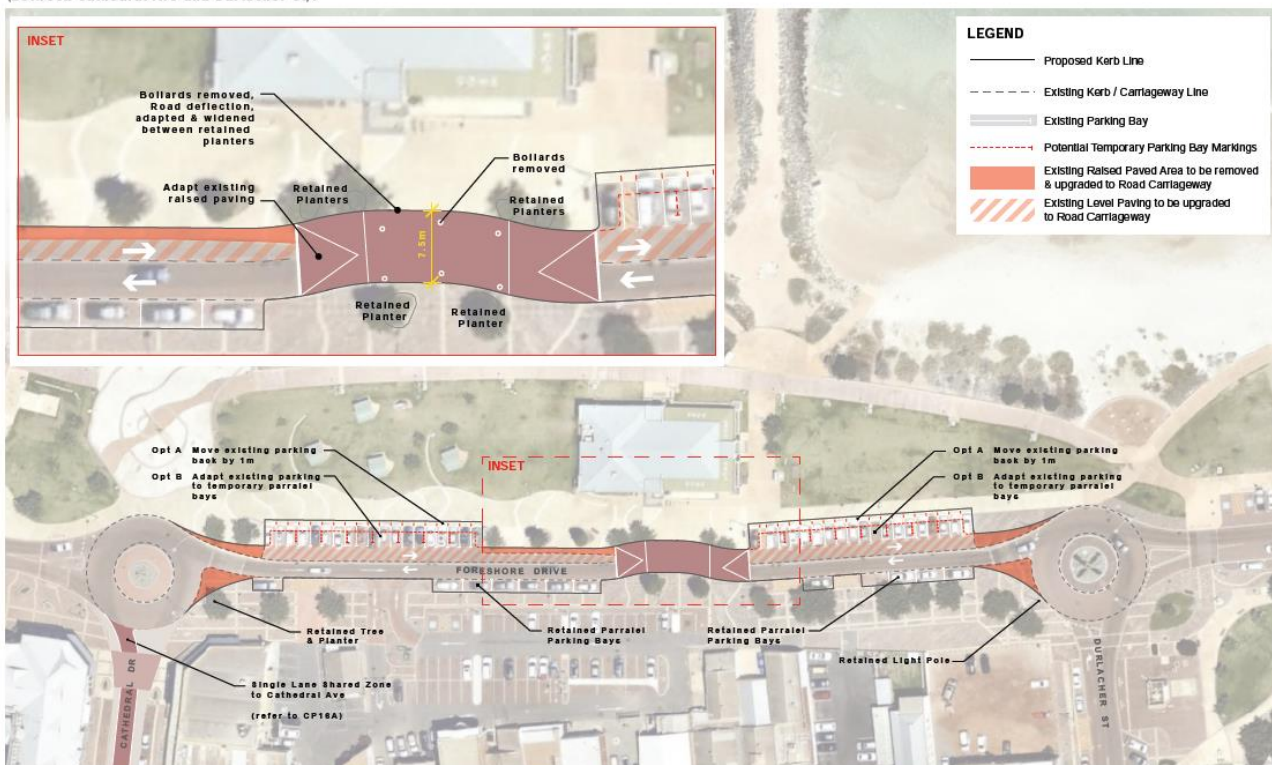
8.3 Road Network

The section of Foreshore Drive between Cathedral Avenue and Durlacher Street is currently one-way. This can cause some confusion for tourists driving to the foreshore from Durlacher St, as well as limiting access to this portion of the foreshore. The City Centre Revitalisation Plan (CCRP) compiled by TPG recommends opening this section of road to two-way traffic to allow greater connectivity along the foreshore.

Figure 8-2 Proposed Foreshore Drive Upgrade (Source: TPG)

TRIAL TWO-WAY TRAFFIC ALONG FORESHORE DRIVE

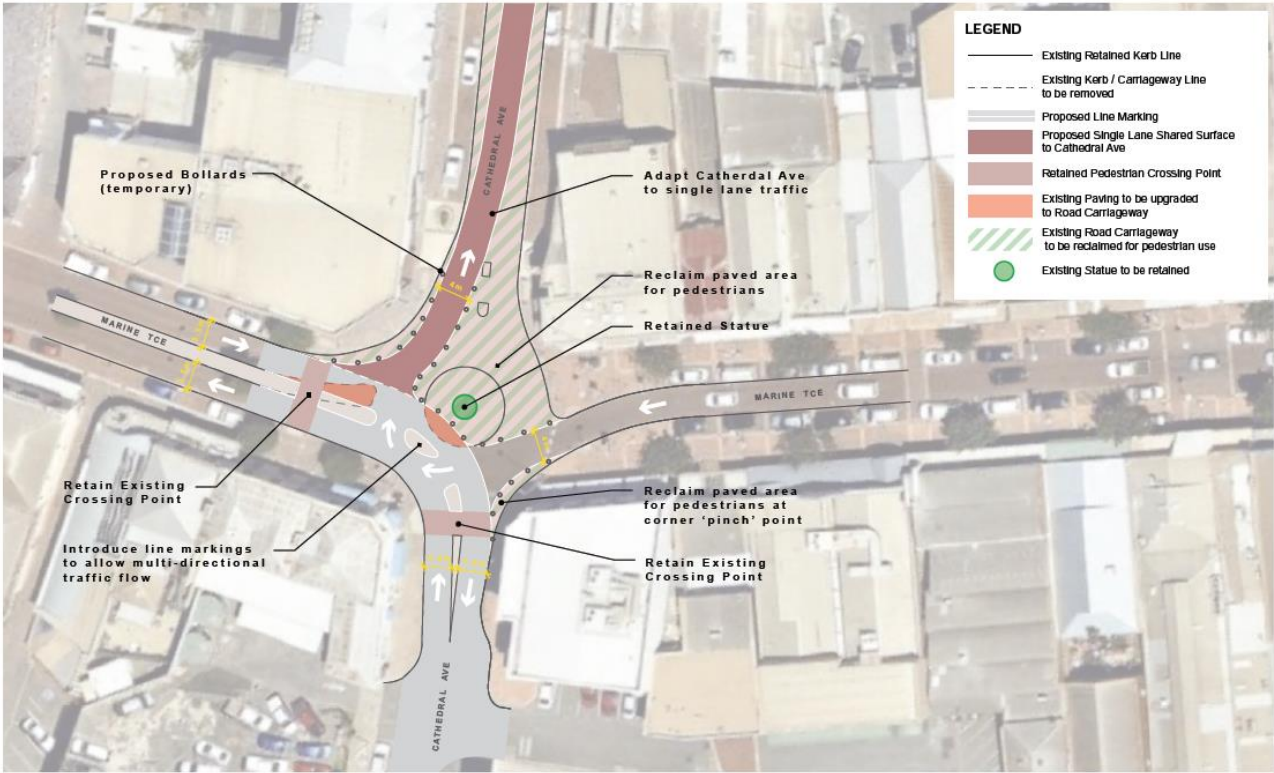
(between Cathedral Ave and Durlacher St).



To provide greater pedestrian connectivity from Marine Terrace to the foreshore, the CCRP also recommends investigating the partial closure of Cathedral Avenue between Marine Tce and Foreshore Dr, reducing it to one way traffic. This is to promote pedestrian priority through to the foreshore from the retail strip.

Figure 8-3 Proposed Cathedral Avenue Modifications (Source: TPG)

RE-CONFIGURE MARINE TERRACE AND CATHEDRAL AVE INTERSECTION FOR PEDESTRIAN PRIORITY.



9 Recommendations

Table 9-1 Table of Recommendations

Issues	Recommendations	Cost Estimates No cost/>\$100k/>\$1m/ >\$10m/>\$100m	Priority Short Term/ Medium Term/ Long Term
Energy			
Limitations to transmission capacity	Advocate that the State Government, Economic Regulation Authority and Western Power to progress MWEPP North project to expand transmission capacity to and from the region. Removing the constraints on the transmission line will provide surety to future power supply for the Greater Geraldton Region.	<i>Study Cost</i> No cost <i>Capital Cost</i> >\$100M	Medium term/Long term
Transportation			
Multi-modal transport mobility	A review of the City's road network should be undertaken, in the form of a 'TransPriority' review	<i>Study Cost</i> <\$100k	Medium term
Sustainable transport growth	Improve provision of non-car transport modes, initially focusing on low-cost improvements within and servicing the CBD such as improved pedestrian connectivity and wider coverage of the City by buses with greater frequency	<i>Capital Cost</i> <\$10m	Medium term
Vulnerable road user safety and mobility	Improve provision of pedestrian and cycling facilities within the City, particularly within the CBD and along/across NWCH	<i>Capital Cost</i> <\$10m	Medium term
North/South (Inner) Bypass vs Outer Bypass options	The CGG to undertake detailed traffic assessments of the inner bypass for the proposed northern and southern corridors to establish optimum connection points to existing highways. Planning of the routes, including any land resumptions, rezoning and road upgrades to be implemented.	<i>Study Cost</i> <\$100k <i>Capital Cost</i> >\$40m to >\$500m	Medium term
Rail network constraints	Planning for rail infrastructure needs to be done in and around the port to ensure heavier axle loads (up to 26 tonne) can be achieved for increased throughput.	<i>Study Cost</i> <\$1m <i>Capital Cost</i> >\$10m to >\$100m	Medium term

Issues	Recommendations	Cost Estimates No cost/>\$100k/>\$1m/ >\$10m/>\$100m	Priority Short Term/ Medium Term/ Long Term
Current Commonwealth Regulations require provision of ARFFS by Airservices to accommodate 500,000 annual passenger movements, combined with a risk appraisal process	Support the Federal Government's proposed change to current regulations to enable providers other than Airservices to provide services related to ARFFS, without requiring CASA approval This will enable local provision of services for airport rescue etc by other providers	<i>Study Cost</i> No cost	Ongoing
Geraldton Airport to increase capability as a Perth-alternative airport and become an international terminal for direct exports and tourism	Expansion and upgrade of the existing runway to 2400m to allow unrestricted A320/B737 (and ideally A330 capacity), plus upgrades to the arrivals lounge and enable a sterile arrival point with border security facilities. Construction of a new 2700M Type 4E-capable runway parallel to the current runway.	<i>Capital Cost</i> >\$20m <i>Capital Cost</i> >\$100m	Short term
Cruise ship berth and passenger terminal at Midwest Ports (note the berth is not just for cruise ships)	MWDC, CGG and Mid West Ports to plan the proposed upgrade to port facilities to provide a new berth for cruise and naval ships to dock within the port for tourism, servicing and crew change-over.	<i>Study Cost</i> <\$1m <i>Capital Cost</i> >\$10m	Medium term
Communications			
High speed internet access for agricultural areas	MWDC & CGG to research and liaise with private fibre optic installers to determine the potential across the Mid West to supply high-speed, high-bandwidth internet to regional agricultural areas	<i>Study Cost</i> <\$100k <i>Capital Cost</i> >\$10m	Short term
Waste and Waste Water			
Planning of water resources	The Department of Water, Water Corporation and MWDC to further develop planning of water resources to ensure adequate sources are available to service the growth of the region.	<i>Study Cost</i> <\$1m	Short term
Treated effluent reuse	CGG to investigate possibility of additional wastewater reuse to reduce demand on potable water resources	<i>Study Cost</i> <\$100k	Short term /medium term

Issues	Recommendations	Cost Estimates No cost/>\$100k/>\$1m/ >\$10m/>\$100m	Priority Short Term/ Medium Term/ Long Term
Oakajee Industrial Estate			
Need for heavy industrial estate away from residential areas	Discussions between MWDC, CGG, LandCorp and the State Government regarding possible funding arrangements to allow staged development of the Oakajee Industrial Estate without the construction of the Oakajee Port	<i>Study Cost</i> <\$100k <i>Capital Cost</i> >\$10m to >\$100m	Medium/ long term
Geraldton City Centre			
CBD Street Network (Foreshore Drive, Marine Tce, Cathedral Ave, Durlacher St, Chapman Rd)	CGG to investigate impact on traffic (vehicular and pedestrian) due to twoway traffic, including SIDRA analysis, services impacts etc	<i>Study Cost</i> <\$100k	Short term
Lack of water pressure within the CBD area for fire suppression systems in new developments	Investigate alternative options to address firefighting requirements in the CBD	<i>Study Cost</i> <\$100k <i>Capital Cost</i> >\$100k to >\$1m	Short term
Overhead power lines within the CBD	CGG to liaise with Western Power to establish a programme for the undergrounding of power throughout the CBD area	<i>Study Cost</i> <\$100k <i>Capital Cost</i> >\$1m	Short term
Establish services headworks investment fund	MWDC and CGG to liaise with Water Corporation and Western Power to investigate a headworks investment fund to reduce barriers to desired CBD investment. MWDC and CGG to investigate possible funding sources from State and National funding programs such as Royalties for Regions.	<i>Study Cost</i> <100k	Short term

About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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