City of Karratha

Local Planning Strategy

PART B: June 2015

City of Karratha

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1.0 Introduction

1.1 Role & Purpose of the Strategy

A Local Planning Strategy sets out the long term strategic planning direction for the local government and guides Council and the community on where growth should occur and how it will be managed. It provides a strategic framework for future development and the rationale for land use zoning defined within the Local Planning Scheme.

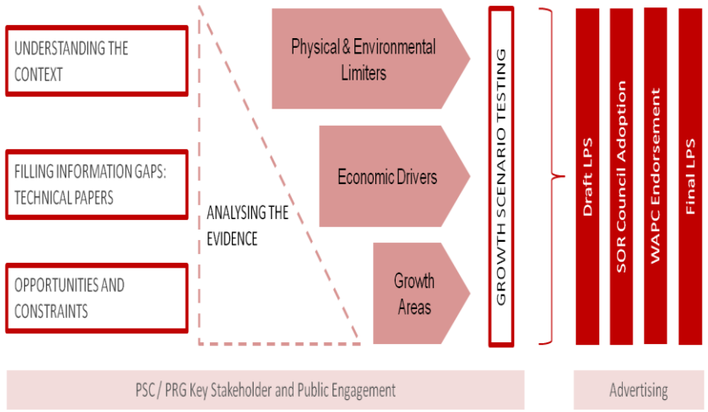
The City of Karratha Local Planning Strategy provides a local government-wide strategic framework to guide growth and development over the next 15 years. The Local Planning Strategy fills a distinct gap in the current strategic planning framework, which focuses either broadly on the Pilbara Region as a whole or locally on individual settlements within the City only.

A Local Planning Strategy is a prerequisite to updating a Local Planning Scheme. The City of Karratha Town Planning Scheme No. 8 (TPS8) was gazetted in August 2000 and is due for review. This Strategy will therefore inform a forthcoming review of TPS8.

The purpose of the City of Karratha Local Planning Strategy is to:

- Interpret the State and regional planning framework to guide planning for the City of Karratha;
- Identify strategic land uses and infrastructure requirements to service future population growth and economic activity to create a sustainable future for the City of Karratha;
- Identify land suitable for future development based on opportunities and constraints presented;
- Provide the background context for zones, reservations and statutory provisions to be implemented through the local planning scheme; and
- Propose implementation, monitoring and review actions to ensure the objectives of the Local Planning Strategy are achieved.

Figure 1 – Broad Overview of the Local Planning Strategy Process



1.2 Strategy Preparation & Structure

Preparation of the Local Planning Strategy has involved comprehensive review of the existing literature and extensive background technical and evidential analysis to supplement gaps in the existing information. Five *Technical Reports* and nine *Evidential Analysis Papers* were prepared by the consultant team in the preliminary stages of the Local Planning Strategy preparation.

Subsequent to that work the City commissioned further studies looking specifically at environmental and transport considerations. These documents contain further analysis and detail beyond the summarised version of background information and analysis contained in the Strategy document itself.

Early preparation involved input from a Project Steering Committee and Project Reference Group each established specifically to provide strategic guidance and direction for the project. At appropriate stages it has also involved consultation with key stakeholders and the City of Karratha community.

The *Town Planning Regulations 1967 (The Regulations)* contain the statutory requirements in respect to preparation, consultation and endorsement of a Local Planning Strategy. *The Regulations* require local governments to prepare a Local Planning Strategy as a basis for any new Local Planning Scheme.

Regulation 12A(3) of *The Regulations* states:

> *(3) A Local Planning Strategy shall –*
>
> *set out the long term planning directions for the local government; apply State and regional planning policies; and provide the rationale for the zones and other provisions of the Scheme.*

Once the Western Australian Planning Commission (WAPC) has certified the Local Planning Strategy is consistent with Regulation 12A(3), the Local Planning Strategy is to be advertised for comment to the public, relevant agencies and stakeholders. The Local Planning Strategy is then reviewed in light of comments received prior to submission to the WAPC for endorsement.

Regulation 12B sets out the procedure for advertisement, endorsement and final publication of the notice of a Local Planning Strategy, which are summarised graphically in **Figure 1** (beside).

The WAPC *Local Planning Manual* sets out the structure and content requirements for a Local Planning Strategy. While Part 1 contains the actual strategy, addressing the strategic vision, principles, objectives and actions to be implemented, ***Part 2 provides the relevant background to the Strategy***.

It includes the following sections of analysis, which form the Strategy rationale:

- State & Regional Planning Context;
- Local Planning Context;
- Local Profile & Analysis of Key Issues; and
- Opportunities & Constraints Mapping.

1.3 Consultation & Engagement Methodology

Preparation of the Local Planning Strategy has been underpinned by a robust consultation and engagement process. The agreed Communication Plan and Consultation Strategy involved five key components or stages, including:

- Stage 1: Media releases and ongoing communication of project deliverables;
- Stage 2: Data collection and information consultation;
- Stage 3: Aboriginal community consultation;
- Stage 4: Scenario development workshops; and
- Stage 5: Statutory consultation.

Communication with the public has been ongoing throughout the project, with a three-staged media release programme. The first stage introduced the project, the second stage invited stakeholders and community to attend the scenario development workshops and provide feedback, and the third stage reported on findings of Aboriginal community consultation and scenario development workshops. The City's Local Planning Strategy webpage has been the primary mode of communication for these project milestones.

Some targeted consultation with key stakeholders was necessary to inform background technical analysis, and thus a data collection and information consultation process allowed engagement with key stakeholders early in the project. This stage of consultation was undertaken through one-on-one meetings and teleconferences between the consultant team and key stakeholders. All key stakeholder engagement from this stage has been documented with meeting findings summarised in a *Targeted Key Stakeholder Consultation Summary*.

Targeted consultation with the City's Aboriginal community was undertaken through facilitated sessions with key Aboriginal Corporations. Engagement sessions took place over two stages, in the form of Aboriginal Corporation board meetings and one-on-one discussions. Engagement focused on understanding aspirations for growth, housing, economic development and community to inform a well-grounded Local Planning Strategy. An *Aboriginal Engagement Outcomes Report* documents the findings of this stage of consultation.

Scenario Development Workshops provided the main opportunity for general stakeholder and community engagement. Three workshops took place in September 2013. Two workshops were held in Karratha and one was held in Perth to enable participation of key stakeholders and government agencies based in Perth. Discussions at the Perth workshop were structured to feed off the findings from engagement with the local community and stakeholders at the Karratha workshops. Workshops consisted of facilitated focus group sessions discussing the important issues around future growth of the City. An initial briefing presentation by the consultant team provided a baseline for facilitated focus group sessions.

As identified in the *Workshop Outcomes Report*, a number of matters clearly of importance to stakeholders of the City of Karratha community were identified. All outcomes of the workshops have helped inform and guide the preparation of the Local Planning Strategy, and have been considered having regard to the various opportunities and constraints identified for the City.

During the drafting of the LSP, it became evident that additional targeted consultation was required with key agencies who have a pivotal role in the delivery of housing and services, and management of growth in the City of Karratha. The additional consultation was required in order to fill gaps, confirm previous advice and obtain updated information to inform the strategy, given that much of the consultation via the workshops was undertaken in 2012/13. This additional targeted consultation involved phone conversations and meetings with key City officials (executive and staff), Department of Planning, PDC, LandCorp, Water Corp, DAFWA and DSD in September, October and November 2013 and has been incorporated into this draft.

There was substantial work undertaken on focused consultation with Indigenous groups and organisations.

The statutory consultation process follows Council adoption and WAPC certification of the *Draft Local Planning Strategy*. Formal advertising provides an opportunity for the public, relevant stakeholders and agencies to provide feedback on the draft before the strategy is finalised. Formal advertising will be undertaken in accordance with *The Regulations*. Comments from advertising will be reviewed and incorporated as appropriate into the final *Strategy* to be adopted by Council and endorsed by the WAPC.

2.0 State & Regional Planning Context

The *Strategy* has been prepared with due consideration to the existing State and regional level planning framework. The following section contains an overview of the key State and Regional Planning Strategies, Plans, Policies and Reports relevant to the City of Karratha. Policy and planning measures requiring implementation at the local level are highlighted to illustrate how the City's *Strategy* incorporates State and regional level planning principles and priorities.

2.1 State Planning Strategy 2050

The *State Planning Strategy 2050* (SPS 2050) provides an overarching strategic plan for Western Australia. It is a broad strategic plan with a vision for coordinated and sustainable development of the State. The key principles of the State Planning Strategy intended to guide all levels of planning decision making are as follows:

- **Community –** Enable diverse, affordable, accessible, and safe communities;
- ***Economy –*** *Facilitate trade, investment, innovation, employment and community betterment;*
- ***Environment –*** *Conserve the State's natural assets through sustainable development;*
- ***Infrastructure –*** *Ensure infrastructure supports development;*
- ***Regional Development –*** *Build the competitive and collaborative advantages of the regions; and*
- ***Governance –*** *Build community confidence in development processes and practices.*

The guiding principles for the City of Karratha Local Planning Strategy are structured similarly around four pillars: Community, Economy, Natural and Built Environment, and Leadership. The specific principles under each pillar have been established to be consistent and to assist in achieving the overall principles and objectives of *SPS 2050*.

SPS 2050 puts forward a number of key considerations for the future of the North West of the State, which encompasses the City of Karratha. One of the main challenges it identifies is balancing the conservation of the region and economic development. It recognises the need for a local construction industry and higher education to facilitate the growth of the resources sector and diversification of the economic base. This Local Planning Strategy provides a planning tool to assist in overcoming these identified challenges in order to facilitate coordinated and sustainable growth, in line with the vision of *SPS 2050*.

2.2 State Planning Framework (Variation No.2)

The *State Planning Framework* is an overarching integrative document, encompassing all State and Regional Plans, Policies, Strategies and Guidelines which apply to land use and development in Western Australia.

It provides a central decision-making framework to guide land use and development in Western Australia. The *State Planning Framework* is the overarching Statement of Planning Policy, under which all other State Planning Policies fall. This *Strategy* has been prepared taking into account the State Planning Framework and all underlying State Planning Policies.

The *State Planning Framework* identifies five key principles to guide planning decision-making. The principles are based around the themes of environment, community, economy, infrastructure and regional development. The Local Planning Strategy guiding principles demonstrate consistency with the key principles of the State Planning Framework.

2.3 State Planning Policies

The following *State Planning Policies (SPP's)* are applicable to the City of Karratha. The *SPP's* are intended to provide guidance for planning strategies, schemes and general land use and development decision-making. They present specific measures that should be applied for preparation of planning strategies, and are therefore pertinent to the development of this *Strategy*.

State Planning Policy	Application to the City of Karratha
SPP 2: *Environment and Natural Resources Policy*	SPP 2 aims to integrate conservation of the environment and sustainable natural resource management with broader land use planning and decision-making. It identifies the need to protect, conserve and enhance the natural environment, and to facilitate wise and sustainable use and management of natural resources. The City of Karratha's natural environment is important for its environmental, cultural and recreational values. Meanwhile, its natural resources make a fundamental contribution to the City's mining and resources based economy. Accordingly, it is critical that the Local Planning Strategy incorporate measures to plan for appropriate balance between conservation of the environment and sustainable natural resource management.
SPP 2.5: *Land Use Planning in Rural Areas*	SPP 2.5 seeks to protect agricultural land resources, whist minimising land use conflict and providing for economic opportunities and rural settlement where appropriate. To this end, SPP 2.5 contains primary objectives relating to rural land. These objectives include the protection of rural land from incompatible uses, the promotion of regional development through ongoing economic opportunities, the promotion of sustainable settlement in and adjacent to urban areas, and the protection and improvement of environmental and landscape assets. A further primary objective is the minimisation of land use conflicts. SPP 2.5 provides that the WAPC will continue to promote rural zones in Local Planning Schemes as highly flexible zones that cater for a wide range of rural land uses that can support primary production, value adding, small-scale tourism, environmental protection and biodiversity conservation. The differing needs of regions are recognised and regional variations may be considered where they meet the stated objectives of the policy, are evidence-based, and supported in Local Planning Strategies and Schemes.
SPP 2.6: *State Coastal Planning Policy*	SPP 2.6 aims to ensure appropriate and sustainable use and development of coastal areas. It seeks to ensure development takes into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria. Coastal hazard risk management and adaptation planning are important measures of SPP 2.6 that must be implemented in areas at risk of being affected by coastal hazards. The City comprises 350kms of Indian Ocean coastline. With settlement largely focused around the coast, coastal areas cater for residential, tourism, maritime industry, energy and minerals industries and other commercial activities. Low-lying areas of the City are extremely vulnerable to inundation and storm surge during tropical cyclones, storms and tsunami events. As such, it is essential the Local Planning Strategy adhere to the requirements of SPP 2.6 in regard to coastal planning.
SPP 2.7: *Public Drinking Water Source Policy*	SPP 2.7 addresses land use and development in public drinking water source areas. It aims to protect these areas from incompatible land use and pollution, and to provide effective long-term management of water resources for public water supply. The West Pilbara Water Supply Scheme serves all settlements in the City, and is nearing yield capacity. The scheme is supplied by entirely climate-dependent surface (Harding Dam) and groundwater (Millstream Aquifer) sources. The City faces limitations to adequate water supply in the face of a changing climate with increasingly unpredictable rainfall events. The Local Planning Strategy must take into account measures of SPP 2.7 for protection of existing and future water supply areas to address this constraint.
SPP 2.9: *Water Resources*	SPP 2.9 seeks to protect, conserve and enhance water resources by promoting their sustainable use and management. The City of Karratha comprises 350kms of Indian Ocean coastline. It contains groundwater aquifers, water courses and surface water catchments, all of which are highly climate dependent. These water resources are worthy of protection for the economic, environmental, cultural and recreational values they afford the City. The Local Planning Strategy, accordingly, incorporates the objectives and measures of SPP 2.9 for sustainable use and management of water resources.

State Planning Policy	Application to the City of Karratha
SPP 3: *Urban Growth and Settlement*	SPP 3 sets out the principles and considerations that apply to planning for sustainable, responsive, coordinated and locally appropriate urban growth and settlement in Western Australia. It seeks to manage growth in response to climatic, environmental, heritage and community values. It aims to build on local and regional economies, coordinate timely provision of infrastructure and services, and provide for a wide range of housing, employment, recreation facilities and open space to enhance quality of life in Western Australian communities. The City of Karratha has experienced significant growth in recent years and is projected to continue growing over the coming 15 years. The Local Planning Strategy plans for the growth of the City to a population of 38,000 by 2031, inclusive of strategies and actions that promote and do not preclude a longer term aspiration of 50,000+. Managing urban growth to achieve liveable communities is therefore an important consideration for the Local Planning Strategy. The objectives of SPP 3 reflect closely the principles and objectives of the Local Planning Strategy.
SPP 3.1: *Residential Design Codes (Variation No. 1*)	SPP 3.1 provides the basis for the control of residential development throughout Western Australia. It is a comprehensive tool utilised by local government to regulate built form and density. While not a strategic planning policy document, SPP 3.1 has been considered in preparation of the Local Planning Strategy in relation to residential density nomination.
SPP 3.2: *Aboriginal Settlements*	SPP 3.2 aims to ensure the recognition of Aboriginal settlements through local planning schemes and strategies and to plan for the orderly and coordinated development of Aboriginal settlements. Three currently exist within the City: • Weymul; • Cheeditha; and • Mingullatharndo. These are acknowledged in the Local Planning Strategy, along with the need to use a collaborative approach to manage their orderly and coordinated future growth.
SPP 3.4: *Natural Hazards and Disasters*	SPP 3.4's objectives are to ensure all planning documents include provisions for natural disaster planning. The aim to doing so being to minimise negative impacts of natural disasters on communities, the economy and the environment. Of particular relevance to the City is the high risk of tropical cyclones, and associated storm surge and inundation. The Local Planning Strategy recognises this risk and identifies areas at risk of inundation during storm events so that adverse impacts of this specific natural hazard can be avoided and mitigated.

State Planning Policy	Application to the City of Karratha
SPP 3.5: *Historic Heritage Conservation*	SPP 3.5 sets out the principles of sound and responsible planning to conserve and protect Western Australia's historic cultural heritage. The policy promotes and facilitates effective conservation, use and management of State and local heritage assets. Aboriginal heritage is protected separately under the *Aboriginal Heritage Act 1972*, and as such the policy does not apply to Aboriginal heritage sites except where listed on a State or Local Heritage Register. The City of Karratha Local Government Heritage Inventory consists of 73 sites of heritage significance. In particular, the Cossack Heritage Precinct is a site of national archaeological significance, providing evidence of a multicultural past as well as the impact of European settlement on Aboriginal cultures. It contains notable well restored public buildings. Roebourne settlement also has a number of heritage sites that hold great importance to both the Aboriginal and European histories of the area. It is vital that the Local Planning Strategy support the policy measures of SPP 3.5 so that the rich heritage of the City is appropriately protected and celebrated into the future.
SPP 3.6: *Development Contributions for Infrastructure*	SPP 3.6 sets out the form, content and process to be followed in providing for development contributions for the provision of infrastructure. The policy promotes efficient and effective provision of public infrastructure. It provides certainty to developers, infrastructure providers and the community in regard to applicable charges and how funds are to be spent by requiring local governments to prepare development contribution plans. Development contribution plans require a strategic basis, which can be identified through local planning strategies and strategic infrastructure plans. The City of Karratha Local Planning Strategy aims to provide the initial strategic basis around the requirement for development contribution plans in the City. In doing so, the Local Planning Strategy takes into account the policy objectives and measures of SPP 3.6.
SPP 3.7: *Planning for Bushfire Risk Management (Draft)*	SPP 3.7 seeks to reduce the risk of bushfire to people, property and infrastructure by encouraging a conservative approach to strategic planning, subdivision, development and other planning decisions proposed in bush-fire prone areas. The SPP is supplemented by revised *Planning for Bushfire Risk Management Guidelines* that assist interpretation and provide advice on how bushfire risk is to be addressed when designing or assessing a proposal within a bush-fire prone area. A critical public safety issue, it is important that the Local Planning Strategy support and seek to implement the final policy measures and requirements of SPP 3.7. The preparation of regional Bushfire Hazard Mapping by the Department of Fire and Emergency Services is an important first step in this process.

State Planning Policy	Application to the City of Karratha
SPP 4.1: *State Industrial Buffer (Amended) (Draft)*	SPP 4.1 aims to avoid land use conflicts between industry and/or essential infrastructure and sensitive land uses. It applies to proposals seeking to provide new industrial uses and/or essential infrastructure, or proposals for sensitive land uses in proximity to existing industry areas. It seeks to protect industry and infrastructure from encroachment, minimise risk to sensitive land uses and promote compatible uses where off-site buffers are required. EPA *Guidance Statement No. 3 – Separation Distances between Industrial and Sensitive Land Uses* provides guidelines for generic buffer distances. The City of Karratha has a considerable amount of industrial land uses with the potential to create off-site impacts. The Local Planning Strategy has considered in detail the issue of existing and future land use separation distances in accordance with SPP 4.1. It recognises site specific technical analysis is required to understand the most appropriate buffer distance and account for potential cumulative impacts.
SPP 5.2: *Telecommunications Infrastructure*	SPP 5.2's objective is to facilitate the provision of telecommunications infrastructure in an efficient, cost-effective and environmentally responsible manner to meet community needs. The policy provides a framework for the preparation, assessment and determination of applications for planning approval for telecommunications infrastructure. The need for high-speed telecommunications in the City is vital to achieving a standard of living competitive with the rest of Australia. The Local Planning Strategy aims to address the need for telecommunications infrastructure and supports the provisions of SPP 5.2 for its efficient provision.
SPP 5.4: *Road and Rail Transport Noise and Freight Considerations in Land Use Planning*	SPP 5.4 aims to promote an integrated system of sustainable land use and transport with efficient freight network design and best practice development. Protecting people from unreasonable levels of transport noise and protecting major transport corridors from incompatible urban encroachment are the mechanisms to achieve this aim. Road and rail transportation, for both everyday domestic usage and freight transport, are central to development in the City. New road and rail connections will be required to facilitate future growth of the population and economy. New residential areas will also be required to accommodate growth, and both must consider implications of transport noise. Noise criteria, management and mitigation provisions of SPP 5.4 are incorporated in the Local Planning Strategy to safeguard residential amenity and efficient transport operations.

2.4 Regional Strategies

Pilbara Planning and Infrastructure Framework (2012)

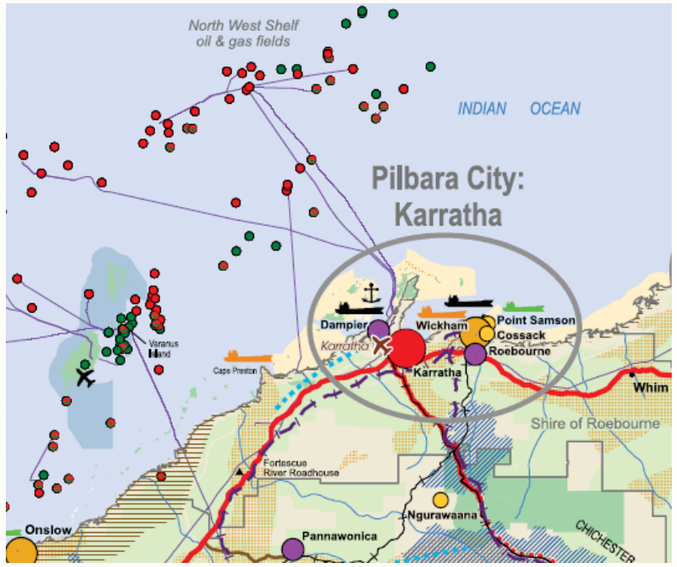
The *Pilbara Planning and Infrastructure Framework (PPIF)*, prepared by the WAPC, details a settlement-focussed regional development approach for the Pilbara. The *PPIF* has been developed under the banner of the *State Planning Strategy* as a regional strategy. It provides a basis for local planning strategies and schemes over the next 25 years. It contains detailed planning for higher order Pilbara Region settlements, identifying Karratha as a vital regional service centre. Its vision is:

> *"By 2035, the region will have a resident population of more than 140 000, based on a more diverse economy that has capitalised on its competitive advantages. As part of the Pilbara Cities vision, the Pilbara will have two cities: Karratha and Port Hedland, each with a population of 50,000. These would be supported by the Newman sub-regional centre with a population of 15,000 and the major towns of Tom Price, Onslow and Wickham.*
>
> *Higher levels of population in the region's main urban centres will support a wider range of employment opportunities; greater housing choice; higher levels of amenity; and access to higher standards of education, health, recreational and other community services. The natural and cultural heritage assets of the Pilbara, such as the coastline, Karijini and the Burrup Peninsula's rock-art galleries will be conserved, celebrated and cherished."*

The *PPIF* identifies major community, utility and transport infrastructure priorities in order to sustainably develop the Pilbara in the context of a rapidly growing population. It also recognises the need to foster environmental and cultural priorities across the Pilbara Region.

The *PPIF* provides guidance for how the City of Karratha fits into the Pilbara Region, and how this role can be expected to evolve, particularly with the development of Karratha into a regional city servicing the West Pilbara Region.

Figure 2 – Strategy Map (Extract)



Source: Pilbara Planning & Infrastructure Framework (2012)

Operational Policies

Liveable Neighbourhoods (2009)

Liveable Neighbourhoods is an operational policy used for the design and assessment of structure plans and subdivision. It is applicable to both greenfield and large areas of infill development throughout Western Australia. The purpose of *Liveable Neighbourhoods* is to facilitate development of sustainable communities in accordance with the direction of the *State Planning Strategy*. The integrated document replaces issues-based development control policies. It covers eight elements, including community design, movement networks, lot layout, public parkland, urban water management, utilities, activity centres and employment, and schools.

The City of Karratha Local Planning Strategy is written to be consistent with the objectives and requirements of *Liveable Neighbourhoods*, recognising the policy's purpose for the development of sustainable communities.

Development Control Policies

The WAPC has adopted a range of operational Development Control Policies (DCP's) to guide its decision-making on structure planning, subdivision and development applications. A number of these policies have effectively been superseded by *Liveable Neighbourhoods*, and where there is a conflict between existing operational policies, *Liveable Neighbourhoods* typically prevails unless it can be demonstrated that it can or should not apply. The following DCP's have some relevance to the City of Karratha and have been taken into consideration in the preparation of this Strategy to ensure no inconsistencies:

- DCP 1.1: Subdivision of Land – General Principles;
- DCP 1.2: Development Control – General Principles;
- DCP 1.3: Strata Titles;
- DCP 1.4: Functional Road Classification for Planning;
- DCP 1.5: Bicycle Planning;
- DCP 1.6: Planning to Support Transit Use & Transit Orientated Development;
- DCP 1.7: General Road Planning;
- DCP 2.2: Residential Subdivision;
- DCP 2.3: Public Open Space in Residential Areas;
- DCP 2.4: School Sites;
- DCP 2.5: Special Residential Zones;
- DCP 2.6: Residential Road Planning;
- DCP 3.4: Subdivision of Rural Land;
- DCP 4.1: Industrial Subdivision;
- DCP 4.2: Planning for Hazards & Safety; and
- DCP 6.1: Country Coastal Planning Policy.

Planning Guidelines & Manuals

Various guidelines and manuals have also been prepared by the WAPC to support operational policies and provide guidance on a range of planning issues. These guidelines and manuals are generally applicable to the City and should be utilised to assist with future planning where relevant. The following manuals and guidelines have some relevance to the City of Karratha and have guided the preparation of this Strategy:

- Tourism Planning Guidelines (May 2014);
- State Coastal Planning Policy Guidelines (July 2013);
- Rural Planning Guidelines (February 2014)
- Guidelines for Preparation of Integrated Transport Plans (May 2012);
- Local Planning Manual (March 2010);
- Better Urban Water Management (October 2008);
- Visual Landscape Planning in Western Australia (April 2008);
- Designing Out Crime Guidelines (June 2006);
- Coastal Planning & Management Manual (February 2005);
- Structure Plan Preparation Guidelines (August 2012);
- Transport Assessment Guidelines for Developments (August 2006);
- The Design & Geometric Layout of Residential Roads (June 1998);
- Acid Sulfate Soils Planning Guidelines (April 2009);
- Basic Raw Materials Applicants' Manual (February 2009);
- Planning for Bushfire Protection (Edition 2 – May 2012);
- Holiday Homes (September 2009);
- Reducing Crime & Anti-Social Behaviour in PAW's (October 2009)
- Road & Rail Transport Noise & Freight Consideration in Land Use Planning;
- Enquiry-by-Design Workshop Process – A Preparation Manual (April 2004);
- Aboriginal Settlement (AS) Guideline 1 – Layout Plan Provisions (July 2012);
- AS Guideline 2 – Provision of Housing & Infrastructure (March 2012);
- AS Guideline 3 – Layout Plan Exclusion Boundaries (July 2012); &
- IPWEA Subdivision Engineering Guidelines Edition 2.2 (August 2012).

2.6 Other Relevant Strategies, Plans & Policies

Pilbara Cities (2010)

Pilbara Cities is a regional level strategy prepared by the Pilbara Development Commission to encourage more people to live and settle in the Pilbara. It is supported by $1.2 billion from the *Royalties for Region Scheme*. The initiative focuses on the effective integration and facilitation of infrastructure expansion, land availability and development, community projects, and economic diversity. It promotes Karratha and Port Hedland as cities with populations exceeding 50,000 each. The plan aims to develop regional centres that promote strong local communities, diversified from the resources sector, with modern amenities and culture.

The Local Planning Strategy is developed to generally be consistent with Pilbara Cities, as it aims to transform Karratha into a vibrant and diverse regional centre, with local community, culture and amenities. Reflective of the most recent population projections prepared by ID Forecast however, this *Strategy* plans for a population of 38,000 across the entire City by 2031, with the capacity to achieve a population of 50,000 and beyond. The major population centre of the City will remain Karratha, and the *Strategy* prioritises the need for a threshold population in Karratha to necessitate regional level services and facilities, consistent with the Pilbara Cities strategic direction.

Karratha City of the North (2010)

Karratha City of the North (KCN) is a growth plan for Karratha released by the City of Karratha and LandCorp as part of the Pilbara Cities initiative. It describes its vision as:

"A liveable, compact, Regional City of 50,000+ people, with a diversified economy, a healthy local community which demonstrates demographic balance, affordability, high quality amenity, and infrastructure. It is a place of choice, to work, visit, grow up, raise families and age gracefully."

The *KCN* is designed as a three-part integrated plan, comprising an *Implementation Plan*, a *City Growth Plan* and a *City Centre Master Plan*, which collaboratively aim to facilitate the growth and development of Karratha into a Regional City.

Much of the town centre revitalisation and urban expansion provided for by the *KCN* is now underway. Additional storm surge and inundation mapping undertaken following preparation of the *KCN* however, uncovered risks for some areas previously identified to accommodate expansion. This *Strategy* revisits *KCN* to review at the high level how growth might be distributed appropriately given the latest information on environmental constraints.

Dampier Townsite Redevelopment & Revitalisation Strategy (DRAFT - 2013)

The *Draft Dampier Townsite Redevelopment and Revitalisation Strategy* is a State Government initiative, prepared in collaboration with the City and Rio Tinto, to strategically plan for growth and revitalisation of Dampier. The *Draft Revitalisation Strategy* calls for government, industry and community to work together to provide the investment and infrastructure required to realise growth. It incorporates a land use plan, identifying future development opportunities, as well as recommended initiatives for revitalisation. It positions Dampier to reach a future residential target population of 3,500 beyond the timeframe of this Strategy, and supports (but does not rely on) the future marina development proposed for Dampier. It has been tested through community and stakeholder engagement, and is anticipated to be adopted as a Longer Term Townsite Strategy.

It is recognised that consistency between the *Dampier Revitalisation Strategy* and City wide *Local Planning Strategy* is of utmost importance to ensure a robust strategic planning framework with respect to Dampier. The principles, objectives and initiatives proposed by the *Draft Dampier Revitalisation Strategy* have been reviewed and incorporated consistently into the City-wide *Strategy*, taking into consideration the population growth for Dampier expected in the timeframe of this Strategy and the current constraints to achieving an ultimate 3,500 population.

Pilbara Development Commission Strategic Plan 2010-2013

The *Pilbara Development Commission Strategic Plan (PDC Strategic Plan)* is a high level strategic plan, which sets the direction for the Pilbara Development Commission advocating for the Pilbara Region and influencing government policy and funding opportunities to enable the sustainable development of the region. The *PDC Strategic Plan* is centred around four major matters facing the Pilbara region. These include:

- An integrated approach to the economy, key services, and private sectors;
- Increasing investment and economic opportunities;
- Creating a more permanent residential population through social and cultural infrastructure; and
- Ensuring the equality of opportunity and enjoyment for all who live and work in the area.

The *Local Planning Strategy* takes into consideration the *PDC Strategic Plan* and aims to work together with the Pilbara Development Commission to create a liveable and prosperous future for the Pilbara.

Pilbara Workforce Development Plan 2013-2016 (2013)

The *Pilbara Workforce Development Plan 2013–2016* is a regional plan formulated jointly by the Pilbara Workforce Development Alliance and Department of Training and Workforce Development to address the demand for skilled and semi-skilled labour. In developing effective strategies to meet current and future workforce development, the plan presents an overview of the region's economics and demographics. It also examines the labour market and its supply to create an action plan for development of the region's workforce.

Karratha Area Development Strategy (1998)

The *Karratha Area Development Strategy (KADS)* is a sub-regional land and water use strategy for the development of Karratha and its surrounds (Cape Preston to Cape Lambert) over 25 years. Prepared by the WAPC its intent was to create a strong plan for integrated State, regional, and local planning, which considers a wide range of significant factors for the City. Some of the key areas identified as crucial in the development of Karratha include cultural and social infrastructure initiatives around secondary and tertiary education, health and training, the need for aesthetic upgrading of the town, and the ongoing promotion of a strong local identity.

A structure plan forms part of the *KADS*, accommodating a projected growth of Karratha to 37,000 people, 20,000 of which could reside in future areas north and south of the hills. *KADS* informed the review of the then *Shire of Roebourne Town Planning Scheme No.7* in the same way that this Local Planning Strategy will now inform the review of *Town Planning Scheme No. 8*.

Pilbara Regional Water Plan 2010-2030 (2010)

The *Pilbara Regional Water Plan* is a strategic document prepared by the Department of Water that focuses on sustainable water resource management for the Pilbara to 2030. It presents the challenges that the region faces, with possible responses to ensure water security. It includes an action plan with priority actions (2010-2014) required to meet a set of long-term outcomes. The *Pilbara Regional Water Plan* is informative in outlining the major issues for water resource management in the region, which need to be reflected and addressed in this *Strategy*.

Pilbara Regional Plan 2012-2017 (2012)

The *Pilbara Regional Plan* is a regional strategy created under the auspices of Regional Development Australia. It focuses on four central priorities:

- The development of leadership and inclusive planning;
- Creation of strong communities;
- Sustaining the natural environment; and
- Maintenance of a resilient economy.

The *Pilbara Regional Plan* presents a broad strategy that examines key areas of importance to the Pilbara region. These include: utilities, transport, health, sport and recreation, accommodation, communication, education, cultural tourism, and land. The document provides a wealth of information on the region and strategies and priorities at the regional level. This *Strategy* has been prepared with consideration of the *Pilbara Regional Plan* and builds on the strategies and priorities identified by this regional level document.

2.7 Guidelines, Forecasts & Reports

Pilbara Framework: Regional Profile (2009)

The *Pilbara Framework: Regional Profile* is a spatial planning profile that provides the background and rationale for the *Pilbara Planning and Infrastructure Framework*. It offers wide-ranging description of the local settlements, canvassing the range of environmental, cultural, demographic, and economic aspects of the region.

Pilbara Infrastructure Priorities (2012)

Pilbara Infrastructure Priorities was prepared under direction of the WAPC's Infrastructure Coordination Committee, to inform the State Government on infrastructure priorities in the Pilbara. The report provides an overview of limitations that will impact on the future medium to long term growth of Karratha. These include:

- Adequate water supply;
- Consistent power supply;
- Availability of affordable housing; and
- Sources of basic raw materials.

As such, planning, design, funding and approvals to enable water and power infrastructure, affordable housing and sourcing of raw materials are critical issues, which this *Strategy* seeks to address.

Pilbara State of the Environment Report (2013)

The *Pilbara State of the Environment Report (SOE Report)* is a document delivered by Regional Development Australia Pilbara, comprising a review of the quality of the natural environment and key issues for environment related decision making across the Pilbara.

The *SOE Report* aims to provide information to improve understanding of risks and facilitate effective management of the Pilbara environment. The report was prepared in consultation with all affected Local Governments and other relevant agencies. It covers themes of air, water, land, biodiversity, coasts, marine environment, heritage and built environment, identifying drivers of change and key pressures for each. Following this it provides indicators and suggested responses for future.

For the City of Karratha, the *SOE Report* identifies water supply to be a critical pressure, which is improving. Conservation of biodiversity and recreational and port impacts to coastline are other critical pressures, which are still declining and requiring management attention. Preparation of this *Strategy* has considered the various issues identified in the *SOE Report* in detail, furthermore it seeks to plan for sustainable environmental management to address pressures on the City's environment.

Karratha Regional Hotspots Land Supply Update (2010)

Karratha Regional Hotspots Land Supply Update, prepared by the WAPC, provides information on the availability of land supply for future residential, industrial, and commercial uses. It also identifies the planning and infrastructure coordination needed to meet demand, based on the status of major projects, and current and anticipated lot creation activity. The document provides valuable information around key issues constraining growth of Karratha, which have informed this *Strategy*.

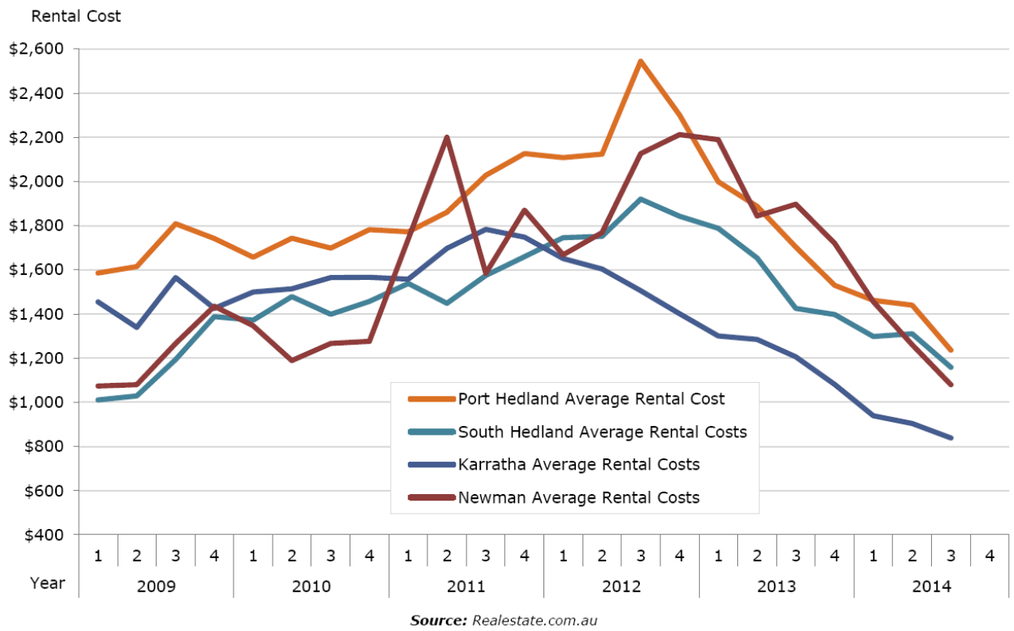
Pilbara Housing & Land Snapshot (October 2014)

The *Pilbara Housing and Land Snapshot* is an overview of data presented by the Pilbara Development Commission. Produced quarterly, it details figures relating to key areas of:

- Advertised residential and commercial properties for rent and sale;
- Land for sale;
- Average house settlement prices;
- Government public housing; and
- Development proposals.

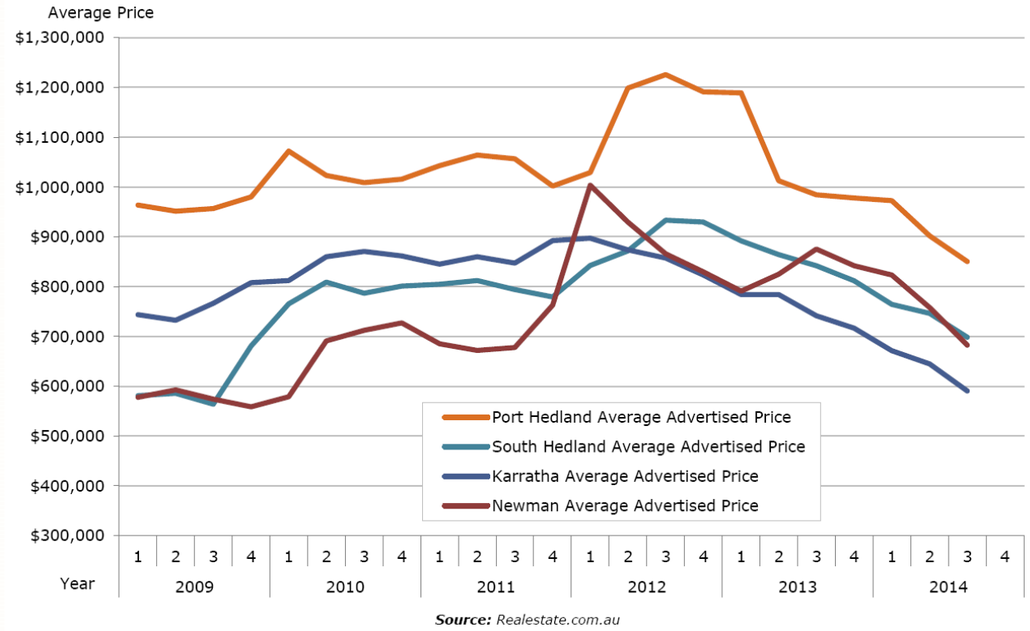
The document provides another important source of information that has informed planning to enable future growth and development in this *Strategy*. Extracts from the most recent report, released in October 2014 appear below.

Figure 3 – Advertised Residential Weekly Rental Cost (Average), Pilbara



Source: PHLS Oct 2014

Figure 4 – Advertised Redidential Dwellings for Sale, Pilbara



Source: PLLS Oct 2014

Summary of Housing, Land & Accommodation Initiatives in the Pilbara 2009-2015 (2009)

The *Summary of Housing, Land, and Accommodation Initiatives in the Pilbara 2009-2015* is a report prepared jointly by the Pilbara Development Commission and the Department of Housing, offering a response to the housing, land requirements, and infrastructure needs in the Pilbara for 2009-2015. It addresses the need to "improve the quantity, quality, appropriate mix and affordability of housing" in the Pilbara, in the circumstances of low, modest, and high growth scenarios. This *Strategy* seeks to improve the housing situation for the City, and has therefore taken this report into consideration.

WA Tomorrow: Population Report No. 7, 2006-2026 (2012)

WA Tomorrow is a WAPC report that presents a best-estimate of future population size based upon the continuation of current trends in fertility, mortality and migration. It differs from other forecasts in that it aims to meet "the requirement and room for future population growth while maintaining local environments and valued quality of life", not an "aspirational target".

The *WA Tomorrow* population forecasts include five banded simulations to 2026, with Band A containing the lowest population forecast and Band E the highest. Even the Band E population forecast of 27,300 by 2026 is considered a low population projection for the City in the context of planning for a population of 38,000 by 2031. This indicates that significant economic growth and diversification will be necessary to achieve both the target population, and the longer term aspiration target of 50,000 on which this *Strategy* has been based.

Figure 5 – Sense of Karratha Palette

Source: Karratha Vernacular Design Principles (Hassell 2011)

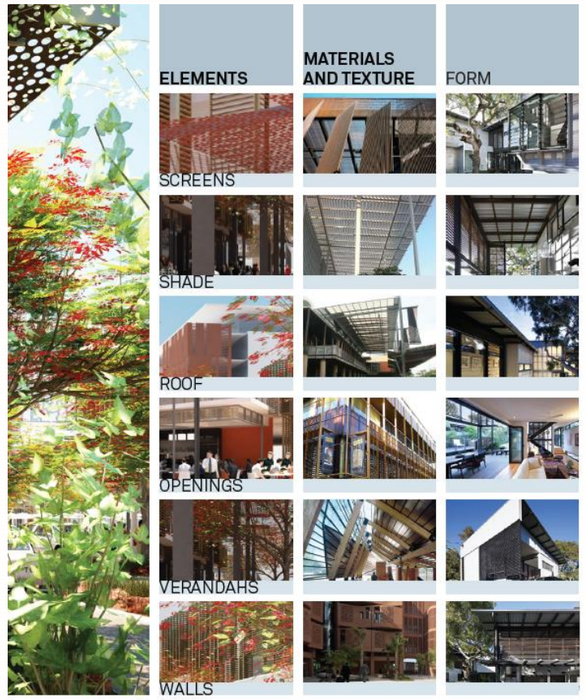
WA State Growth Outlook 2013 (2013)

WA State Growth Outlook 2013 is a report prepared by the Chamber of Minerals and Energy of Western Australia. The report details projected growth and demand in the resources sector to 2023 across the State. It aims to provide an integrated outlook on industry development intentions and government policy, and to update and understand demand profiles and implications under changing market conditions. It notes key factors applicable to the Pilbara:

- Employment will decline by 9,300 workers in 2018, from a base of 63,900 in 2012, as the industry moves into the operational phase.
- 73% of incremental growth in water abstraction to 2018 will occur in the Pilbara.
- To 2023, Pilbara ports will represent 80-95% of new trade volume in WA. 90% of all WA exports depart from Port Hedland and Dampier Ports.
- Self-generation, primarily through natural gas, will remain the predominant source of electricity supply in the Pilbara.
- Expansion plans will require an emphasis on the issue of connectivity of roads in the Pilbara.

The details of the report around the declining construction workforce of the Pilbara as the resources sector moves into an operational phase has important implications for the City, and are considered in this *Strategy*.

Figure 6 – Buildings & Technology Design Principles (Extract)



Source: Karratha Vernacular Design Principles (Hassell 2011)

Planning for Resources Growth in the Pilbara: Employment & Population Projections to 2020 (2008)

This report, prepared by Heuris Partners for the Pilbara Industry's Community Council focuses on detailing the population and employment impacts of current and future resource projects in the Pilbara. It shows potential impact on employment and population growth to 2020, and especially emphasises the potential service demands for 2015-2020. The report contains important context for population and employment planning to inform this *Strategy*. It is again identified that the City will experience a significant decline in construction workforce unless major new projects are commenced.

Pilbara Vernacular (2012)

The *Pilbara Vernacular* is a planning and design document prepared for LandCorp to guide regionally specific design responses for future development in Pilbara towns. Its objectives are to:

- Ensure high quality buildings and public realm and enhance the interface between the two.
- Provide a contemporary design response to the Pilbara context including logistic and economic considerations.
- Evoke a sense of place which reflects the local landscape, environment, climate and culture.

The *Pilbara Vernacular* identifies a key challenge to this process is a disconnect between the minimal but influential heritage built form and lightweight metal construction, minimal shading and insulation short-term builds that are at the end of their life spans. A coherent contemporary development style overview is vital for the future design of Pilbara built communities. This *Strategy* aims to ensure the objectives and principles of the *Pilbara Vernacular* are realised to enhance public realm and built form environments.

Karratha Vernacular (2011)

The *Karratha Vernacular* is a design principles document, prepared for LandCorp, similar to the Pilbara Vernacular, but specific to Karratha. Its purpose is to *"outline a set of design principles that developers will need to address for new developments within the City Centre and residential estates."* The document emphasises that:

Current development practices are not delivering the required social benefits for the community of Karratha that will secure its transformation from a resource town into a City of the North. A key objective for this paradigm shift is to set a new benchmark for "beauty" and "excellence" in design, built form and service delivery.

The *Karratha Vernacular* is intended to guide all future development in Karratha, despite its focus on the City Core and Mulataga. This *Strategy* takes into consideration the provisions of the *Karratha Vernacular* and supports the need for design principles to create a local appropriate built form and environment.

3.0 Local Planning Context

The City of Karratha *Local Planning Strategy* reflects the strategic vision and direction of the City established within existing local government strategic planning. The *Strategy* also takes into consideration the current planning context set by draft and adopted structure plans for individual settlements. The following section addresses the existing strategic direction and planning context of the City, and discusses how the *Strategy* fits into this context.

3.1 Local Government Vision & Mission Statements

The City's *Strategic Community Plan 2012-2022* identifies Council's vision for:

> *"A cohesive and vibrant community, celebrating diversity and working together to create a sense of place and a sustainable future."*

It also states the City Council's mission as being:

> *"To provide community leadership and excellent local government services in an innovative and efficient manner to enhance our Shire's social, cultural, economic and environmental wellbeing."*

This *Strategy* has been prepared with due regard to Council's established vision and mission statement, and its ultimate goal is to achieve this vision.

3.2 Local Government Strategic Plans

Strategic Community Plan 2012-2022

The City of Karratha *Strategic Community Plan* provides a ten year strategic direction for the City. It is updated annually, and brings strategic and tactical planning documents together. It was created based upon extensive community consultation and is focused around four strategic themes, being community, economy, natural and built environment, and leadership. It identifies the following goals under each of these themes:

- **Community –** diverse and balanced…further develop and maintain the infrastructure, facilities, services, activities and programs to create aesthetically attractive and liveable towns which will develop into more diverse and balanced communities.
- **Economy –** well managed and diversified…develop infrastructure and facilities in a sustainable way to support the communities' needs.
- **Natural and Built Environment –** thriving and sustainable…strive to ensure our community lives sustainably in a thriving natural environment;
- **Leadership –** responsive and accountable…provide transparent and accountable local government service delivery that meets our communities' expectations.

The *Strategic Community Plan* goes on to specify outcomes, responses and indicators to achieve each of its goals.

The Part B analysis section of this *Strategy* has been prepared to be consistent with the *Strategic Community Plan* and adopts the same four strategic themes as a quadruple bottom line approach for its guiding principles.

Karratha 2020 Vision & Community Plan (2009)

The *Karratha 2020 Vision and Community Plan (Karratha 2020)* was prepared by Geographia in association with CCS Strategic Management. It is a facilities and services plan which assesses Karratha's infrastructure and service needs in response to future population growth. The plan combines demographic analyses, comparative profiling of other regional towns, one-on-one interviews, literature review and community surveys to identify and prioritise community needs.

Karratha 2020 identifies the shifting role for Karratha from a principally resource driven settlement to a sustainable, economically diverse regional city of 30-50,000 people by 2020. *Karratha 2020* advocates for a number of projects now currently complete, still underway, or needing to be incorporated in this *Strategy* as future priorities.

Karratha Revitalisation Strategy (*DRAFT* – 2015)

The *Karratha Revitalisation Strategy (KRS)* aims to identify opportunities and key actions required to improve the liveability of the suburbs of Pegs Creek, Millars Well and Bulgarra, as Karratha grows towards its goals of becoming a Pilbara City.

The revitalisation works identified involve a variety of actions to be undertaken by a range of bodies and people, including landowners, the City of Karratha, other government agencies and the community. The *KRS* sets no strict timeframe for implementation, acknowledging that it will be influenced by market forces, priorities and available resources. Its implementation however, will ensure that future individual developments (Greenfield and infill sites), redevelopment and improvements are guided by a longer term strategic vision, consistent with the intent of the *KCN* and this *Local Planning Strategy*. The KCR anticipates that this will provide a framework for:

- A consistent approach with existing strategic policy and planning aspirations;
- Identification of appropriate sites, which are development ready;
- Identification of priority and focus areas; &
- Implementation actions and short, medium and long term timeframes.

The KRS recognises that the City and Western Australian Planning Commission, through its decisions on planning, subdivision and development applications, as well as the City's governing maintenance and development of parks, pathways, roads and swales, revegetation and other amenity improvements will be major influences on its successful implementation.

3.3 Local Structure Plans

Point Samson Structure Plan (*DRAFT* – 2015)

Currently in its early stages of preparation, the *DRAFT Point Samson Structure Plan* seeks to establish an appropriate framework for future growth of the Townsite to accommodate an ultimate population of up to 1,000 people. The plan recognises a number of significant constraints that make short-to-medium implementation unlikely. As a result, this *Strategy* makes use of the Structure Plan in identifying future growth areas, but forecasts the majority of growth occurring outside its 2031 planning horizon.

Roebourne Structure Plan (2014)

Recently advertised for public comment, the *Draft Roebourne Structure Plan* identifies capacity for significant growth in Roebourne (up to a population of 3,000), as well as a number of crucial development issues that must be addressed in order for Roebourne to be reinvigorated as a safe, amenable, attractive and vibrant place to live and work.

The *DRAFT Roebourne Structure Plan* incorporates both infill and urban expansion opportunities to accommodate growth. It also highlights two key activity clusters; one with a community focus at the northern end of the town centre, and one with a heritage building and business focus to the south. The proposed development framework, and development capacity identified have been important in informing the growth areas of this *Strategy*, taking into consideration the population growth expected for Roebourne in the timeframe of this Strategy.

Wickham Townsite Structure Plan (2011)

The *Wickham Townsite Structure Plan* was prepared by Taylor Burrell Barnett for Rio Tinto and has been adopted by the City of Karratha. The plan was the result of agreement between Rio Tinto and the City to collaborate to address growth and development options for Wickham in light of Rio Tinto's planned expansion of operations at Cape Lambert. The Structure Plan advocates a staged approach to residential development, based on two forecast growth population thresholds (3-4,000 and 5-6,000), with the following forming Key Principles of the *Wickham Townsite Structure Plan*:

- To consolidate and expand the pattern of land use for Wickham based on the existing zoned 'footprint' of the town.
- Improve and build upon the road network existing within the town.
- To achieve functional areas of POS.
- To provide a focal point for entry into, and revitalise the Town Centre Area.
- To achieve sustainable growth for the urban environment.
- To provide diversity of housing types and land ownership.
- To guide the preparation of future Development Plans so that coordinated planning outcomes can be achieved.
- To identify areas for potential development by third parties.

The *Wickham Townsite Structure Plan* is given due consideration and incorporated in the City-wide *Strategy,* taking into consideration the population growth expected for Wickham in the timeframe of this *Strategy*. Construction of the first stage of urban expansion to the south of the existing townsite has recently been completed. Analysis of this current planning and development trajectory in Wickham has played an important role in the formulation of this *Strategy*.

Draft Dampier Structure Plan (2015)

The draft *Dampier Structure Plan* is being prepared by Urbis to guide the future development of the Dampier townsite. The *Dampier Structure Plan* is considering development options based primarily on the existing constraint of limited capacity within the Waste Water Treatment Plant remaining in place. The hypothetical scenario where the WWTP constraint is overcome is also considered.

Given the WWTP constraint and the limited capacity for additional dwellings, the *Dampier Structure Plan* considers the optimum location of new development. The *Dampier Structure Plan* also considers where renewal of the existing area(s) should occur via subdivision and redevelopment.

4.0 General City Profile

The City of Karratha is one of four local government areas in the Pilbara region. Located approximately 1,200km from Perth, it is an expansive local government area, covering approximately 15,278 km².

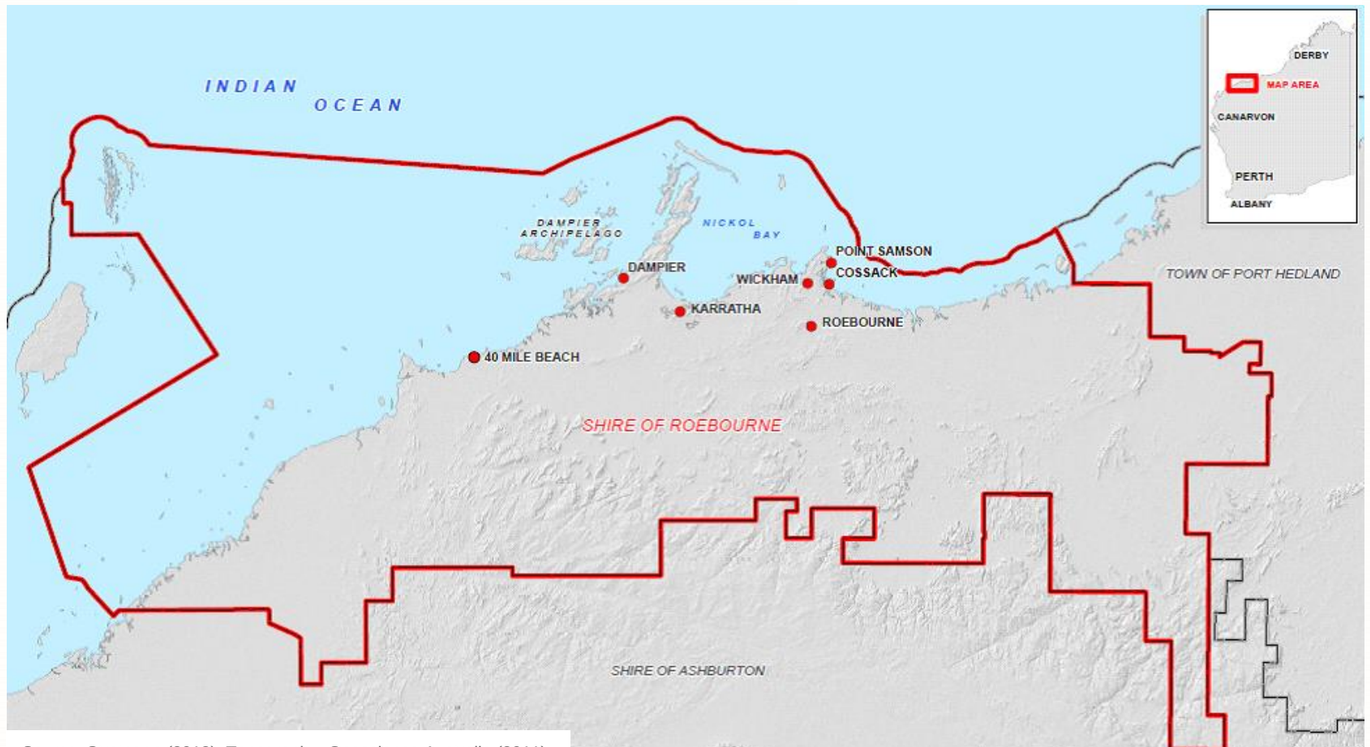
The City is bordered by the Town of Port Hedland to the east, and the Shire of Ashburton to the south. It consists of approximately 350 km of Indian Ocean coastline to the north and west. **Figure 7** (beside) displays the City of Karratha local government area.

The vast land area is characterised by minimal settlement, except in the northern coastal area generally between the Burrup Peninsula and Cape Lambert. All of the City's major settlements are congregated in this coastal area.

The City's major settlements include Karratha, Dampier, Wickham, Roebourne and Point Samson. Karratha accommodates over 70 per cent of the City's total population, and currently fulfils the role of the primary service centre for the City and West Pilbara Region. A handful of other outlying communities and townsites comprise a very small proportion of the overall population. Both State and local strategic planning directives encourage growth of existing settlements over the establishment of new settlements, and it is anticipated future population growth for the City will be contained within the existing settlement framework. **Figure 8** represents the preferred growth pattern for the City's settlements.

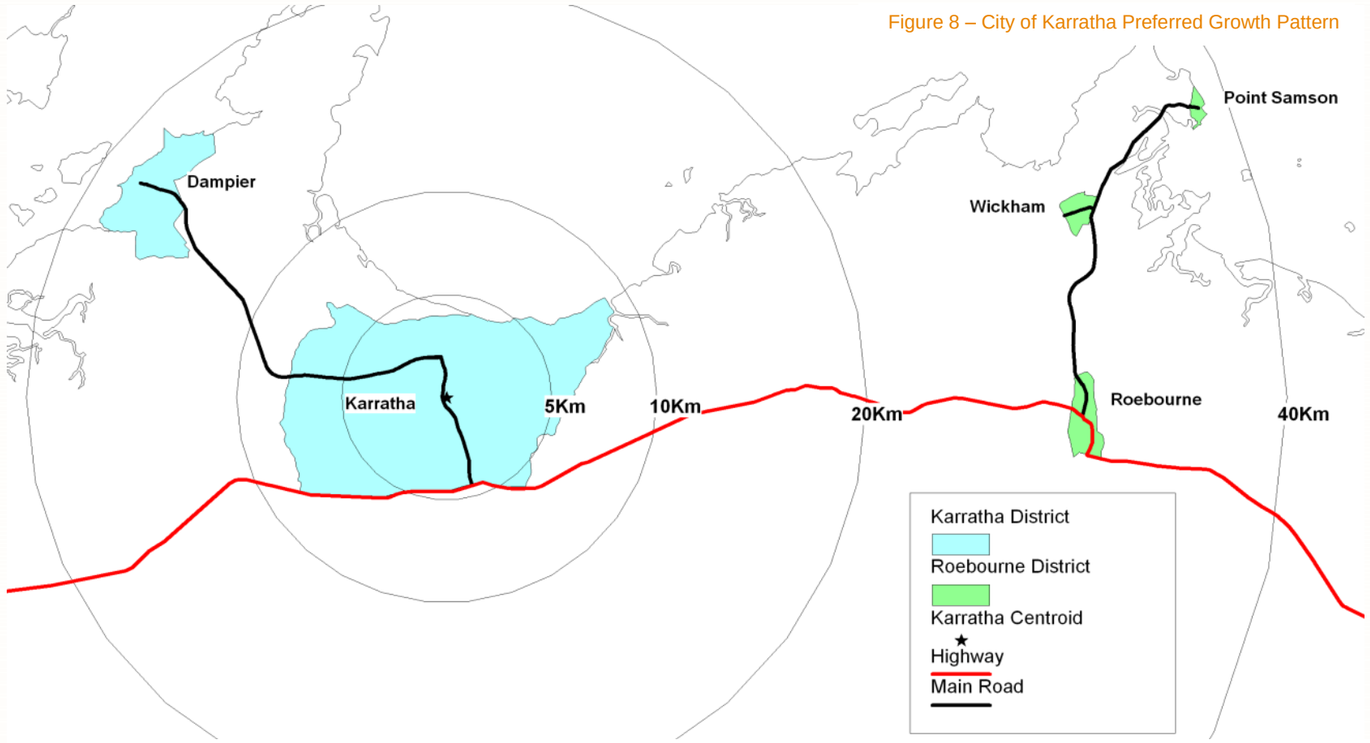
Its location in the economic powerhouse region of the Pilbara is an important aspect to the future planning of the City of Karratha. The economic imperative of the region has instigated a wealth of State government funding and associated regional level planning in recent years in the form of the Pilbara Cities initiative. The robust regional level planning framework establishes a trajectory for the future of the City within the Pilbara region-wide context. The planning aspires for Karratha and Port Hedland to become robust and diverse liveable regional cities of the Pilbara. This Local Planning Strategy supports this vision and seeks to coordinate planning for growth of the City of Karratha to achieve Regional Centre status for the Pilbara.

Figure 7 – City of Karratha Local Government Area



Source: Strategen (2013); Topography: Geoscience Australia (2011)

Figure 8 – City of Karratha Preferred Growth Pattern



Source: City of Karratha

5.0 Theme 1: Community

5.1 Local Profile: Population & Housing

Current and Projected Population

There are several sources of population projection data available for the City of Karratha. These show some variation. For reference, the 2011 Census reports 22,900 residents (Place of Usual Residence) in the City and the ABS Estimated Resident Population for the City at June 2011 is 23,634 and 24,626 at June 2012. The latter figure adjusts for missing data, for example, residents who were overseas at Census time.

The population of the City of Karratha is highly dependent on economic activity in the City. It is therefore closely linked to an Economic Development Strategy and the success of various elements of that strategy.

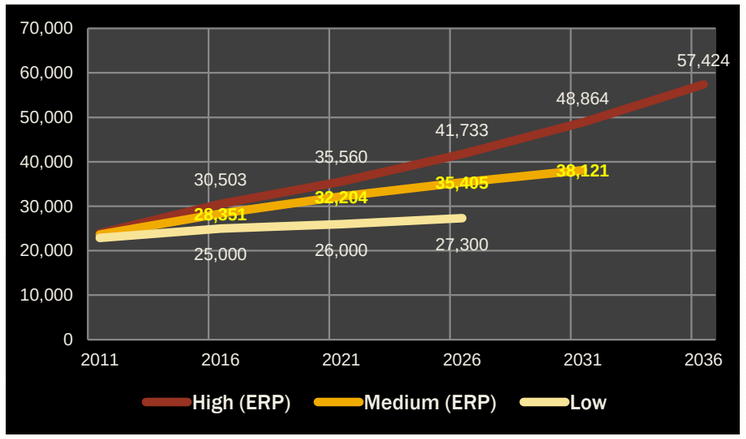
Three scenarios were identified to guide this *Strategy*:

1 Low: (WA Tomorrow, Band E) - The low scenario is consistent with results of the CME / PWC study and is the WA Tomorrow band most closely corresponding to the 2011 Census (WA Tomorrow has a 2006 base). It assumes limited economic diversification and no substantial new resources projects.

2 Mid: (Forecast id, City of Karratha 2014) - The mid scenario is the id Consultants projections. It is consistent with current development activity and developer intentions. It assumes some economic diversification.

3 High: The high scenario is consistent with the *Karratha City of the North* and *Pilbara Cities* strategy, as reflected in the *Pilbara Planning and Infrastructure Framework*. This publication contains slightly modified and more detailed projections compared with the original 2010 KCN plan. It aims for a population of 50,000 in Karratha / Dampier in 2035. It assumes significant economic diversification.

Figure 9 – City of Karratha: Low, Medium & High Population Scenarios



Source: Syme Marmion; Forecast id (City of Karratha)

Estimated Resident Population

The population projections prepared for the City by id. Consultants are based on the *Estimated Resident Population (ERP)*. *ERP* is calculated at the 30th June each year and calibrated to the most recent *Census of Population and Housing*. The process involves:

- adding the people who were temporarily absent from the area on Census night;
- subtracting the overseas visitors counted in the area on Census night;
- augmenting the figure for estimated net undercount in the census;
- adjusting for difference between census night and 30th June; and
- updating each year using administrative data from a variety of sources.

ERP is more accurate than the figures from the *Census of Population and Housing* as *ERP* corrects for the undercount and discrepancies associated with multiple places of residence from the *Census*. The *ERP* statistic also has a number of limitations, including:

- they are available for local government areas only
- they estimate the resident population of an area, meaning that they do not include transient (FIFO) workers.

ERP is a good estimate on which to base this *Local Planning Strategy* as it is the best estimate of the residential population of a community at any one time and therefore the demand for infrastructure and community facilities.

Under the medium and high growth scenarios, by 2031 the population of the City will be between 38,100 and 48,800. This compares with a current population of around 25,000. Both scenarios therefore forecast significant growth in the current population within the planning timeframe. The speed and scale of this depends in large measure on the extent to which the economy diversifies around its very strong base in the minerals and energy sector.

This *Strategy* seeks to facilitate significant local economic development and diversification, in a manner that would allow the high population forecast to be achieved. Its immediate focus however, is on accommodating growth in line with the medium growth scenario by 2031, which reflects the most recent population growth forecasting by Forecast id. Consulting.

Table 1: City of Karratha: Low, Medium & High Population Scenarios

Year	High (ERP)	Medium (ERP)	Low
2011	23,926	23,619	22,900
2016	30,503	28,351	25,000
2021	35,560	32,204	26,000
2026	41,733	35,405	27,300
2031	48,864	38,121	
2036	57,424		

Source: Syme Marmion; Forecast id (City of Karratha)

FIFO

Fly-in-Fly-Out (FIFO) workers are a significant and variable component of the population within the City of Karratha. Exact figures are difficult to obtain as Census data is reported by place of usual residence, on which the *ERP* is based, and place of enumeration. The latter reports the population of a particular location at the time of the Census.

It is important to note that for most locations there are only relatively minor aggregate differences between the place of residence and place of enumeration data. The difference in the City of Karratha however, is large. This points to the relatively large numbers of FIFO workers in the City at various times. This number fluctuates over time. This is illustrated in the table below.

Table 2: City of Karratha: Place of Residence vs Enumeration

	2006	2011	Change
Place of Usual Residence	16,423	22,900	+ 6,477
Place of Enumeration	19,352	29,968	+ 10,616
Difference	2,929	7,068	

Source: ABS Census Cat 2001.0 Table B01 and Cat 2003.0 Table T01 / Syme Marmion

The difference between the two totals (i.e. approximately 2,929 in 2006 and 7,068 in 2011) gives an indication of the approximate scale of the FIFO workforce in the City. Note that the very substantial increase between 2006 and 2011 is likely to be predominantly **construction**-related.

A comprehensive study by the AEC Group in 2012, estimates a 2012 City FIFO population of 10,719. A report by Syme Marmion & Co estimates a long-term FIFO operations workforce of around 2,000 – 2,500 broken down as follows:

- Woodside: 300
- Rio Tinto: 600-650
- Others: 1,000-1,500

Depending on the final arrangement for Cape Preston operations this may be a little higher, but is unlikely to exceed 3,000 – 3,500.

The issues surrounding the impact of FIFO on the housing sector and demands for community infrastructure are discussed later in this report.

Assessing the Scenarios

To enable planning and infrastructure decision to be made some assessment of the scenarios is useful. There are several ways in which they can be assessed, including investigating the drivers of growth and by reference to the history of similar communities.

Drivers of Growth

For a small and remote community such as the City of Karratha population dynamics are strongly linked to economic activity. The City currently has a relatively narrow but very robust economic base. It is:

- a processing, port and service base for off-shore LNG;
- a port and service base for in-land iron ore (high-quality hematite) operations;
- a port and processing base for iron ore (magnetite) mining operations;
- a producer of selected other minerals (e.g. salt); and
- an administration and regional government centre.

The vast majority of the population is directly or indirectly dependent on this economic base. The core industries (LNG and iron ore) have experienced a period of very substantial construction, commencing in the early 2000s. All evidence is that this is now largely completed, with few major new construction projects currently in prospect in the City. There are some new construction projects in early stages of commencement outside of the City (e.g. the Roy Hill project) and these may result in some spin-of activity in the City, for example in construction contracting, supplies and support.

This transition from construction to operations in the minerals and energy sector is common across the State. According to the Chamber of Minerals and Energy WA (CMEWA) in Western Australia:

The workforce required for growth plans in the resources sector is projected to peak at 125,000 people in 2014 - around 9,000 above the 2012 workforce of 116,000.

- *After the peak in 2014, employment will slowly reduce as the current wave of construction activity gives way to operations. From 2018, the workforce will reduce to below 2012 levels.*
- *Driven by the completion of construction of a number of major projects, the construction workforce will peak in 2014 before declining to 24,000 below 2012 levels in 2018.*
- *As major projects commence operation, the operating workforce will increase strongly to 2018, with an additional 19,000 operational staff required.*

The Pilbara is forecast by CME to require 9,000 fewer workers in 2018. This fall comprises a reduction of 23,000 construction workers, partially offset by 14,000 additional operational workers.

This is consistent with the 2012 CMEWA *People for the Pilbara Report*. This Report, released by the Chamber of Minerals and Energy and prepared by Price Waterhouse Coopers (PWC), investigates all resources projects currently underway, committed or in planning (up to a stage of preliminary feasibility study) and uses a weighting methodology incorporating the probability of any individual project proceeding to provide estimates of labour demand from resources projects.

The CME/PWC report uses indirect employment multipliers and family population multipliers to arrive at estimates of population change in Pilbara LGAs arising from resources projects.

The overall conclusions for the City of Karratha are:

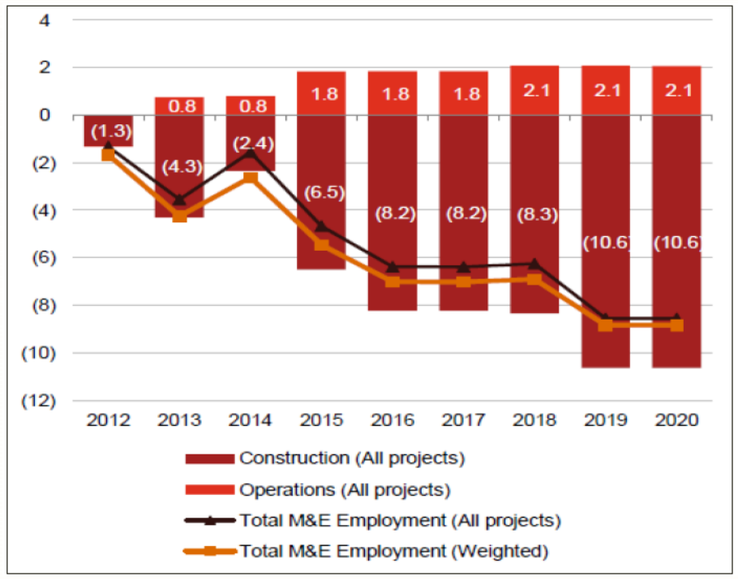
- The City will experience a decline in the overall workforce directly related to minerals and energy projects. This decline has already commenced with the completion of the Pluto construction phase and will commence in 2014 and increase through to 2018.
- A major driver of the decline is the large construction workforce already employed in the area in 2011. This workforce will decrease as the current set of projects is completed.
- Although there will be a corresponding increase in the operations workforce, it will not be large enough to offset the decline in construction personnel.

The expectation is therefore for some increase in operational workforce to 2020 (around 2,100 increase over 2011), but for a very substantial decrease in construction workforce (up to 10,600 by 2020) as projects are completed.

This would only change if new projects not yet at a stage of preliminary feasibility study were to arise before 2020 and if major infrastructure projects, for example Anketell Port were to commence within that time. If this were to occur it would likely extend the duration over which the construction FIFO workforce was a significant factor in the economy of the City (for example extending demand period for short-stay and TWA accommodation), but the end outcome would be similar to that described here.

The expected change in minerals and energy projects workforce is shown in the following graphs. The first shows quite substantial decreases in the FIFO construction workforce and small increases in the operational FIFO workforce and residential workforce:

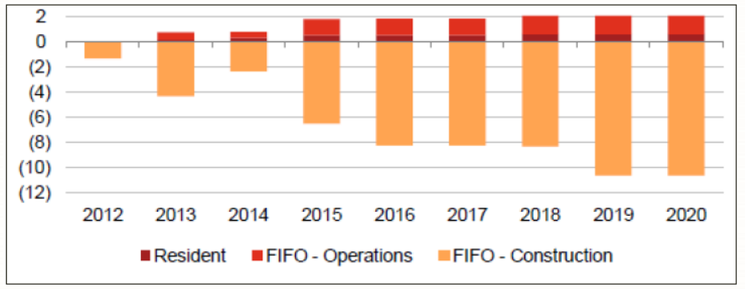
Figure 10: City of Karratha: Minerals & Energy Workforce by Type



Source: CMEWA / PricewaterhouseCoopers (2012) / Syme Marmion

The expected impact of these changes on the FIFO and residential workforce population is shown in **Figure 11** below.

Figure 11: City of Karratha: FIFO vs. Residential



Source: CMEWA / PricewaterhouseCoopers 2012 / Syme Marmion

Any *Economic Development Strategy* prepared for the City must recognise the need for significant diversification of the economic base if the City is to avoid the fluctuations common to communities that are dependent on the resources industry alone. It identifies four main areas of potential for expansion as means of diversification:

- Tourism;
- Agribusiness;
- Regional and Specialist Education and Research; and
- Regional Services.

While each one of this has potential in the City, each also has barriers to overcome. There is therefore a wide variation in estimates of the contribution each will make to the economic life of the City.

On the other hand, there are several factors that will put downward pressure on the further growth of the City. These include:

- **The steady introduction of remote operations technology**

Rio Tinto Iron Ore has an active program to introduce remote operations technology to its mining and logistics operations, with one objective to reduce the labour force located in remote areas. While much of this applies to the mine site, it also applies to transport and logistics, with the result that increased production volumes will not be linearly correlated with labour demand.

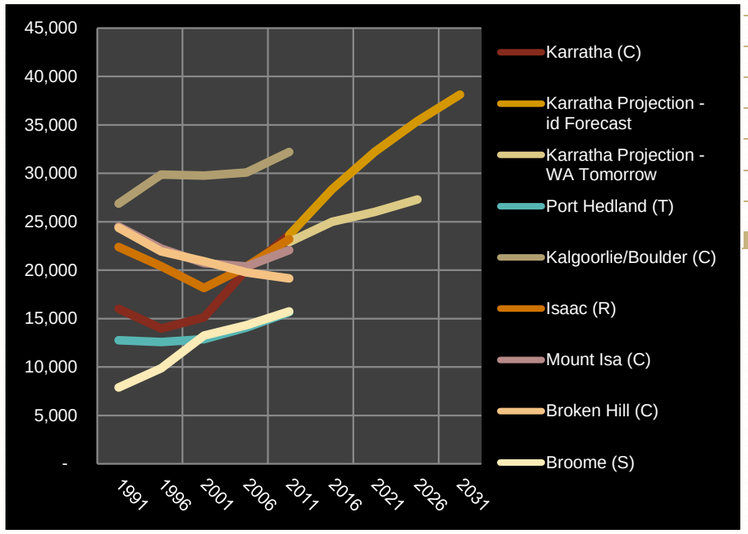
- **A reduction in FIFO workers in the City**

The CME / PWC report estimates the indirect employment multiplier of FIFO construction employment worker of up to 1.97. This is based on the indirect employment multiplier for resident workers. There is little research on this and the FIFO multiplier must be taken as an upper bound. Nevertheless, FIFO employment does have spin-off effects to the local economy and thus the multiplier is greater than 1. However, the relationship is not symmetrical – increased economic activity and thus indirect employment resulting from increases in FIFO numbers does not equate to an equal reduction in indirect employment numbers when FIFO number decrease. Still, there will be a decrease in spin-off economic activity as FIFO numbers decrease and thus a dampener on population growth generally.

Growth Rates in Other Resource-Economy Communities

In addition to the various forecasts provided for the City the growth rates and patterns for other comparable resource communities have been examined. The recent population history (from 1991 to 2012) of some other communities in Australia in which resources mining forms an important or dominant part of the economy is shown in the graph and table below. It is compared with the WA Tomorrow and Forecast id. projections for the City of Karratha.

Figure 12: Population Growth – Selected Resource Communities



Source: Syme Marmion

The pattern observed across these remote resource dependant settlements is one of many fluctuations in population growth, particularly:

- The City of Karratha had no growth at all in the period prior to 2002 and then has grown at 4.4% p.a. in the 10 periods from 2002.
- Port Hedland grew at 0.7% p.pa. prior to 2008 and at 3.1% p.a. in the 4 subsequent periods
- Kalgoorlie grew at 1.8%p.a. in 7 periods from 1991, then declined at -0.2% p.a. until 2006 and grew at 1.6% p.a. to 2012.
- Isaac, containing the Bowen Basin Coal mines in Queensland, declined in population at a rate of -2.1% p.a. from 1991 to 2001 and then grew at 2.4% p.a. in the 11 years to 2012.
- Mt Isa has shown an overall decrease in population from 1991 to 2012, declining at a rate of -1.6% p.a. in the 13 years to 2004 and then growing at 1.6% p.a. in the 8 years to 2012.
- Broken Hill's population declined at a rate of -1.2% p.a. between 1991–2012.
- Broome, which has a diverse economy (pearling, a strong tourism industry, fishing, agriculture, aquaculture, pastoral and off-shore exploration industries) has grown at 3.5% p.a. in the 21 periods to 2012.

It is interesting to note the consistent growth pattern of Broome of 3.5% over 21 years. This is driven by the diverse local economy.

The average annual growth rates for each of the above settlements is shown in **Table 3** below.

Table 3: Growth (AAGR), Selected Resource Communities

	Period	AAGR	# periods	Period	AAGR	# periods	Period	AAGR	# periods	Period	AAGR	# period
Roebourne	**1991 - 2012**	2.1%	21	**1991 - 2002**	0.0%	11	**2002 - 2012**	4.4%	**10**			
Roebourne - id forecast										**2011 - 2031**	2.4%	20
Roebourne - WA Tomorrow										**2011 - 2026**	1.2%	15
Port Hedland	**1991 - 2012**	1.1%	21	**1991 - 2008**	0.7%	17	**2008 - 2012**	3.1%	**4**			
Kalgoorlie	**1991 - 2012**	1.0%	21	**1991 - 1998**	1.8%	7	**1998 - 2006**	-0.2%	**8**	**2006 - 2012**	1.6%	6
Isaac	**1991 - 2012**	0.3%	21	**1991 - 2001**	-2.1%	10	**2001 - 2012**	2.4%	**11**			
Mount Isa	**1991 - 2012**	-0.4%	21	**1991 - 2004**	-1.6%	13	**2004 - 2012**	1.6%	**8**			
Broken Hill	**1991 - 2012**	-1.2%	21									
Broome	**1991 - 2012**	3.5%	21									

Source: ABS Cat 3222.0 / Syme Marmion / Forecast .id (City of Karratha)

Under the latest .id Consulting forecast projections, the City would grow from a population of 15,118 in 2001 to 38,121 (inclusive of FIFO) in 2031, an annual average growth rate of 3.1% over a 30-year period. This is considered to be a very high rate of growth, particularly when forecast over 30 years.

Long term growth the City will be in the context of overall population growth in Western Australia, and particularly outside of the Perth metropolitan area. The ABS has recently provided long term population projections for Australia, including for areas of Western Australia outside of Perth.

There are three series. Each shows modest growth (between 0.2% and 0.5%) in the period 2013 to 2036 and reduced growth, or even a population decline in the period 2036 to 2061. These are shown in the table below.

For reference, the Greater Perth area is expected by the ABS to grow at between 2.3% and 3.2% p.a. in the period 2013 to 2036 and at between 1.3% and 2.1% p.a. between 2036 and 2061.

Table 4: Population Growth (AAGR), WA (outside of Perth Metropolitan Region)

	Period	AAGR	# Periods	Period	AAGR	# Periods
Series A	2013 - 2036	0.5%	23	2036 - 2061	0.2%	25
Series B	2013 - 2036	0.3%	23	2036 - 2061	-0.2%	25
Series C	2013 - 2036	0.2%	23	2036 - 2061	-0.2%	25

Source: ABS Cat 3222.0 / Syme Marmion

A Population Model

The comparative analysis in the previous section suggests that the average annual growth rate applied by Forecast .id (3.1%) is quite high when compared to other similar locations. Western Australia's wider growth patterns have been within the context of the fortunes of the mining industry, particularly for the non-metropolitan regions and these growth rates are considerably lower than those used for City of Karratha estimates.

For comparative purposes a basic population model was produced by Syme Marmion in 2014 which links forecast economic activity in the City with population (tied to *ERP*) and FIFO numbers.

Methodology and Assumptions

The overall methodology is to:

1 Estimate the direct employment from the economic sectors that form the economic base of the City (principally those sectors that export goods or services outside of the region). Data is reported and analysed as an increment on the preceding year, with 2011 as a base year.

2 Estimate the indirect employment resulting from an incremental increase in direct employment in the base economy. The indirect multiplier is only applied to the increase in resident worker numbers. As noted previously, given the expected decrease in FIFO numbers the indirect employment effects for them are disregarded.

3 Using family multipliers, estimate the annual population increment resulting from direct employment changes in the base economy and the indirect employment arising from that.

The main assumptions are and data sources are:

- The population base is the 2012 *ERP*.
- Direct and indirect employment effects are calculated to 2021. From 2021 to 2031 an overall population growth rate of 1.5% p.a. is applied.
- Employment multipliers are as per Pilbara Development Commission, Pilbara Regional Economy V2 (March 2012)
- The family multiplier (resident worker) is 2.48
- Direct minerals and energy employment is as estimated in the CMEWA / PwC report. This includes all minerals and energy projects at least to a stage of pre-feasibility study.
- Additional minerals and energy projects are allowed for in the model. The model assumes construction of Anketell port in 2020/21.
- The model estimates employment growth in other sectors of the base economy, the so-called diversification projects, namely:
  - Tourism;
  - Agribusiness;
  - Regional and Specialist Education and Research; &
  - Regional Services.

Results

The model shows City residential population (*ERP*) as follows:

Table 5: Estimated Resident Population Growth, City of Karratha

2011	2016	2021	2026	2031
23,634	28,102	30,390	32,758	35,268

Source: Syme Marmion

This gives the following average annual growth rates:

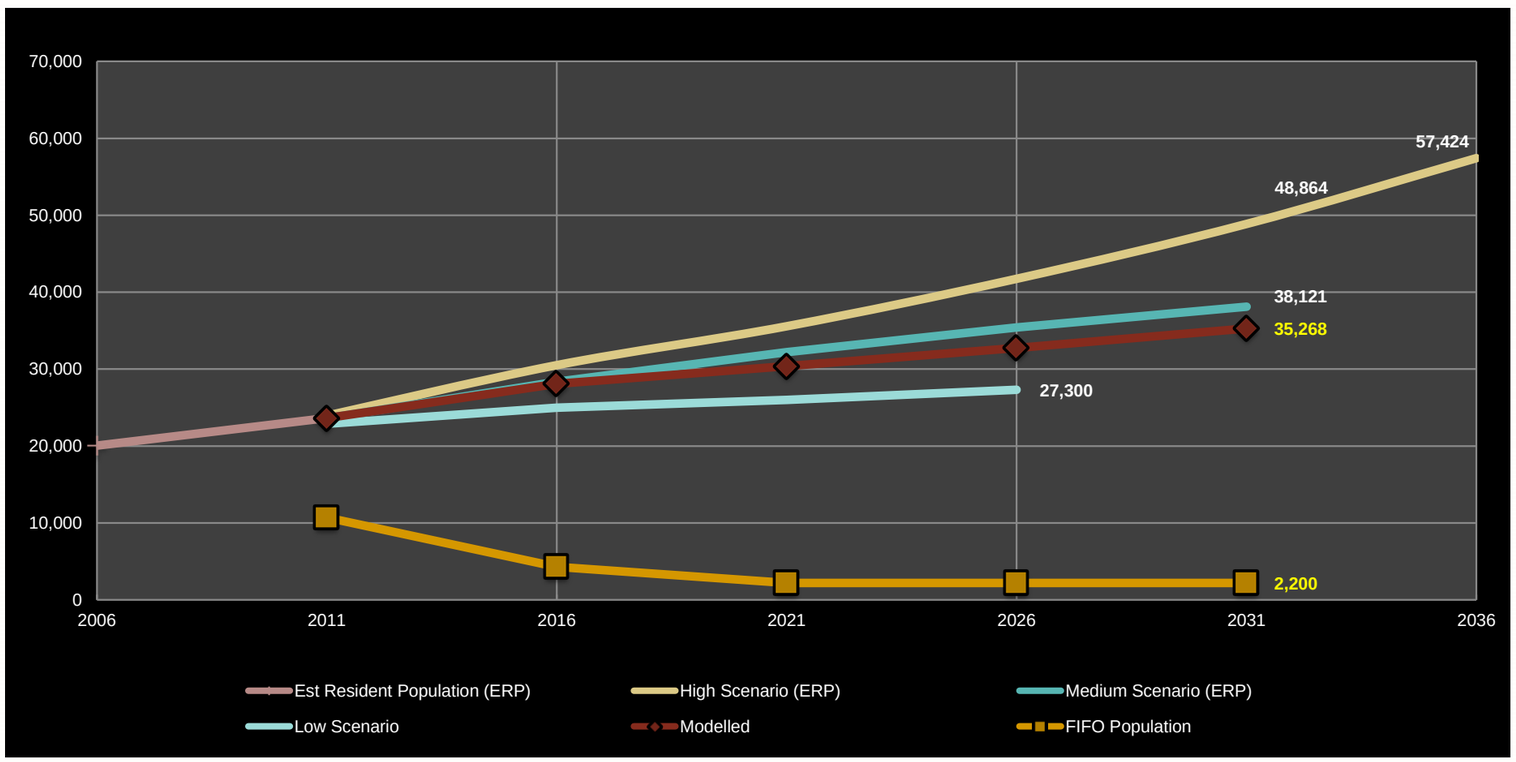
Table 6: Population Growth (AAGR), City of Karratha

Ave Annual Growth Rate 2011 - 2016	3.5%	calculated
Ave Annual Growth Rate 2016 - 2021	1.6%	calculated
Ave Annual Growth Rate 2021 - 2031	1.5%	estimated

Source: Syme Marmion

The comparison of the modelled population and the high, medium (.id Consulting) and low (WA Tomorrow) projections previously identified are shown in the following graph. The graph also shows the projected FIFO population for the City over time.

Figure 13 – Population Scenarios & Modelled Population Growth



Source: Syme Marmion; Forecast .id (City of Karratha)

The points to note from this model & graph include;

- The combined resident and FIFO population for the City of Karratha by 2031 grows to 37,468.
- The FIFO population has already been observed to fall from a high in 2011 to 2013 with an increase in 2014 – sourced from CME / PWC.
- The gradual decline in FIFO has been assumed to plateau, as a combined impact of increasing minerals exports and changes in employment rates in these industries.
- Strong growth in resident population is still forecast up to 2016
- Adding the FIFO population brings this forecast very close to the Medium Scenario.

This work suggests that it would be acceptable to plan for the medium range of population growth. Whilst this analysis suggests is that it is unlikely that the High population forecast of 48,864 will be reached by 2031, it is important to note that strategic land use planning is about protecting development options and ensuring that the City can accommodate a growing population.

Concluding Comments on Population Forecasts

Karratha and other remote resource towns have weathered sudden changes in population growth in the past, so it is important that the aspiration target population of 50,000 also be used when considering planning decisions for growth over the next 15 years. Opportunities to accommodate this figure will not be closed.

The cost of developing land in the City is very high when compared to other parts of the State and due to the dominance of Crown land lead times can also be very high.

This *Local Planning Strategy* seeks to strike a balance between:

- providing high cost developed land ready for the next boom but too early
- leaving the City with a shortfall of developed land with long lead time to the next releases.

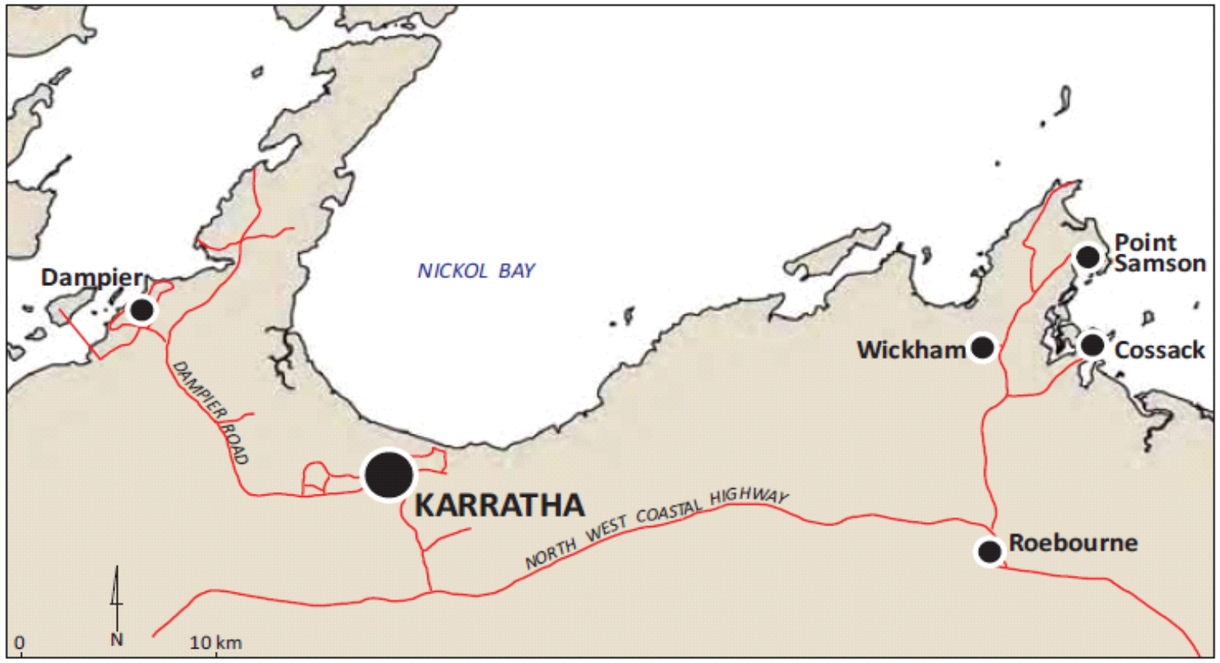
The intent of this *Strategy* is to prepare for the next wave of development so that a population of 50,000 can be accommodated at some point in the future while the infrastructure to meet the other needs of the population can more closely follow forecast population patterns. With such a potentially volatile population growth it is important that this strategic planning document is frequently reviewed and the population growth patterns including distribution of the growth is closely monitored.

Both the Medium and Low growth scenarios rely on at least some level of economic diversification. To reach even the Low growth figures a considerable amount of economic diversification is required. One of the lead indicators of population growth is the broadening of employment patterns away from the current domination of the construction and mining industries.

Population Distribution

The population within the City is distributed primarily over the five key settlement areas (Karratha, Dampier, Roebourne, Wickham and Point Samson). **Figure 14** shows the distribution of the settlement areas within the City of Karratha.

Figure 14: Existing Settlement Pattern



Source: Karratha City of the North (2010)

Karratha

The town of Karratha has developed into the largest and most economically diverse community in the Pilbara. Karratha has higher order services, facilities (education and training, government offices and health services) and the largest and most diverse shopping centre in the Pilbara. All facilities and services are concentrated in the town centre.

Karratha is the City's major population centre and had an ABS Census population figure around 17,000 in 2011. Karratha is expected to continue to accommodate the majority of the City's population and be the major focus of future residential development.

Dampier

Dampier is in the process of transferring its services and facilities historically run by Hamersley Iron (Rio Tinto) to be operated by usual government agencies. The City of Karratha now administers the town, with private home ownership increasing, primarily through Hamersley Iron's home purchasing scheme. Based on ABS Census data, Dampier had a population of around 1,350 in 2011.

Roebourne

Roebourne is located 39km east of Karratha on the banks of the Harding River. Roebourne continues to develop and is a thriving hub for Aboriginal enterprise and culture. Roebourne had a population of about 800 in the 2011 Census, of which 338 were non-Aboriginal people.

Wickham

Wickham is located 8km north of Roebourne. It has a close relationship with Cossack, Roebourne and Karratha. Residents of Wickham are likely to use Point Samson and Cossack for recreational purposes and Karratha for higher order services. Wickham had a population of around 2,200 in 2011.

Point Samson

Point Samson is a coastal community sited about 4km east of Cape Lambert. The population of Point Samson in 2011 was approximately 300 people.

Cossack

No population growth is planned for Cossack. This represents that there is no permanent habitation of this historic settlement.

Population Projections by Settlement

Table 7 shows the projected population in the settlement areas under the medium population projection, indicating that:

- In 2011 around 28% of the City's population was located in the settlement areas outside of the Karratha District;
- By 2031 the population within the Karratha District is expected to increase by at least 89%; and
- By 2031 only 21% of the population will reside outside the Karratha District.

Table 7: Population Projections by Settlement Area – Medium Growth Scenario

Year	2011	2016	2021	2026	2031
Karratha District	16,944	20,790	24,500	27,451	30,120
Dampier	1,310	1,334	1,340	1,355	1,363
Wickham - Point Samson	2,336	3,004	3,128	3,332	3,347
Roebourne / City Remainder	2,979	3,224	3,237	3,266	3,291
City Total	23,619	28,351	32,204	35,405	38,121

Source: Forecast .id (City of Karratha 2014)

As the City plans for a growing population, consideration must be put to how this population might be distributed. Development capacities of each settlement, current settlement level redevelopment and structure planning initiatives have been considered to identify how the high population growth scenario might best be distributed across the City. The distribution pattern was also tested through key stakeholder and community consultation. Broad agreement on the following distribution (as also depicted in **Table 8**) was reached:

- Karratha remaining the major population and service centre of the City, accommodating 75-80% of the City's population (approx. 37,200 to 40,200);
- Redevelopment of Dampier to harness its tourism and residential amenity opportunities with growth of its population to between 3,000 and 3,500; and
- Coordinated growth of the eastern corridor settlements (to achieve a threshold population to provide for local level services, while avoiding unnecessary duplication) as follows:
  - Wickham 5,000 to 6,000
  - Roebourne 1,500 to 2,800
  - Point Samson 300 to 500

Table 8: Proposed Population Distribution by Settlements – High Growth Scenario

Year	2021		2031	
Population Range	**Low**	**High**	**Low**	**High**
Karratha	27,663	28,785	37,200	40,200
Dampier	2,231	2,506	3,000	3,500
Roebourne	1,115	2,005	1,500	2,800
Wickham	3,718	4,296	5,000	6,000
Point Samson	223	358	300	500

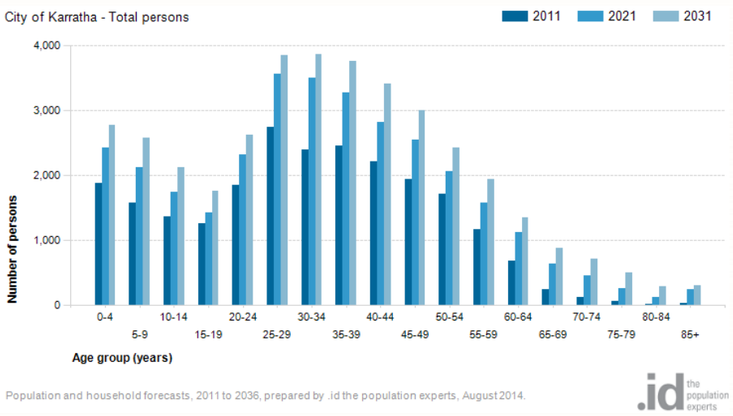
Source: Syme Marmion

5.2 Demographics

Age Distribution

The age distribution of the projected population for the City is likely to change over time. **Figures 15 & 16** below shows the most recently forecast demographic change for residents in the City out to 2031.

Figure 15 – Forecast Age Structure by 2031



Population and household forecasts, 2011 to 2036, prepared by .id the population experts, August 2014.

Key Projections

The projections indicate that by 2031, the population of the City will include:

- An increasing proportion of school-age children: by 2031 there will be over 6,450 in the 5 – 19 age groups, compared with around 4,200 in 2011;
- Increasing numbers, but a decreasing proportion of people aged between 20 – 49 (from 57.5% to 53.9%), in particular 20 – 30 year olds (from 19.4% to 17%); and
- A substantial increase in over 55 age groups: by 2031 there will be over 4,000 people aged over 60 in the City, compared with around 1,000 in 2011.

Population and the Workforce

Changes in the City's economy over time will result in workforce changes and consequent demographic changes. The main labour force scenario is for:

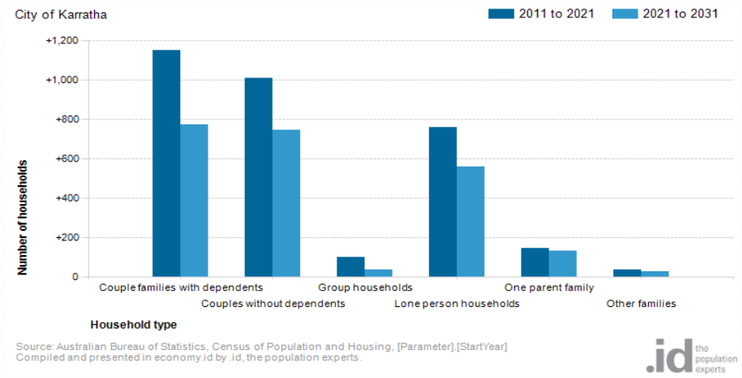
- Reduction in FIFO numbers as construction activity is completed;
- Stabilisation of operational workforce;
- Growth of service population (consumer services);
- Possible growth of producer services; and
- Some increase in knowledge intensive producer and consumer services.

The gender balance in the City is currently heavily skewed towards males both on measures excluding FIFO (place of usual residence) and those including the FIFO workforce (place of enumeration). This balance is expected to move closer to 50:50 over time as construction projects wind down and services employment increases.

Household Composition

The projection by .id Consulting for the City shows little change in relative proportions of household types over time, as depicted in **Figure 17**.

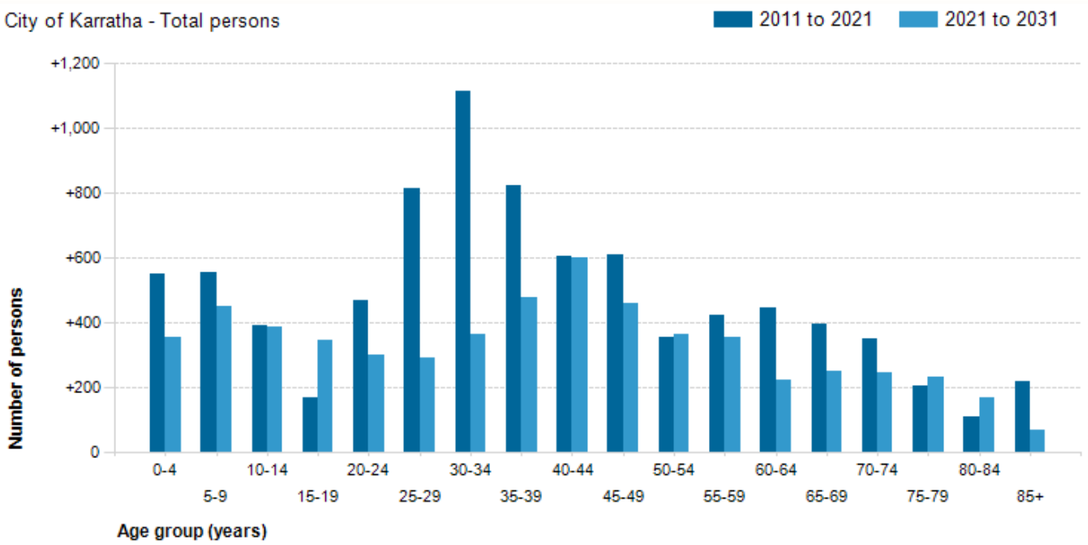
Figure 17 – Forecast Change in Household Types



Source: Australian Bureau of Statistics, Census of Population and Housing, [Parameter].[StartYear]
Compiled and presented in economy.id by .id, the population experts.

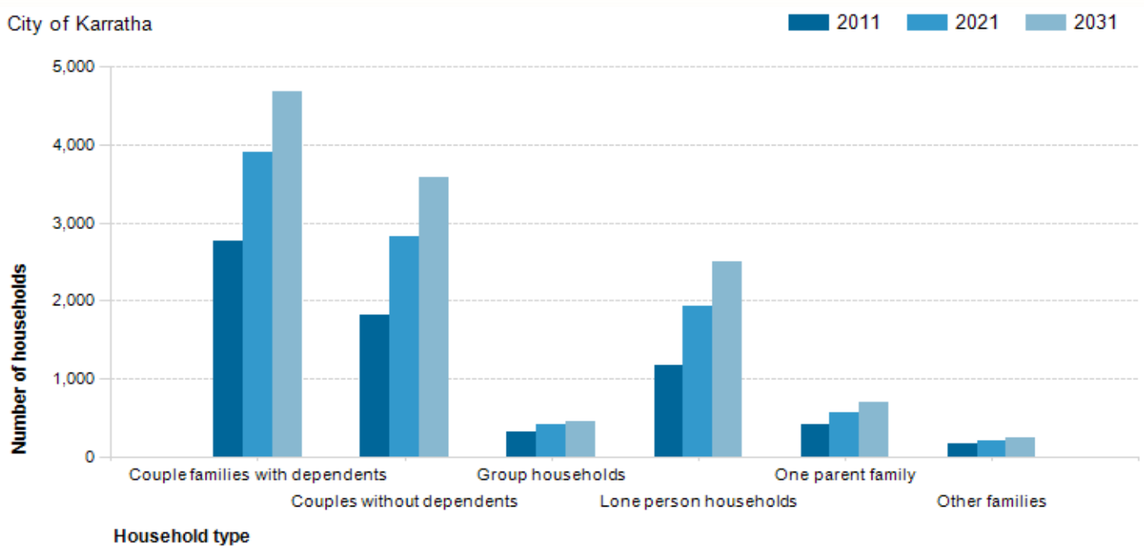
The conclusion from these data is that absolute number of the various household types will move with population change, as shown in Figure 10.

Figure 16 – Forecast Change in Age Structure



Population and household forecasts, 2011 to 2036, prepared by .id the population experts, August 2014.

Figure 18 – Forecast Household Types



Population and household forecasts, 2011 to 2036, prepared by .id the population experts, August 2014.

Existing Dwelling Stock

Overall the *Valuer General's Office (VGO)* identifies 7,820 dwellings within the City. This figure differs slightly from the 2011 Census due to the date the dwelling was rated and different classification processes used by each source. The *VGO's* data has been used in addition to *ABS Census* data for the purposes of this assessment, as it allows a range of analyses not possible through Census based data alone.

Age of Dwelling Stock

The existing dwelling stock in the City shows two distinct construction phases:

- ***1970 – 1988:*** whereby over 4000 dwellings built in this period are still standing, representing 61% of the current stock of dwellings in the City; and
- ***2008 – 2012:*** with between 250 and 350 new dwellings being built per year during this period.

Even with the most recent boom in dwelling construction, in the 20 years to 2012 there were just over 2,500 new dwellings built in the City, which falls significantly short of the previous growth phase of the 1970s and 1980s. In between these two growth phases there were a negligible number of new dwellings built in the early 1990s, followed by a moderate growth phase, which started in the mid to late 1990s and lasted through to around 2007. During this phase between 80 and 120 new dwellings were built per year.

Housing Types & Densities

As at 2011 three bedroom houses were the predominant housing typology in the City, making up 42.9% of the total occupied dwelling stock at the time. Four or more bedroom houses made up 37.2% of the dwelling stock. Houses of three or more bedrooms therefore comprise the considerable majority of the City's existing dwelling stock.

In 2011 there were 1,719 households in the City that had more bedrooms than usual occupants. Some of these dwellings may have been occupied by people who were counted as persons not usually resident (i.e. FIFO workers and people living in the City for less than 6 months of the year). Either way, there is evidence of an existing market shortfall whereby there is a need for more dwellings with one and two bedrooms in the City.

As depicted by **Figure 19**, over half of the dwellings in the City are located on land zoned for low density development, predominantly R20 (53%) and a small amount (1%) are zoned R10. Medium density zones (R30, R40, R50, and R60) collectively accommodate 18% of homes with most zoned R30. In addition to dwellings located on land with an R-Code the remaining 27% of homes are located on land that does not have an R-Code. These dwellings may be located within the Urban Development zone, City Centre zone or other non-residential zonings.

Figure 20 shows that actual densities in the City are significantly below that permitted in the most prevalent R-Codes (R20 and R30) and also R50 zoned land. In contrast R10, R40 and R60 zones all have densities greater than that theoretically permitted by the R-Codes.

A broad snapshot of the lot size typologies within the City's settlements appears on the following pages. The figures demonstrate the significant dominance of larger lot sizes (600m^2+), this is despite the *KRS* noting that the average lot size has dropped from 702m^2 in 2000, to 560m^2 in 2000, representing a rate of $470m^2. In the Easter Corridor lot sizes above 1,000m^2 constitute more than a third of the overall lot product, forming the predominant lot typology in Roebourne and Point Samson in particular. This demonstrates a genuine need to continue to increase the variety of lot and housing product, particularly those aimed at smaller households given the projected shift in household sizes.

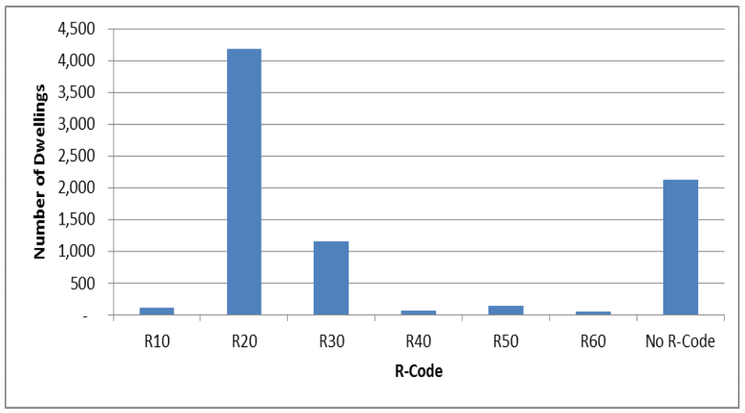
Home Ownership

The tenure of dwelling stock in the City is significantly different by comparison to the broader Western Australia housing market. This is largely due to significant proportions of dwellings being rented by employers to house staff as part of their employment package (i.e. 40.5% of all dwellings in the City were being rented by 'other landlord type'). In 2011 only 24.6% of all occupied dwellings in the City were either owned outright or were being purchased (i.e. owner-occupied). This is less than half the average for Western Australia.

Housing Affordability

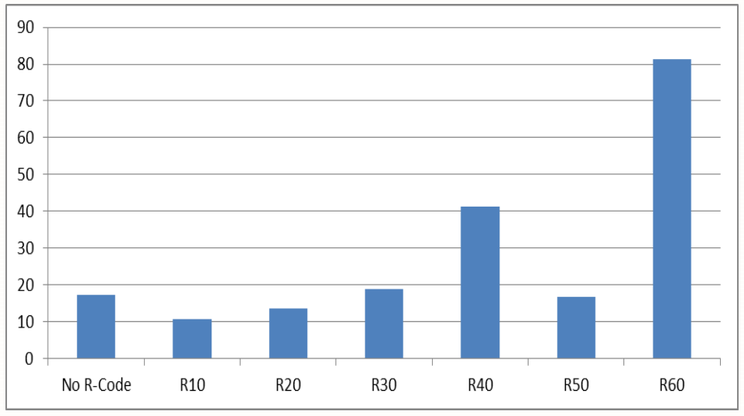
A key constraint to population growth in the City is the amount and price of suitable housing options for the workforce. The main inhibiting factor is that much higher than average house prices deter workers from relocating to the region, while construction of additional housing is almost prohibitively expensive. Affordable housing (rental or mortgage repayments) is defined to be 30% of weekly income.

Figure 19 – Number of Dwellings by R-Code (2011)



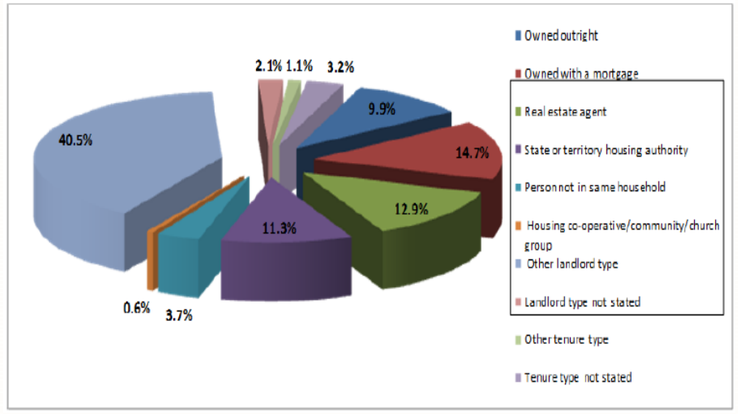
Source: Department of Planning, Integrated Land Information Database; MacroPlan Dimasi

Figure 20 – Actual Net Site Density by R-Code



Source: Department of Planning, Integrated Land Information Database; MacroPlan Dimasi

Figure 21 – Dwelling Stock by Tenure



Source: ABS Census 2011

Figure 22 – Karratha Settlement Pattern & Residential Lot Typologies

KARRATHA LOT YIELD			
Size	No. Lots	% Total Lots	Average Size
1m² - 349m²	247	4.28%	301m²
350m² - 400m²	137	2.37%	382m²
401m² - 500m²	421	7.29%	439m²
501m² - 600m²	763	13.22%	554m²
601m² - 1000m²	3847	66.65%	725m²
1001m² - 2000m²	270	4.68%	1168m²
2001m²+	87	1.51%	4325m²
Total Number of Lots	5772		

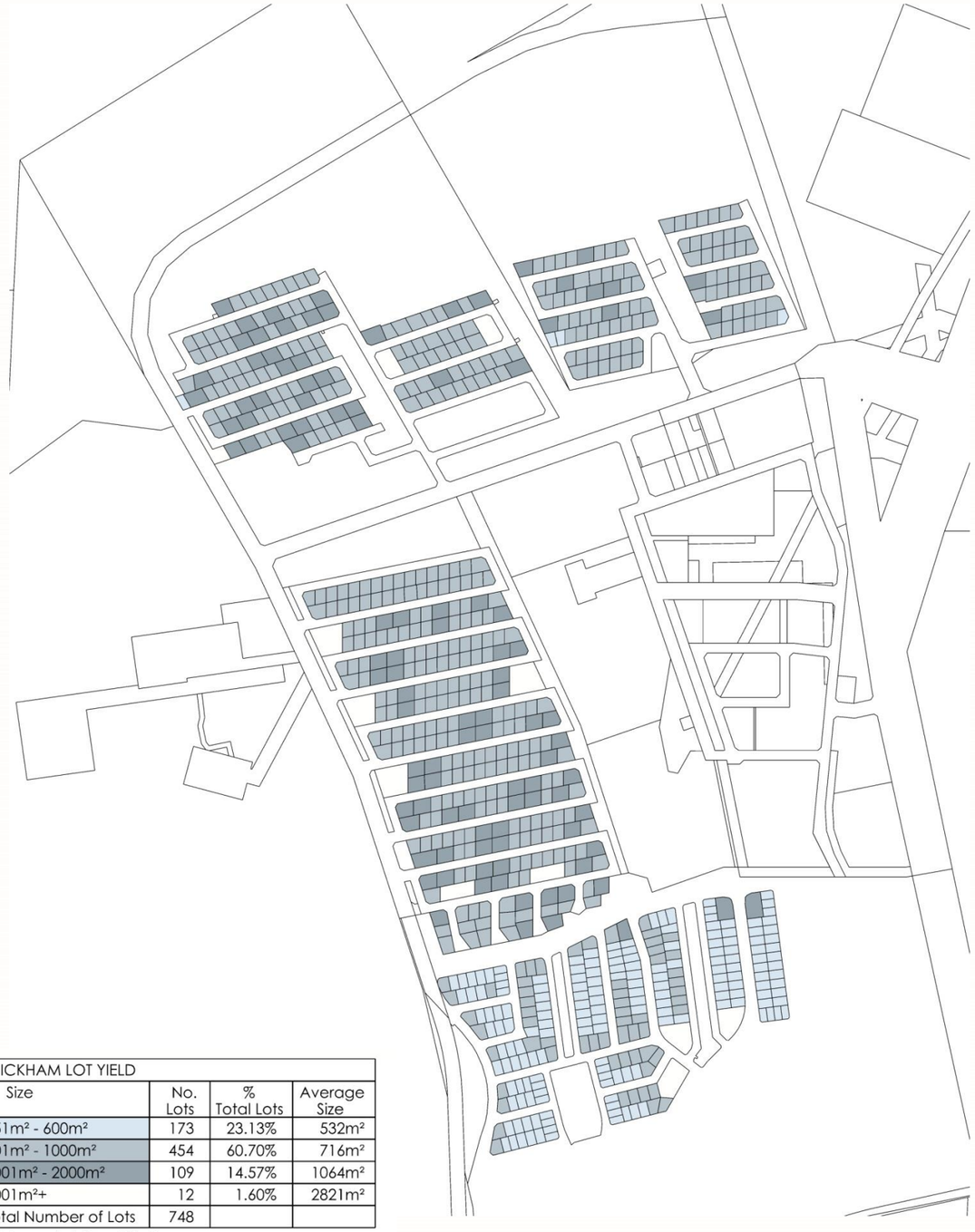
Minimum Lot Size 72m²
Maximum Lot Size 27313m²
Average Lot Size 731m²
Total Lot Area 4219983m²

Figure 23 – Dampier Settlement Pattern & Residential Lot Typologies

DAMPIER LOT YIELD			
Size	No. Lots	% Total Lots	Average Size
351m² - 600m²	2	0.48%	496m²
601m² - 1000m²	201	47.97%	924m²
1001m² - 2000m²	197	47.02%	1138m²
2001m²+	19	4.53%	4652m²
Total Number of Lots	419		

Minimum Lot Size 469m²
Maximum Lot Size 10345m²
Average Lot Size 1192m²
Total Lot Area 499485m²

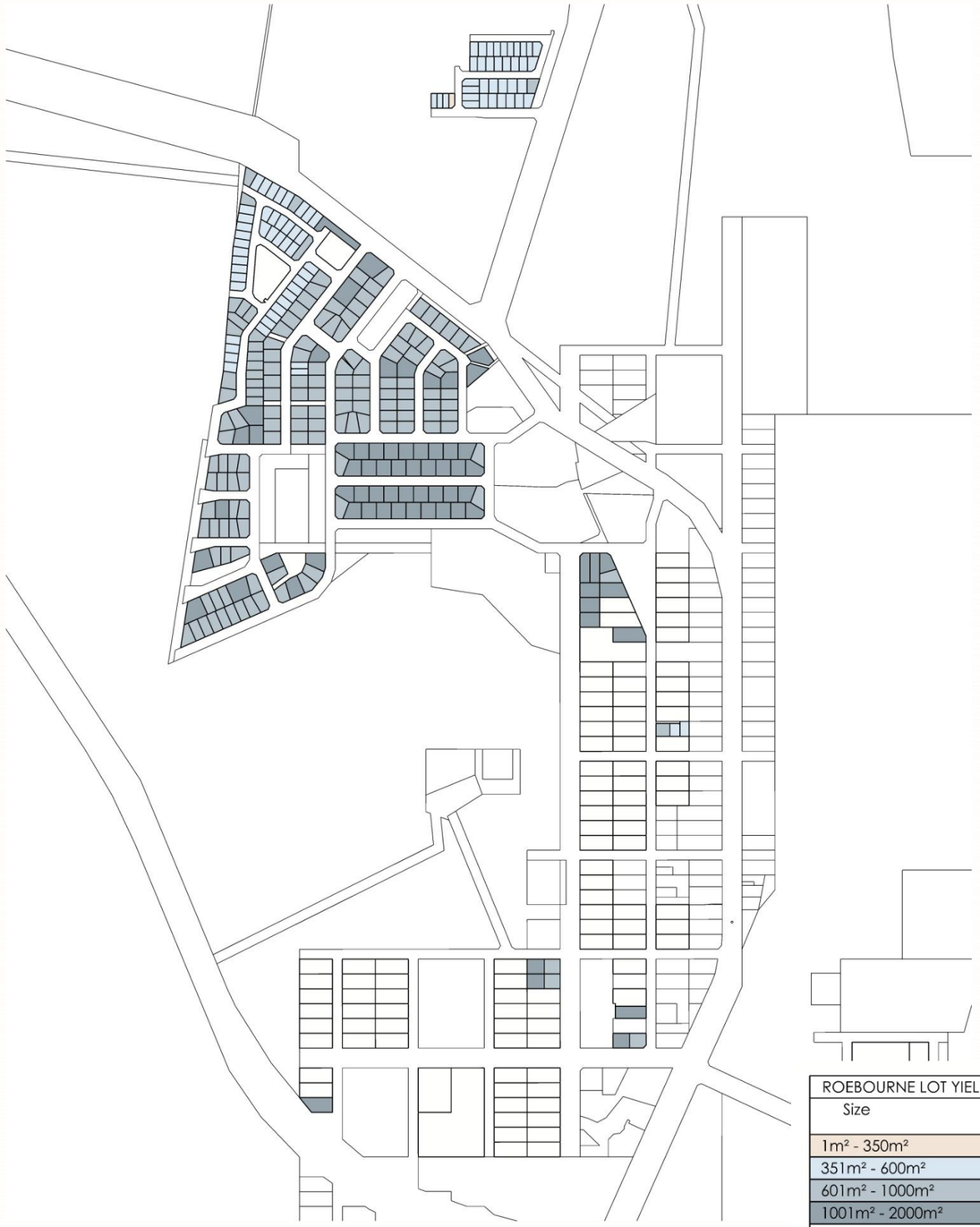
Figure 24 – Wickham Settlement Pattern & Residential Lot Typologies



WICKHAM LOT YIELD			
Size	No. Lots	% Total Lots	Average Size
351m² - 600m²	173	23.13%	532m²
601m² - 1000m²	454	60.70%	716m²
1001m² - 2000m²	109	14.57%	1064m²
2001m²+	12	1.60%	2821m²
Total Number of Lots	748		

Minimum Lot Size 400m²
Maximum Lot Size 3769m²
Average Lot Size 758m²
Total Lot Area 567480m²

Figure 25 – Roebourne Settlement Pattern & Residential Lot Typologies



ROEBOURNE LOT YIELD			
Size	No. Lots	% Total Lots	Average Size
1m² - 350m²	1	0.24%	342m²
351m² - 600m²	83	20.24%	517m²
601m² - 1000m²	150	36.59%	841m²
1001m² - 2000m²	69	16.83%	1162m²
2001m²+	107	26.10%	2359m²
Total Number of Lots	410		

Minimum Lot Size 342m²
Maximum Lot Size 18199m²
Average Lot Size 1224m²
Total Lot Area 502144m²

Figure 26 – Point Samson Settlement Pattern & Residential Lot Typologies

POINT SAMSON LOT YIELD			
Size	No. Lots	% Total Lots	Average Size
351m² - 600m²	3	2.68%	570m²
601m² - 1000m²	51	45.54%	874m²
1001m² - 2000m²	57	50.89%	1125m²
2001m²+	1	0.89%	2023m²
Total Number of Lots	112		

Minimum Lot Size 563m²
Maximum Lot Size 2023m²
Average Lot Size 1004m²
Total Lot Area 112519m²

Income Profiles

A comparison of current income profiles for the City against averages for Western Australia indicates a major difference between the very high and the very low income earners (Refer **Table 9**).

Table 9: Comparison of Personal Weekly Income

Number	City of Karratha	Pilbara Region	Western Australia
Less than $400 pw	2,489	6,553	584,920
$400 - $999 pw	2,022	5,077	488,249
$ 1,000 - $1,499 pw	2,204	5,652	260,396
$ 1,500 pw or more	7,217	20,327	308,175
Total	13,932	37,609	1,641,740

Percentage	City of Karratha	Pilbara Region	Western Australia
Less than $400 pw	18%	17%	36%
$400 - $999 pw	15%	13%	30%
$ 1,000 - $1,499 pw	16%	15%	16%
$ 1,500 pw or more	52%	54%	19%
Total	100%	100%	100%

Source: Australian Bureau of Statistics, 2011 Census of Population and Housing

The income pattern for each of the towns is shown in **Figure 27**.

The breakdown of income patterns for each of the City's settlements shows similar income profiles across Dampier and Karratha in particular.

Both Point Samson and Wickham have slightly higher proportions of people on lower incomes and fewer on very high incomes. Incomes in the Roebourne settlement are distinctly different to that of the rest of the City.

Currently there is substantial difference in income patterns between Pilbara local government areas and between communities in the City of Karratha communities, with very high proportions of individuals earning high income (above $1,500 per week and of that group more than two-thirds are earning above $2,000 per week) in Karratha, Dampier and Wickham. This is likely to moderate over time. It is likely that the individual income profile will come to resemble that of places such as Kalgoorlie over time as the occupation mix changes. There would still be a high proportion of high income earners, but some growth in the proportion of lower and middle income earners. This will result in added pressure on housing affordability, and emphasizes the need to provide moderately priced accommodation in greater numbers.

Unless large numbers of workers of moderate incomes can be accommodated in the City the opportunities for economic diversification that underpin the higher population scenarios will not be realised. There has been pressure on housing affordability for some time and all relevant agencies need to continue the focus on affordability and interventions such as subsidised key worker accommodation. The alternative is a continuation of the current situation, with a larger than average proportion of very high income residents, but no real population growth or economic diversity.

Land & Housing Prices

There is a notable variation in both the value of land and the value in housing within the City due to the differences in locality between settlements.

Having experienced strong average growth of 10.6% per annum between 2000 and 2012 (**Figure 28**), the median lot sales for the City fell to $327,000 in the third quarter of 2014.

Sales of detached dwellings have been relatively subdued recently, with 71 settlements thus far in 2014, including just 8 in the September quarter. The median price of those 8 settlements was just $500,000, a rapid fall from the $800,000+ average achieved between 2010 and 2012. Similarly the median dwelling price for higher density products within the City increased by approximately 12% per annum to a high of $585,000 between 2000 and 2012, with the value of 1 and 2 bedroom dwellings dropping to $394,853 in 2014.

Figure 28 provides a graphical representation of median property prices by property type between 2010 and 2012. Prices are based on sales over asking price. **Figure 29** shows the decline in both sales and sales price (approximately 30%) over the last 3 years, and a rapid growth in the number of properties having been listed for sale. Over the same period **Figure 30** shows a similar decline in the average cost of renting, in part caused by a rapid increase in the availability of dwellings.

Figure 29 – Residential Dwellings For Sale & Settlements

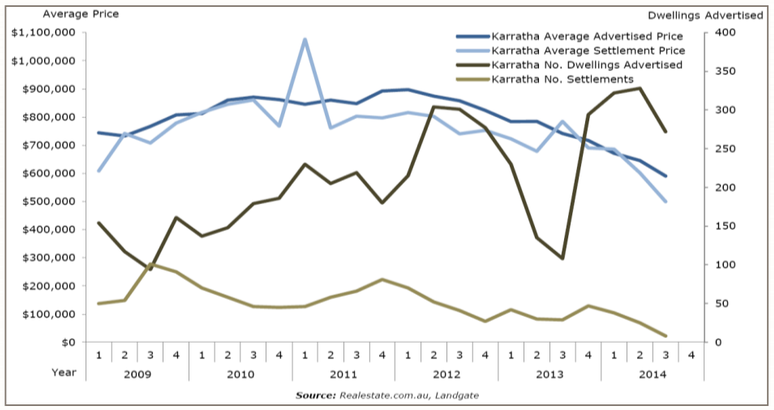
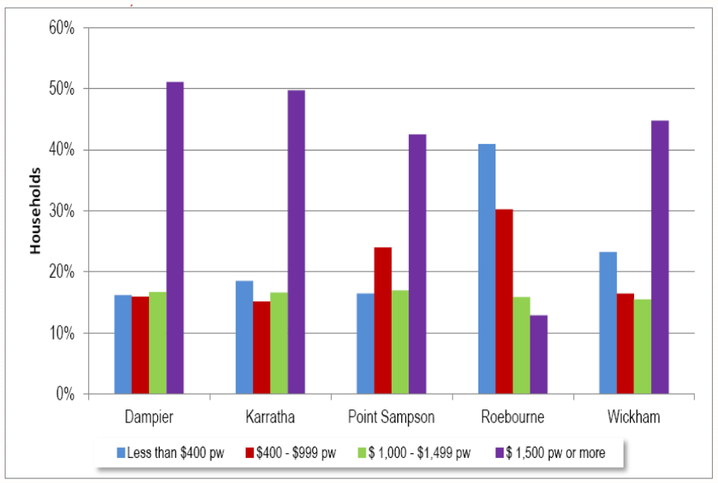
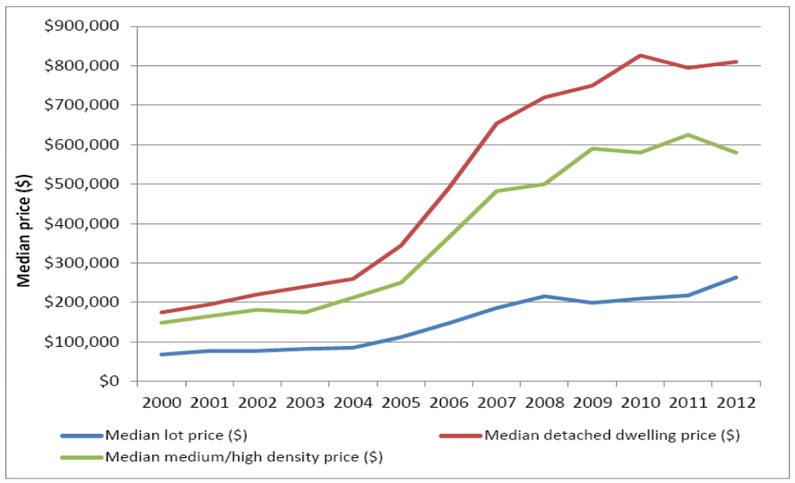


Figure 27 – Residents' Personal Weekly Income by Settlement (2011)



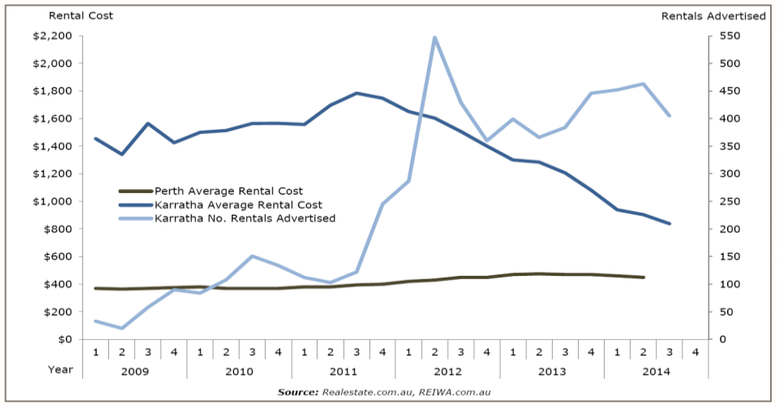
Source: Australian Bureau of Statistics, 2011 Census of Population and Housing

Figure 28 – Median Prices by Property Type (2000 – 2012)



Source: RPData; MacroPlan Dimasi

Figure 30 – Advertised Residential Rental Properties & Avergae Weekly Cost



Source: PHLS Oct 2014

Housing Demand

Property Market

Detached dwellings in the City accounted for 49.8% of all sales on average between 2000 and 2012. Approximately 272 single dwellings were sold per annum on average in the City. This is significantly higher than the average number of lot sales per annum (184 sales), which accounted for 33.8% of activity. Three bedroom properties accounted for the highest proportion of detached dwellings.

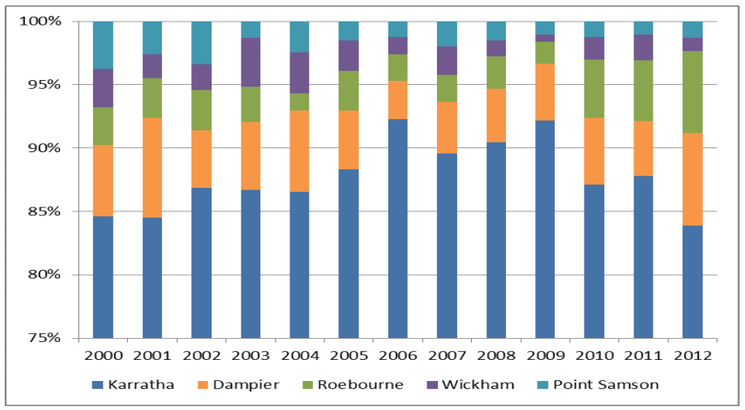
Activity for medium and high density dwellings in the City (i.e. townhouses, duplex units and apartments) was significantly lower than for detached dwellings. It is noted this statistic may be the result of the lack of this product type being available, rather than necessarily preference from residents. Approximately 90 density dwellings were sold per annum on average between 2000 and 2012 representing 24.9% of all sales activity within the City.

The proportion of medium and high density dwellings as a percentage of total dwellings sold increased over the same timeframe, identifying a possible shift in purchasing preference from a traditional detached dwelling to higher density product. In 2000, high-density dwellings accounted for 18.2% of total dwellings sold, by comparison to 25.7% in 2012. This is possibly due to shifting purchasing preference, such products being more affordable than detached dwellings or an increased level of supply within the City.

Karratha accounted for 87.7% of all sales activity per annum in the City on average over the 12 year assessment timeframe. Since 2000, the proportion of market activity in the settlements of Dampier and Roebourne has increased as these areas have captured some of the excess demand not able to be accommodated in Karratha.

Since 2012, the demand for dwellings within the City has significantly decreased. As evidenced in the previous section, currently the residential property market in Karratha is the weakest it has been in many years following the end of the construction boom related to resource projects; royalties for regions projects and other government agency developments.

Figure 31 – Total sales activity by settlement



Source: RP Data; MacroPlan Dimasi

Population Effect on Housing Demand

The fundamental driver for housing demand is population growth, which when divided by the prevailing household size provides the number of houses required to cater for future growth. The average household size has remained constant (2.9 persons per dwelling) in the City between the census years of 2006 and 2011. There is, therefore, a direct relationship between population and housing growth, which has been forecast by the Department of Health and Ageing to continue into the medium term (to 2026).

As at 30 June 2012 there were 24,860 residents (estimated) in the City with Karratha housing around 70% of this population. Population growth has averaged 6.3% per annum between 2006 and 2011. The majority of this growth has been occurring in Karratha adding 930 residents per annum between 2011 and 2012.

Forecasts of new dwelling requirements by .id Consulting, consistent with the medium population projections, show around 5,700 new dwellings are required in the period 2012 to 2031 inclusive. For the high population scenario, it is estimated that around 10,000 new dwellings would be required, with the higher population also likely to be accompanied by some reduction in average residents per dwelling.

To arrive at an estimate of the mix of housing types that would be required, an analysis has been undertaken that considers:

- Current housing type mix;
- A comparison with other Australian communities that have some similarities to the City of Karratha;
- An analysis of the relationship between household type and housing type; &
- Projections of household mix based on the medium and high population projections.

Results of analysis are displayed in **Table 10**, which shows the estimated total dwelling commencement requirements to 2031 under the medium and high population projections.

Table 10: Projected Housing Mix & Dwelling Commencement Required

Housing Type	Proportion	Medium Population Growth	High Population Growth
Single residential	75% - 80%	4,275 – 4,560	7,500 - 8,000
Medium density	10% - 12%	570 – 685	1,000 - 1,200
Apartments	5% - 8%	285 – 455	500 - 800
Short-stay and other	2% - 4%	115 - 230	200 - 400

Source: Syme Marmion

New and hybrid accommodation types (for example lifestyle villages and park homes) are generally substitutes for single residential or medium density accommodation and would fit into those categories. Based on the targeted population ranges for each settlement under the high population projection, the distribution of dwellings across the City's major settlements for the medium and long term are estimated as displayed in **Table 11**.

Table 11: Projected Maximum Additional Dwelling Requirements by Settlement

	Target Population Range		Total Dwelling Requirement Range		Existing Dwellings	Maximum Additional Dwellings Required
	Low	High	Low	High		
2021						
Karratha	27,663	27,785	9,539	9,926	6,178	3,748
Dampier	2,231	2,506	769	864	518	346
Roebourne	1,115	2,005	385	691	251	440
Wickham	3,718	4,296	1,282	1,481	754	727
Point Samson	223	358	77	123	119	4
					2021 Total:	**5,265**
2031						
Karratha	37,200	40,200	12,828	13,862	6,178	7,684
Dampier	3,000	3,500	1,034	1,207	518	689
Roebourne	1,500	2,800	517	966	251	715
Wickham	5,000	6,000	1,724	2,069	754	1,315
Point Samson	300	500	103	172	119	53
					2031 Total:	**10,456**

Source: MacroPlan Dimasi; Planning Solutions

Short-Stay Workers Accommodation

The implication of the analysis on economic growth in the City is that there is no general demand for new Transient Workers Accommodation (TWA) camps, unless new major infrastructure projects commence. There may be some project-specific requirements for temporary construction worker accommodation for specific projects during their construction phase. This particularly applies to projects at Cape Preston and the Balla Balla project at Whim Creek. It is likely that the Anketell port project will proceed in relatively modest phases, with some limited requirements for short-term TWA accommodation during construction.

The encroachment of industrial land by residential uses (i.e. TWA camps) is a particular issue for the City of Karratha and should be avoided to maintain the efficient functioning and supply of the primary industrial land use.

It is possible that there will remain a FIFO workforce of around 3,000 – 4,000 in the City over the long term. This would largely be a mixture of long term operations (principally LNG and port operations) and short term maintenance workers. A high proportion of these could be located in and around the main settlements. This would be consistent with City's policy on TWA accommodation. The evidence is that a large, relatively short-term influx of temporary workers, as might be found in a construction boom, can have a disruptive effect on a host community and some separation is not only justified but preferable for construction camps. Long term operations workers however, can have a degree of involvement in the community (purchasing local goods and services, involvement in community activities), if they are appropriately located. This supports a policy direction for operational FIFO accommodation within the urban centres, not in separate bespoke camps.

Housing & Land Supply

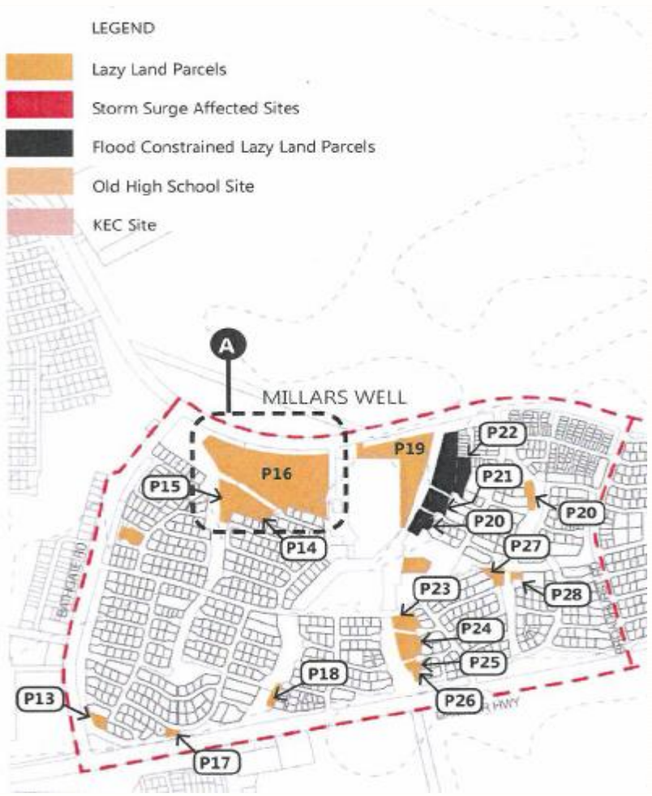
Urban Expansion

Over the 12 year period 2000 to 2012 the number of lots sold in the City increased significantly, in line with population growth. On average approximately 157 land sales were recorded per annum, with the highest number of sales recorded in 2011 (400 sales). Over that 12 year period there was annual growth of 15.3% per annum.

Despite the reduction in lot sales since 2012 due to the GFC and drop in income prices, lot sales are expected to remain relatively high, as urban expansion will be relied upon to accommodate a substantial proportion of the City's population growth. Land for urban expansion over the 20 year timeframe is identified in all settlements except Dampier, which has significant infill capacity to accommodate its target growth level. In total 767 hectares of land has been identified with capacity for urban expansion, with 566 hectares located in Karratha.

Table 12 details potential additional dwelling yields for all settlements, including detailed breakdown of capacity for all urban expansion areas. Table 9 also outlines capacity for additional dwellings through strategic infill development, as discussed further in the following section on Infill potential.

Figure 32 – Karratha Lazylands (Millars Well Extract)



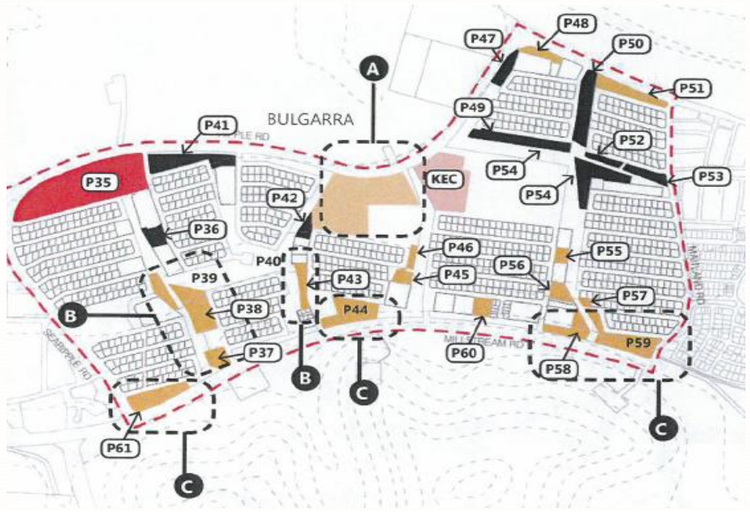
Source: *DRAFT* Karratha Revitalisation Strategy (2014)

Table 12: Estimated Dwelling Yield Capacity for Settlements (2012)

Settlement	Development Area / Opportunity	Land Area (Ha)	Additional Dwelling Yield	Priority	Notes / Assumptions
Karratha	Town Centre	71	1,420	1-3	*assumes gross density of 20 dw/ha
	Zoned Built Lots		326	1-2	*assumes 50% uptake
	Zoned Vacant Lots		61	1-2	*assumes 85% uptake
	Lazy Lands Stage 1		200	1	*based on CoK/PDC estimates for sites already rezoned (DA40-46)
	Lazy Lands Additional Stages	59	443	2	*assumes 50% total area developable and gross density of 15 dw/ha
	Tambrey N/bourhood Centre	10	200	2	*assumes gross density of 20 dw/ha
	Nickol West	70	250	1	*based on Nickol West Development Plan
	Madigan	108	1440	1-2	*based on Madigan Road Development Plan
	Mulataga	164	2000	2	*based on Mulataga Development Plan
	Gap Ridge	104	1248	3	*assumes gross density of 12 dw/ha
	Mulataga Hills	94	1128	3	*assumes gross density of 12 dw/ha
	Mulataga East	96	1152	3	*assumes gross density of 12 dw/ha
Total			9,868		
Dampier	Coastal Village (Town Centre)		184	2-3	*based on Dampier Redevelopment Strategy
	The Lookout		134	2	*based on Dampier Redevelopment Strategy
	Beachside		96	3	*based on Dampier Redevelopment Strategy
	POS Infill Sites		46	3	*based on Dampier Redevelopment Strategy
	Hill Road Ridge		90	3	*based on Dampier Redevelopment Strategy
	Hampton Views		51	3	*based on Dampier Redevelopment Strategy
	Zoned Built Lots		251	1-2	*assumes 50% uptake
	Zoned Vacant Lots		70	1-2	*assumes 85% uptake
Total			921		
Roebourne	NASH	44	394	1-2	*based on NASH Development Plan
	Mt Welcome South	19	190	3	*assumes gross density of 10 dw/ha
	Mt Welcome North	8	96	3	*assumes gross density of 12 dw/ha
	Zoned Built Lots		72	1-2	*assumes 50% uptake
	Zoned Vacant Lots		137	1-2	*assumes 85% uptake
Total			889		
Wickham	Wickham South	72	753	1	*based on Wickham South Development Plan
	Wickham Drive Infill	6	72	1	*assumes gross density of 12 dw/ha
	Carse Street Infill	8	96	3	*assumes gross density of 12 dw/ha
	Zoned Built Lots		160	2	*assumes 50% uptake
	Wickham North	44	528	3	*assumes gross density of 12 dw/ha
Total			1,609		
Pt Samson	Cliff Street	14	140	3	*assumes gross density of 10 dw/ha
Total			140		
Grand Total			13,397		

Source: As referenced in Notes / Assumptions; Planning Solutions

Figure 33 – Karratha Lazylands (Bulgarra Extract)

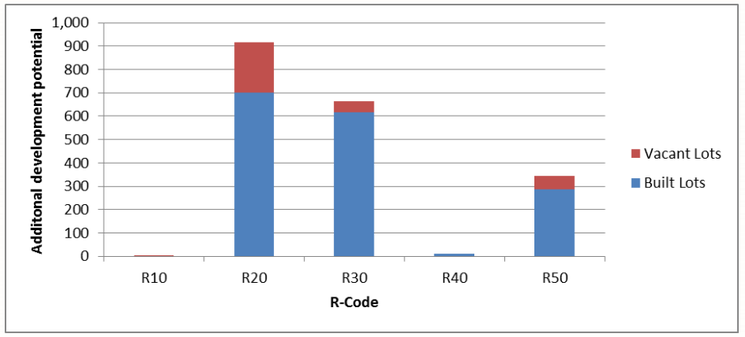


Source: *DRAFT* Karratha Revitalisation Strategy (2014)

Infill Potential

As a result of the relatively low densities achieved to date in the R20, R30 and R50 zones, a significant number of lots remain under-developed and could under the right circumstances become viable for further subdivision. Overall, theoretical capacity remains for over 1,900 homes on land that already has an R-Code, the bulk of this on R20 zoned land. Most of the additional development potential exists on lots that have already been developed (83 per cent); the remaining 17% of additional development potential is on currently vacant lots.

Figure 34 – Additional Development Potential by R-Code



Source: Department of Planning, Integrated Land Information Database; MacroPlan Dimasi

Karratha has the greatest capacity for additional dwellings on land that already has some development, but there is also a significant capacity for additional dwellings on built lots in Dampier. In terms of vacant residential land, Roebourne town site has greatest capacity for additional dwellings followed by Dampier and then Karratha. Refer **Table 13** and **Table 14** for respective additional capacity on built and vacant land.

Table 13: Additional Dwelling Capacity by R-Code on Land with Existing Dwellings

R-Code	Karratha	Dampier	Roebourne	Wickham	Point Samson	Total
R10	0	0	0	0	1	**1**
R20	153	382	144	22	0	**701**
R30	488	0	0	130	0	**608**
R40	11	0	0	0	0	**11**
R50	0	119	0	168	0	**287**
R60	0	0	0	0	0	**0**
Total	**652**	**501**	**144**	**320**	**1**	**1,618**

Source: Department of Planning, Integrated Land Information Database, MacroPlan Dimasi

Table 14: Additional Dwelling Capacity by R-Code on Vacant Land (2012)

R-Code	Karratha	Dampier	Roebourne	Wickham	Point Samson	Total
R10	0	0	0	0	3	**3**
R20	25	26	161	3	0	**215**
R30	47	0	0	0	0	**47**
R40	0	0	0	0	0	**0**
R50	0	56	0	0	0	**56**
R60	0	0	0	0	0	**0**
Total	**72**	**82**	**161**	**3**	**3**	**321**

Source: Department of Planning, Integrated Land Information Database, MacroPlan Dimasi.

In addition to the capacity for additional dwellings under existing R-Code zonings, there is potential for rezoning to increased densities at strategic sites. Increased density should generally be focused around town centres, key transportation links, public open space, or other facilities and amenities. Opportunities for split density coding over strategically located sites may also be utilised to encourage redevelopment to higher densities subject to improved built form, affordability components or environmentally sustainable design. Dwelling yields as a result of increased R-Code zonings will be dependent on the extent of rezoning, as well as development take-up rates.

Increased residential density codings would be appropriate in the Karratha City Centre, or the future Tambrey Neighbourhood Centre. This opportunity should also be used to encourage redevelopment of aging dwelling stock in Bulgarra, Millars Well and Pegs Creek. Similar rezoning opportunities to encourage infill redevelopment may also be appropriate to apply to central sites in Dampier, Roebourne and Wickham.

Stage 1 of the Lazy Lands project will deliver approximately 200 additional dwellings for Karratha over seven parcels of surplus public open space. These sites have already been rezoned and are identified as DA40-46 on the Scheme Maps. Development of these sites, however, has been stalled due to issues relating to the pricing of Crown Land, which are currently preventing the sale of the land. Approximately 59 additional hectares of surplus public open space have been identified through the Lazy Lands project. If it is conservatively assumed that due to flooding constraints 50% of this land is developable, capacity exists for another 443 dwellings under a gross density of 15 dwellings per hectare scenario.

Table 15: Proposed Residential Density Table & Potential Dwelling Yields

Suburb	Total (m2)	Average Lot Size (m2)	Low End %	High End %	Suggested Dwelling Yield (Low Range)	Suggested Dwelling Yield (High Range)
Existing Residential	1,927,055	700*			2,753	2,753
Proposed Residential Area	445,095					
Total Proposed Residential Area	2,372,150					
R20/R40 Split Code	786,125					
No change		700	96%	90%	1,078	1,011
Redevelop Lot (R20)		500	2%	5%	31	79
Amalgamate and Redevelop (R40)		220	2%	5%	71	179
Sub Total					**1,181**	**1,268**
R30/R60 Split Code	985,704					
No change		700	96%	85%	1,352	1,197
Redevelop Lot (R30)		300	2%	5%	66	164
Amalgamate and Redevelop (R40)		220	2%	10%	90	448
Sub Total					**1,507**	**1,809**
R30/R80 Split Code	407,976					
No change		700	96%	85%	560	495
Redevelop Lot (R30)		300	2%	5%	27	68
Amalgamate and Redevelop (R80)		112	2%	10%	73	364
Sub Total					**660**	**928**
Urban Development Zone (Local Structure Plan to determine R-Coding)*	19				482	482
Sub Total					**482**	**482**
TOTAL					3,830	4,487
INCREASE					1,077	1,734

Assumptions:
The provided take up rates are conservative estimates only for the 5 year period from 2015 to 2020 (across the whole study area)
The estimates are based on the assumption of an average lot size of 700m2.
The estimates above are indicative only and subject to change due to influence from outside and market conditions etc

Source: *DRAFT* Karratha Revitalisation Strategy (2014)

DRAFT Karratha Revitalisation Strategy

Prepared more recently in 2014/15, the *DRAFT Karratha Revitalisation Strategy (KRS)* seeks to achieve the *Karratha City of the North* objective of delivering compact neighbourhoods and diversity of housing in Karratha's inner suburbs. Accordingly, *KRS* recommends residential re-codings which allow for an increase in density on strategic locations, and assist in creating more diverse housing stock and streetscapes.

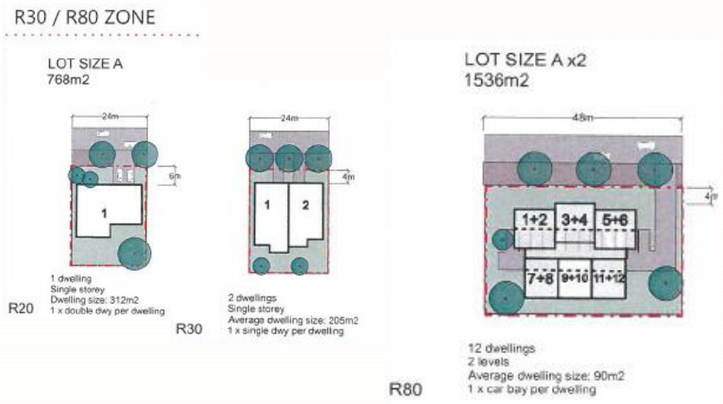
The key tool proposed to achieve this is a split coding technique whereby density restrictions for house lots under 1,000m^2 in area (i.e. single lots) are typically maintained at a lower level, whereas the application of a higher code requires the amalgamation of properties. For example, in an R20/40 split coded area, single lots receive no increase in permissible density, except where they may be amalgamated to create a grouped housing site at R40.

The allocation of higher residential codings are based on a preference for increased density within the walkable catchment of community nodes and centres, future 'transit' and key sources of amenity. The highest densities (R80) are reserved for areas within immediate proximity of the Karratha City Centre (R80), whilst the walkable catchments of the community nodes in Pegs Creek, Millars Well and Bulgarra allow for redevelopment up to R60.

To offset the loss of a number of Lazyland sites that upon further scrutiny have proven too constrained as to likely be developed for residential purposes, *KSR* identifies a number of additional sites, including four major sites for which it includes schematic concepts that it puts forward as catalysts for the rejuvenation of surrounding land.

KSR provides supplementary detail on the ability to develop and potential dwelling yield that might be generated. **Table 15** provides an indication of the additional development potential of adopting the recommended split-codings. In reality redevelopment will be slow and sporadic, hence it is expected that only low proportions of properties will be amalgamated to enable more significant density within the 2031 planning horizon of this *Local Planning Strategy.*

Figure 35 – Redevelopment Typologies (Example)



Source: *DRAFT* Karratha Revitalisation Strategy (2014)

Sequencing of Dwelling Delivery & Population Growth

The following represents the most recent work that has been undertaken with respect to population growth and dwelling demand by Forecast .id.

Forecast .id note that the addition of dwellings to the housing stock is a major driver of population growth in an area, providing opportunities for households to relocated from other areas or new households to form locally (such as young people leaving the family home or separations/divorces).

Residential development can take various forms depending on the availability of land. These include new housing estates on Greenfield sites, subdivision in existing residential neighbourhoods (often called infill development), conversion of industrial lands to residential lands, and densification by building up.

Forecast .id worked with the City of Karratha's planners to understand the likely development activity in each small area. This forms the development assumptions for the forecasts. Individual assumptions for each of the Karratha District Precincts are identified in **Table 16**.

Residential development forecasts assume the number of dwellings in Karratha District will increase by an average of 276 dwellings per annum to 13,199 in 2036. The bulk of additional dwellings will be accommodated within the suburbs of Baynton / Gap Ridge and Nickol in the first instance (131 per annum) followed by Mulataga in the years to follow (104 per annum).

Figures 36 and **37** show the sequencing of dwellings necessary to match population growth out to 2036.

Table 166: Land Development & Infill Assumptions

Karratha District Precinct	List of Forecast Land Developments & Infill Assumptions
Baynton Gap Ridge:	• Baynton West (South) - 541 dwellings (2012-2018) • Madigan Estate - 600 dwellings (2014-2023) • Baynton West Medium Density - 198 dwellings (2022-2025) • The Baynton - 80 dwellings (2014) • Lot 309 Perentie Road - 10 dwellings (2013) • Baynton West Estate - 181 dwellings (2012-2016) • No infill development assumed
Nickol:	• Lot 4227 Tambrey Drive - 40 dwellings (2019-2020) • Tambrey Primary School excess land - 80 dwellings (2014-2016) • Lot 503 & 504 Falcon Parade, Lot 339 Desert Pea Boulevarde - 26 dwellings (2012) • Lot 3860 & 4634 Tambrey Drive, Lot 500 Bathgate Road - 300 dwellings (2017-2021) • Jingarri Estate - 330 dwellings (2012-2019) • Lazy Lands - 105 dwellings (2016-2036) • Nickol West Estate - 70 dwellings (2012-2017) • No infill development assumed
Millars Well:	• Lazy Lands - 63 dwellings (2016-2036) • No infill development assumed
Karratha, Pegs Creek, Stove Hill:	• Warambie Estate - 65 dwellings (2012) • Lot 1950 & 1952 Balmoral Road, Pt lot 4472 Balmoral Road (CR 35210) - 21 dwellings (2015) • Pelago East and West - 310 dwellings (2012-2014) • The Quarter - 50 dwellings (2015) • Moderate level of infill development (8 dwellings per annum)
Bulgarra:	• Lot 72 Padbury Way - 28 dwellings (2012) • Lazy Lands - 250 dwellings (2019-2036) • Karratha Dunes - 10 dwellings (2012) • Low level of infill development (2 dwellings per annum)
Mulataga:	• Mirvac Mulataga - 2,360 dwellings (2016-2036) • Lot 4932 Mystery Road (CR 36708) - 200 dwellings (2032-2036) • Lot 4218 Dampier Road (CR 41013) - 50 dwellings (2032-2036) • No infill development assumed

Source: Forecast .id (2014)

Figure 36 – Forecast Population, Households & Average Household Size

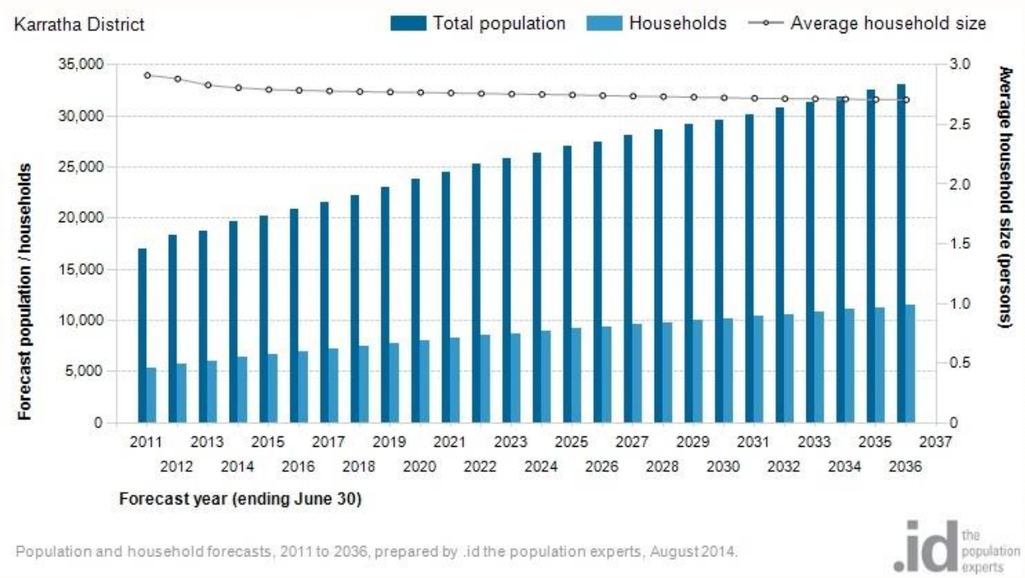
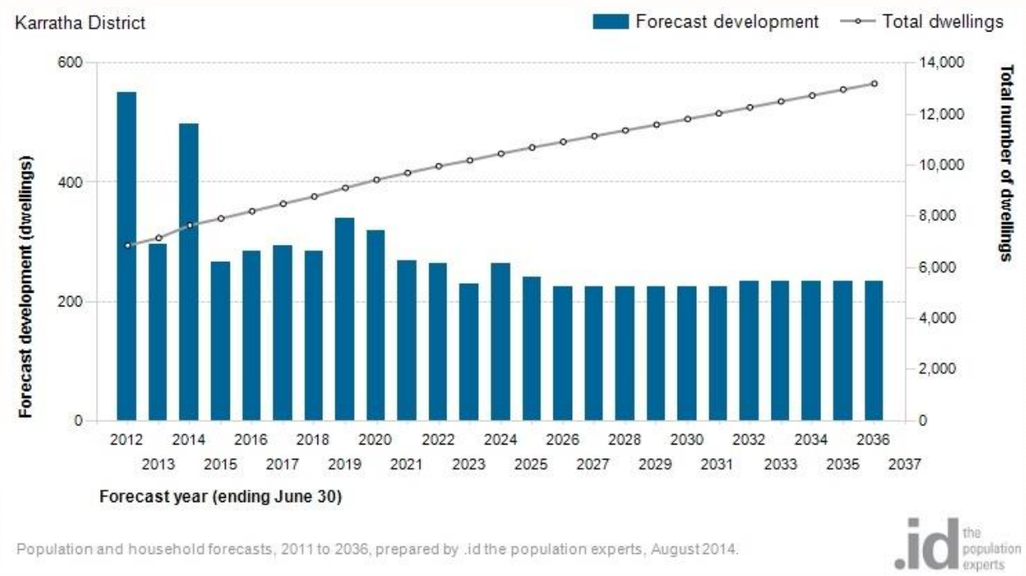


Figure 37 – Forecast Residential Development



5.3 Key Issues: Population & Housing

- The intent of this LPS is to prepare for the next wave of development so that a population of 50,000 can be accommodated at some point in the future while the infrastructure to meet the other needs of the population can more closely follow the forecast population patterns.
- With such a potentially volatile population growth it is important that this strategic planning document is frequently reviewed and the population growth patterns including distribution of the growth is closely monitored.
- Under the medium and high growth scenarios by 2031 the population of the City will be between 38,100 and 48,800. Compared with the current population of about 25,400, these scenarios suggest there is a reasonable expectation for a significant increase in the current population within the 15 year planning timeframe. The speed and scale of growth depends in large measure on the extent to which the economy diversifies around its very strong base in the minerals and energy sector. Resources projects alone will not be sufficient to reach employment projections and will not produce the higher population estimates.
- Further analysis of comparable resource dependent settlements placed within the context forecast projects suggests that the likely growth pattern will be the Medium growth scenario.
- A decline in the level of construction activity, increase in services activity and general diversification of the existing economic base are projected to impact the composition of the workforce as follows:
  - Reduction in FIFO numbers as major construction project are completed;
  - Stabilisation of the operational workforce;
  - Growth of the service population (particularly for consumer services);
  - High increases in the retail, education services and health services sectors;
  - Possible growth of producer services; and
  - Some increase in knowledge intensive producer and consumer services.
  - Workforce changes will in turn affect the following demographic changes:
    - Increasing proportions of school-age children;
    - Decreasing proportions of those aged 20-49; and
    - Significant increases in over-55 age groups.
- The above workforce and demographic changes will likely be accompanied by changes in income patterns, with an increase in the proportion of lower and middle income households. This will put pressure on all aspects of affordability in the City. Unless workers of moderate incomes can be accommodated in the City, in large numbers, the opportunities for economic diversification that underpin the higher population scenario will not be realised. There has been pressure on housing affordability for some time and all relevant agencies need to continue to focus on affordability with increasing intervention such as subsidised key worker accommodation.
- Despite recent increase in new housing supply, the median house price in the City increased from approximately $175,000 per dwelling in 2000 to approximately $810,000 per dwelling in 2012. This represents growth of 13.6% per annum.
- The average weekly rent in Karratha peaked in 2007 at $2,180 per week. As at December 2012 the average weekly rent was $1,400 per week and by September 2014 it was $800 and still on a falling trend.
- Based on Valuer General's Office data and the 2011 ABS Census, the City has an existing dwelling stock of approximately 8,000, with approximately 79% of this located in Karratha. The City will require up to an additional 10,000 dwellings to accommodate the high population growth scenario. The estimated housing mix required comprises 75 – 80% single / low density, 10 – 12% grouped dwellings / medium density, 5 – 8% multiple dwellings / high density and 2 – 4% short-stay accommodation.
- 80% of the occupied dwelling stock consisted of three or four bedroom dwellings in 2011. Under-occupied dwelling stock is common in the City. In 2011 approximately 1,720 households resided in dwellings with a higher number of bedrooms than occupants. This suggests a potential existing market shortfall of one and two bedroom dwellings.
- There is capacity to develop up to another 1,939 dwellings across the City on land currently zoned with an R-Code, but not developed to its full potential (i.e. built below capacity or vacant lots). Karratha has the greatest capacity for additional dwellings on land that already has some development, but there is also a significant capacity for additional dwellings on built lots in Dampier. In terms of vacant residential land, Roebourne has the greatest capacity for additional dwellings, followed by Dampier and then Karratha. The age of existing dwelling stock, with 61% of dwellings constructed between 1970 and 1988 presents opportunities for redevelopment.
- Other opportunities for infill development exist in the form of surplus public open space and town centre redevelopment. Opportunities and community appetite for infill are greatest in and around Karratha's central suburbs and in Dampier.
- Urban expansion will need to be combined with infill development to achieve additional dwelling supply requirements. Current Development Plans for Mulataga, Madigan Estate and Nickol West in Karratha, NASH in Roebourne and Wickham South have the capacity to supply an additional 4,587 dwellings collectively. When combined with infill opportunities, the existing Development Plans accommodate for projected population growth for each settlement to the medium term (2021). Further urban expansion of Karratha, Roebourne and Wickham will be necessary to accommodate growth to 2031.
- Only Dampier currently does not have Development Plans in place to meet its target growth for the medium term. Opportunities for infill development and redevelopment are greater in Dampier than expansion options, and therefore urban expansion is not proposed as part of Dampier's growth strategy over this planning timeframe. Nonetheless, appropriate planning, and particularly resolution of infrastructure requirements, is needed to facilitate infill.
- Point Samson's projected additional dwelling demand at 2021 is 4 dwellings, and therefore growth is considered negligible until the long term. Urban expansion will, however, be required to meet longer term growth in Point Samson.

5.4 Community Facilities, Recreation & Open Space

Existing Facilities

Community facilities and services are essential to offer a competitive standard of living which attracts a broad demographic profile to live in the City for the long-term. There is a wide range across the City in the current level and quality of community facilities provision. While many facilities require upgrades or expansion to adequately service the population, others are high quality, providing valuable service to the community. The Pilbara Cities initiative and Royalties for Regions, as well as mining company funding has resulted in the City benefiting from substantial community infrastructure investment in the last few years. Much of the investment has been focused in Karratha, with major projects such as the Leisureplex and City Centre Revitalisation.

Future Provision Requirements

A detailed assessment of community facilities requirements for the City of Karratha is contained in the *Community Facilities Report*, incorporated as *Technical Report 4* supporting this *Local Planning Strategy*.

A comparison of the future community facilities demand indicates the impact of different population projections. **Table 17** provides a summary of the findings of the Community Facilities Report, as now refined by the City, comparing the demand for future facilities under the medium and high population scenarios.

Under any scenario the majority of population growth, and therefore demand for community facilities and services will be in Karratha. The population growth in other settlements, Wickham in particular, will justify demand for some increase in services and facilities there, but these are in general of a local nature and should not substitute for larger and more regionally based facilities that will be required in Karratha.

Although capital works for new facilities are a major issue, an additional consideration for the City will be maintenance and management of community facilities, which have ongoing costs.

Education - Primary Schools

There are eight Government primary schools in the City:

- Karratha Primary School (includes the newly amalgamated Karratha Education Support Centre);
- Millars Well Primary School;
- Pegs Creek Primary School (Independent Public School 2013);
- Tambrey Primary School;
- Baynton West Primary School (Independent Public School 2013); &
- Dampier Primary School;
- Wickham Primary School;
- Pilbara Camp School (specialising in nautical experiential learning).

Primary school provision will need to expand in line with population growth, and new primary schools will be required in the urban expansion areas of Karratha in the medium to long term.

Table 17: Projected Medium & High Growth Community Facility Requirements

Facilities	Service Level	Ratio	Current	Required 2031		Difference
				Medium (38,121)	**High 48,864)**	**High - Low**
Active Recreation Space (ha)	ha/1,000 population	2	48	85	98	13
Active Recreation Space Standards						
Playing Fields	City	25,000	1	2	2	-
Playing Fields	District	10,000	2	4	5	1
Playing Fields	N'hood / Local	5,000	6	8	10	2
Aquatic Centre	City	50,000	1	1	1	-
Aquatic Centre	District	20,000	2	2	2	-
Indoor Recreation Centre	City	50,000	-	1	1	-
Indoor Recreation Centre	District	20,000	1	2	2	-
Skate Park	City	35,000		1	1	-
Skate Park	District	7,000	2	6	7	1
Skate Park	Local	3,500	2	12	14	2
BMX Track	City	30,000	1	1	1	-
BMX Track	District	10,000	1	4	5	1
Passive Recreation Space Standards						
Combined Passive & Active Spaces		N/A	7			
Local Parks & Playgrounds	Local	1,000	28	42	49	7
Specific Standards						
Sports Change rooms	Local	5,000	4	8	10	2
Clubrooms	District	10,000	2	4	5	1
Clubrooms*	Local	5,000		8	10	2
Golf Course	District	25,000	2	2	2	-
Beach Facilities	District	-				
Social/Cultural						
District Community Centre	District	10,000	1	4	5	1
Local Community Centre/Neighbourhood Centre*	Local	5,000	4	8	10	2
Library	District	20,000	1	2	2	-
Library	Local	5,000	3	8	10	1
Youth Centre	District	15,000	2	3	3	-
Seniors Centre	District	20,000		2	2	-
Childcare Centre	District	7,500	2	6	7	1
Childcare Centre	Local	5,000	4	8	10	2
Health						
Community Health Clinic	District	10,000	4	4	5	1

*Local community centre and local clubrooms should be collocated as one project

Source: Adapted from Syme Marmion & Co. Community Facilities Plan 2013; City of Karratha

Secondary Schools

There are two Government secondary schools in the City; Karratha Senior High School and Roebourne District High School. There are no plans for additional government secondary schools in the short and medium terms. There is one non-Government secondary school, which is St Luke's College.

The population of the *Eastern Corridor* is encouraged to grow to achieve the necessary threshold to facilitate a High School at Wickham.

There is interest both within the community and from the Department of Education to develop Karratha Senior High School into a leading secondary school for the region. This may include boarding facilities to accommodate students from regional areas. Planning for Roebourne District High School includes arts based specialisation. A specialist arts program presents an opportunity for the school to provide a unique offering to the Pilbara Region and to encourage engagement of students through alternative pathways.

Tertiary Education

The *Pilbara Institute* has campuses in Karratha and Roebourne, offering apprenticeship and traineeship programs in a limited range of fields. It also offers public training programs in industrial skills training, occupational health and safety, business, computer and education training, and lifestyle courses through its Pilbara Skills Centre.

A valuable opportunity exists for the City in expanding the quality and scope of its tertiary education offering. Tertiary education opportunities within the City are currently very limited, and expanding both technical training through TAFE and apprenticeship programs, as well as university level education presents an opportunity to train the City's population in situ, rather than relying on population leaving the City to receive higher levels of education and training, with the risk they will not return.

In the longer term, tertiary education may be developed to a level that will also attract population to the City to study in areas of regional specialisation. Expansion of tertiary education is therefore not only an element of community infrastructure, but an important component to the development and diversification of the City's local economy.

A site of no more than 4 hectares can be expected to easily accommodate the long term expansion requirements for tertiary education. While the Karratha City Centre has been identified as one possible location, there would also be benefit to co-locating a future university campus with the existing Pilbara Institute site in Karratha. Land in the locality of the Pilbara Institute campus will be available with the relocation of Karratha's hospital to the City Centre.

Health Services

Hospitals for the City are currently located in Karratha and Roebourne. The Karratha Health Campus Pilbara Cities project is committed to bringing a new hospital to the Karratha City Centre. The project will be the largest expenditure on a single health infrastructure project in regional Australia to date, and will significantly improve the City's existing health services. Karratha is also expected to receive a GP Super Clinic to expand its healthcare services. Aged care and specialist facilities will be important complementary services that may be collocated with the future Karratha Health Campus and GP Super Clinic.

Police & Emergency Services

The following police and emergency services are in place in the City:

- Karratha Police Station;
- Dampier Police Station;
- Roebourne Police Station;
- Wickham Police Station;
- Karratha Fire and Rescue Service;
- Dampier Fire and Rescue Service;
- Roebourne Fire and Rescue Service;
- Wickham Fire and Rescue Service;
- Point Samson Bush Fire Brigade;
- Karratha State Emergency Service;
- Roebourne / Wickham State Emergency Service;
- Karratha St John Ambulance;
- Roebourne St John Ambulance; &
- Wickham St John Ambulance.

The Karratha facilities of each are likely to require upgrades and expansion as the population increases. Rationalisation of services may be appropriate where duplication exists between neighbouring settlements. Consolidation of an eastern corridor emergency services centre should be a future consideration.

Table 188: Active Recreation Open Space Provision – Analysis of Current Situation

Activity	Current Situation
AFL Ovals	AFL oval exist at Bulgarra, Leisureplex, Millars Well, Roebourne (2), Wickham, Dampier, Additional provision at Mulataga and potential expansion of Millars Well will ensure that needs are accommodated beyond 2023. All facilities will need to ensure appropriate clubhouse infrastructure is provided to serve sports needs.
Rugby Union / League	Current provision satisfies needs and potential capacity for growth (league use).
Diamond Pitch Sports	Incorporated within oval development and complementary to Football provision. No additional infrastructure required.
Soccer Pitches	Potential pressure point as growth in sport and junior provision exceeds population growth. Provision of approximately 9 to 11 pitches may be required to 2023. Provisions at Leisureplex (3), Pegs Creek, Tambrey Oval, Nickol West, Baynton East, Wickham, Dampier are likely to satisfy needs. An ongoing review of the demand will need to be undertaken.
Cricket Ovals	Cricket infrastructure caters for current need and growth.
Athletics (Grass & Synthetic)	Need for synthetic provision not proven – case would need to be assessed post 2023.
Hockey Pitches (Grass, Synthetic, Alternatives)	Demand for hockey is increasing, forming an emerging requirement which will be required to be addressed.

Source: Adapted from Syme Marmion & Co, Community Facilities Plan, 2013

District & Local Open Space

It is Western Australian practice for 10% of gross subdivisible area to be given up free of cost as public open space. Such public open space may be inclusive of both district and local open space, and should include a minimum of 8% allocated for active and passive recreational purposes.

District level open space within the City consists of open space recreation facilities and playing fields used district wide, generally for multiple sporting purposes. For the purposes of this assessment it also includes playing fields identified to be used City wide. There are currently three playing fields of district level significance in the City and two golf courses, located at Karratha and Wickham. This provision satisfies current demand, but will need to grow in line with population.

Local open space includes active and passive recreation spaces such as ovals, parks and playgrounds. It also includes areas not used for recreation, but reserved for drainage, or areas that may serve dual purposes for both recreation and drainage. Drainage is a vital consideration of urban design in the Pilbara environment, which is subject to severe rainfall patterns, cyclonic events and coastal inundation.

The City is relatively well provided for in respect to public open space, with a current excess of local open space overall. There are 28 local parks and playgrounds in the City. Based on the recommended service provision ratio of 1:1000 and a current population of approximately 25,000, the current requirement would be for 25 local parks and playgrounds, resulting in a moderate surplus of 3. Drainage areas are also generously provided for, particularly in Karratha, Dampier and Wickham.

The Lazy Lands project has identified 61 parcels of surplus land reserved for parks, recreation and drainage. An increased understanding of coastal processes and flood risk has confirmed these pieces of land are either not subject to flooding, or can be designed to mitigate flooding. Accordingly, the surplus open space is slated to be developed for residential infill to assist in increasing dwelling supply for Karratha. The *DRAFT Dampier Townsite Redevelopment and Revitalisation Strategy* similarly proposes opportunities where pockets of land currently reserved for parks, recreation and drainage may be utilised for infill residential development.

Local level playing fields currently exist in all settlements other than Point Samson, which has a population well below the 1 per 5000 people benchmark threshold. The City currently meets the 2011 benchmark requirement for six local level playing fields across the City. With continued rapid expansion in Karratha, Mulataga, Baynton East and Nickol West however, oval developments are considered essential to meeting projected playing field requirements. There is also a pressure point on provision of rectangular playing fields for soccer and a need to assess viability of provision for hockey. **Table 18** identifies the current situation of the City with respect to playing fields and recreational activities.

Regional Open Space

The majority of the coastline of the City of Karratha, as well as its islands, is reserved under TPS8 for conservation, recreation and natural landscapes. Coastal areas of the City comprise sites rich in environmental and cultural value.

Coastal reserves contain mudflats, mangroves, rocky outcrops and beaches of environmental significance, which provide habitat to a diversity of species. In particular the Burrup Peninsula and islands of the Dampier Archipelago provide significant habitat and are recognised as environmentally sensitive areas. The Burrup Peninsula also contains the world's richest known concentration of rock art, and is therefore a site of international significance. The regionally significant *Burrup Peninsula Conservation Reserve*, *Dampier Archipelago Nature Reserves* and *Murujuga National Park* have been established over these areas to protect their ecological and cultural significance.

Outdoor sporting and recreation activities associated with the coast, including boating, fishing, diving, camping and 4-wheel driving are exceedingly popular, and place pressure on the coastal environment. Thus, active management of coastal areas is important to preserving these regionally significant areas of open space. *DRAFT Foreshore Management Plans* have recently been prepared for 40 Mile Beach, Karratha and Point Samson foreshores. A *Foreshore Management Plan* is already in place for Cleaverville.

Other regionally significant open space is located inland around key environmental features in the vicinity of the City's settlement areas. Inland areas of regional significance for conservation, recreation and natural landscapes include:

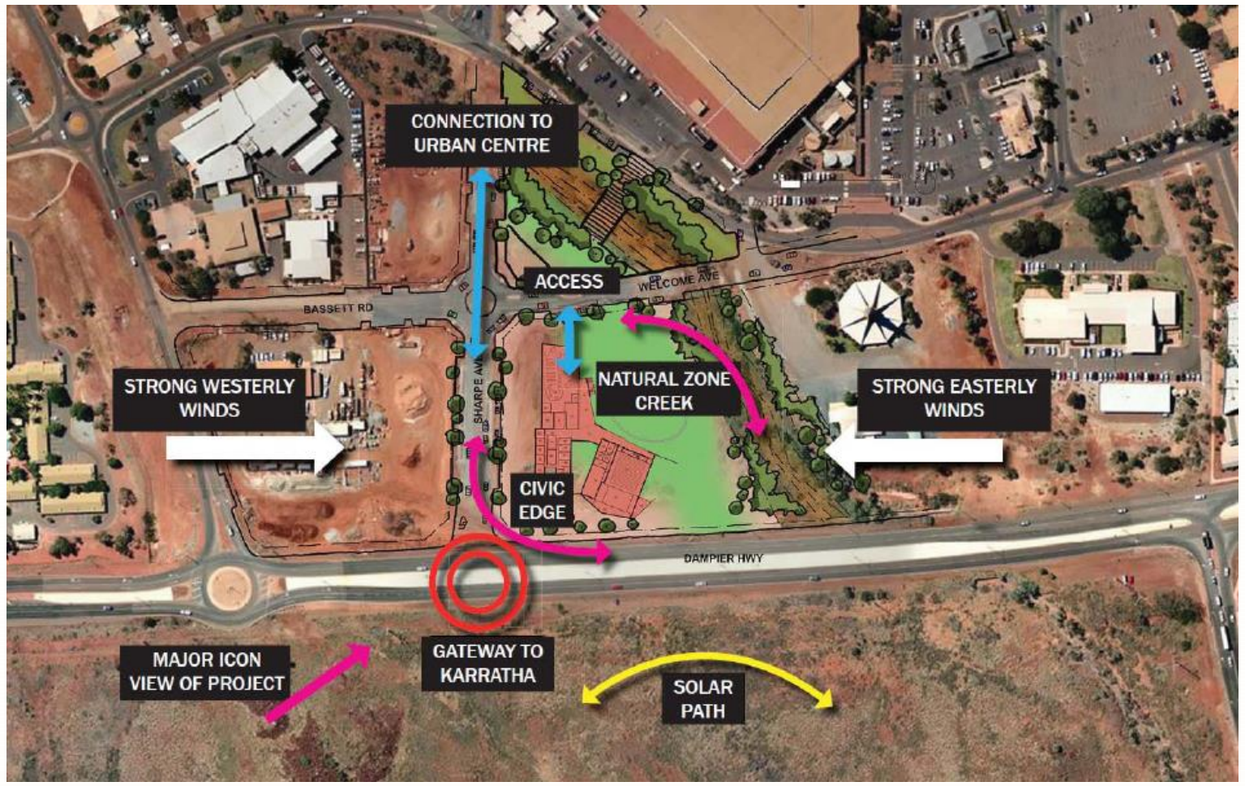
- The Karratha Hills;
- Rocky outcrop areas to the east of Dampier;
- Mount Welcome (Roebourne); and
- The Harding River.

There is some impetus from within the community to increase the environmental and recreational significance for the Karratha Hills through a *Karratha Hills Recreation and Nature Reserve*. This is a valuable proposal currently being considered by Council.

5.5 Key Issues: Community Facilities, Recreation & Open Space

- To achieve the high population projection implicit in the Pilbara Cities vision the City will need to contain a rich mix of community facilities and services to support its population in happiness and prosperity:
- Education services at a high level to keep people in place longer, including better quality secondary school education and upgraded tertiary education with development of regional research specialties;
- Health services that meet all of the health needs of all the community;
- A richer cultural life, with a wide variety of cultural activities;
- Well supported and vibrant community groups;
- A wide range of formal and informal sporting/recreation opportunities; and
- Places for people to meet – this means paying attention to the liveability of the major centres, particularly the Karratha City Centre.
- Under any scenario the majority of population growth, and therefore demand for community facilities and services will be in Karratha. The population growth in other settlements, Wickham in particular, will justify demand for some increase in services and facilities. These are of a local nature in general and should not substitute for larger and more regionally based facilities that will be required in Karratha.

Figure 38 – Karratha Cultural Precinct – Building Concept



Source: JCY Architects (2014)

- The *Karratha Leisureplex* performs a regional, district and local level function for sport, recreation and leisure uses. Programming and use of this space must be maximised. Its provision of court space will likely generate substantial increase in participation in basketball and netball due to the latent demand suppressed by the former *Karratha Entertainment Centre* facility.
- The proposed *Karratha Cultural Precinct* will also perform a regional, district and local level function. The *Concept Design Report* released in February 2014 proposes development of a 450 seat theatre and performing arts centre, a new library, rooftop cinema, art gallery, outdoor amphitheatre and local history museum which when developed, will go a long way addressing the immediate gaps in community facilities, particularly performing arts since closure of the Walkington Theatre in 2011.
- The City currently meets or exceeds benchmark requirements for provision of district and local public open space, including playing fields, parks and playgrounds. Despite this, continued rapid growth of the City will necessitate provision of new public open space, and will particularly require new playing fields in Mulataga, Baynton East and Nickol West for Karratha. Clubroom / clubhouse facilities to serve all new oval facilities are essential. There is also need for upgrading of existing clubhouse facilities which fall below assessed service standards.

- There may be need to provide for additional rectangular pitch sports (predominantly soccer) which is currently experiencing significant growth across the State above population growth. There may also be need to provide hockey facilities. Assessment is required to consider whether this infrastructure would be viable.
- Public open space for the purpose of drainage is a vital consideration of urban design in the Pilbara environment, which is subject to severe rainfall patterns, cyclonic events and coastal inundation. An increased understanding of coastal processes and flood risk has, however, allowed identification of 61 parcels of public open space in Karratha that are surplus to the required drainage network. Infill development of this surplus public open space will be an important component of increased dwelling supply in Karratha.
- The ecological integrity of regionally significant open space found along the City's coast is increasingly impacted by industry and recreation uses associated with the growth of the City. Active management of coastal areas, in accordance with *SPP 2.6*, should be a priority for the City. The *Foreshore Management Plans* recently drafted for 40 Mile, Karratha and Point Samson demonstrate measures underway to achieve successful coastal management. The City should seek to prioritise implementation of these plans.
- Additional regional open space around major landscape and environmental features inland from the coast also warrant conservation and preservation. A proposal to create a recreation and nature reserve over the Karratha Hills provides means to ensure protection and enhancement of this significant landscape feature.

Figure 31 – Karratha Cultural Precinct - Perspective

6.0 Theme 2: Economy

6.1 Local Profile: Economy & Employment

A Global Context

The City of Karratha is currently driven by the commodity market which is part of the global economy. The global economy is still fragile following the GFC. The IMF is not optimistic about medium term growth in the markets of Europe and Japan, cautions about growth in the USA and forecasts a slowdown in the China and India economies. In this context, the medium to long term growth and the City's economy must be viewed with equal caution. The City must identify medium to long term opportunities for diversification of the economy and must factor in lower growth rates in the region of 1.5% between 2021 and 2031.

Pilbara Regional Economy

The City of Karratha is a significant economy within the Pilbara Region. The region has immense reserves of natural resources, which provide massive direct export sales and also fuel a thriving economy of support services. The Pilbara's economy is strongly dominated by the mining and petroleum industries and the area is considered to be the State's premier mining region. These industries have grown at a considerable rate in recent years, but growth is likely to slow over the next 10-20 years and require fewer workers to support economic activity as construction is completed and operation commences.

The largest export commodity in Australia is iron ore and approximately 95% of this is produced in the Pilbara. Demand for iron ore principally comes from Japan, China and other rapidly developing Asian nations. In 2010, approximately 400 million tonnes of iron ore were exported from the Pilbara, worth AU$46.5 billion. New projects are continually being proposed and developed in the region as extensive geological research is uncovering more resources. The iron ore commodity market is part of the global economy and prone to fluctuation in a highly competitive market.

The region also produces 70% of Australia's natural gas. This is sourced from the Carnarvon Basin off-shore and is serviced and processed onshore from within the City of Karratha at Dampier. In addition to iron ore and natural gas, 85% of Australia's crude oil and condensate comes from the Pilbara. The Pilbara also produces a range of other minerals having a total 2011 value of AU$2.4 billion. This is led by:

- Gold and silver at $1 billion
- Copper at $643 million,
- Manganese and salt at $585 million; and
- Other minerals at $131 million.

While the City of Karratha contributes a relatively small proportion of this resource value, it is one of the region's major service and extraction hubs where port, rail, government and industry intersect. Other industries include manufacturing, tourism, sheep and cattle, fishing and aquaculture. All figure prominently in the economy of the region, providing a diversity of activity – and a range of business opportunities. A number of projects aimed at economic diversification are also currently being trialled across the region, including solar energy production and algae production for biofuel and protein.

Local Economy

The City of Karratha is one of the four local government areas that make up the Pilbara region of Western Australia along with the Shire of Ashburton, Shire of East Pilbara and Town of Port Hedland. The City of Karratha had a Headline Gross Regional Product of $18 billion in 2012 which ranks the municipality second to the City of Perth out of 139 LGAs in WA and nationally 6th after the cities of Brisbane, Sydney, Melbourne, Perth and Gold Coast.

The economy of the City is heavily dependent on the minerals and energy sector. The mining sector accounts for $12.25 billion of the $17.8 billion total value added (69% of total) in the City (2011/12 estimates) and the oil and gas and iron ore mining make up 63% and 34% respectively of value added in the City from the mining sector. Construction, the next largest sector measured by value added and the largest employment sector, is overwhelmingly directly related to mining and resources projects.

There are three major resource companies operating in the City (Rio Tinto, Woodside Energy Ltd and Citic Pacific Mining). Each company is currently operating or rolling out mining and energy extraction infrastructure investments worth an estimated $69 billion. The most significant include:

- Woodside operated North West Shelf Venture;
- Woodside's Pluto project;
- Rio Tinto's expansion of Dampier Port;
- Rio Tinto's Cape Lambert Port and Rail Expansion; and
- CP Mining plans for Cape Preston.

In addition to this, some $16.8 billion worth of investment is under consideration or at pre-feasibility stage.

The City contains a very high proportion of the Pilbara employment – around 33% of all regional employment and between 30% and 60% of most services. However, it has only 19% of resident employees in the mining sector. It has a higher proportion than the regional average of employment in the following sectors:

- Electricity, Gas, Water & Waste Services
- Public Administration & Safety
- Construction
- Professional, Scientific & Technical Services
- Retail Trade
- Rental, Hiring & Real Estate Services
- Financial & Insurance Services
- Manufacturing
- Transport, Postal & Warehousing
- Information Media & Telecommunications
- Education & Training
- Wholesale Trade
- Health Care & Social Assistance
- Administrative & Support Services
- Other Services

Regional & Local Growth Prospects

Minerals & Energy Sector Economic Outlook

In 2011 approximately 410 million tonnes of iron ore was exported from the Pilbara at a value of AU$60.3 billion, approximately 45% of world iron ore exports. The demand for iron ore is expected to grow; one of the biggest drivers of demand is the growth of China. The Bureau of Resources and Energy Economics forecasts that iron ore world demand will continue to grow up to nearly 2,000 mtpa by 2025. Primary risks to the growth of the Pilbara iron ore industry are:

- Change in the Chinese economic outlook;
- Cost pressures;
- Lack of skilled workers;
- International competition from Brazil and West Africa; and
- Infrastructure constraints, ports, roads, housing, power, water.

In 2011 the world LNG trade measured 238 million tonnes of LNG. Due to its location, the growth in the Asia Pacific region is most important to Pilbara LNG and this trade in 2011 was measured at 147 million tonnes annually. Demand for LNG in the region was expect to continue to increase at a 6% yearly average. Primary risks to the growth of the Pilbara LNG industry are:

- Demand for skilled labour will outstrip supply;
- Increase in capital and labour costs;
- Development of alternative fuel sources; and
- Competition from other suppliers.

However, these risks may be offset by recent (2014) slowdown in the employment growth of the iron ore sector, providing that skill sets can be transferred from one industry to another.

Despite these risks, given the current investment detailed across all categories of minerals and petroleum in the Pilbara it is estimated by the WA Chamber of Minerals and Energy that an approximate additional workforce of the following will be needed between 2012 and 2018:

- 40,000 construction workers.
- 17,493 operational workers.

Major Industry Projects Economic Outlook

The major industry projects in the City and in the Pilbara generally provide a very strong economic underpinning. The prospects are for some growth in operations expansion for iron ore and other minerals in the Pilbara and wider region with forecast increased export bulk. However, only a few of these new projects are in the City and operational stages require a smaller, more skilled workforce than the construction stage. Opportunities will therefore be in value chain goods and services to remaining ongoing and future construction and operational phases. Karratha is already a centre for this, with a number of small and medium enterprises marketing into the resource sector value chain.

Similarly, LNG generally shows growth prospects. However, the extent to which this will flow on specifically to the City of Karratha is uncertain. There are prospects for on-shore support to future processing of any floating LNG platforms. However, it is unlikely this will lead to large increases in operational labour demand.

With a solid and expanding LNG industry, opportunities for businesses in the City will be likely to utilise the existing skill base in LNG and offshore servicing to expand to other areas. However, it is noteworthy that the current preferred site for a common user facility that might be a focus for the expansion of businesses servicing the off-shore industry is at Port Hedland. There is likely to be a rapid increase in the level of knowledge of FLNG technology and capturing this in the City, possibly via some specialised research projects, to the extent it is possible will provide a knowledge base that can be applied elsewhere.

Regional Services Economic Outlook

The Technical Report: Population prepared for this *Local Planning Strategy* identifies the prospect of an increased regional role for Karratha as the main service centre for the Pilbara, becoming the Primary Centre in the Pilbara for high end and specialist services, particularly in meeting demand for:

- Education services;
- Health services; and
- Administration (private and public sector).

Competitive position

Generally, investment in and development of major projects (private and public) is cyclical in nature with periods of highs and lows. There are prospects for new large projects and the City must position itself to participate in them. However, energy and impetus for new economic growth in the City, particularly for significant diversification, will come from within the community. Growth and diversification will come from a large number of small projects and from diversity in the economy, rather than the relatively small number of very large projects that has been typical in the past. It is most efficient to build on the strengths of existing initiatives and land use activities, of which there are many.

In addition, Karratha must focus on creating sufficient land and infrastructure supply for centre growth.

Table 19: Comparative Strengths & Weaknesses for the City of Karratha Economy

Comparative Strengths	Comparative Weaknesses
• Home to large-scale world-class economic activity, including world-class purchasers. • Skills and experience of marketing to major purchasers; • Exportable goods or services that may be applicable to in other similar international markets; • The biggest centre in the region, housing the greatest diversification, scale and range of regional services and is most likely to contain the mix of community, cultural and social facilities that will keep attract and keep a wider population mix; • The location of the regional office for a number of government agencies. This provides a base for further expansion; • Good variety of lifestyle attractions around the Nickol Bay area generally; • Very strong local and regional economy, with forecast continuing expansion; and • Natural features for a range of economic activity, including solar radiation, flat land and a large quantity of industrial by-product.	• A high cost base (this is common in many resource-based communities): • Labour costs are high, on all national and international comparisons; • General costs of doing business are high, including high utilities and services costs; • Costs of commercial and residential accommodation remain relatively high, although these are starting to moderate; • Local market is still relatively small (scale is not yet there); • There is 'crowding out' of tourism activity by FIFO worker demand – this is expected to reduce fairly quickly from 2014; • Human capital rankings (educational attainment, skilled labour) are relatively low compared with other Australian regions; • High proportions of services are imported from other centres, principally Perth; • Competing centres (e.g. Geraldton and Bunbury) are seen to have better lifestyle amenity and a lower cost base; and • The region competes with others (Kimberley, Northern Territory, North Queensland) for political attention.

Source: Syme Marmion | Economic Drivers Evidential Analysis Paper
RDA | Pilbara Plan

Table 19 and **Table 20** summarises the comparative economic strengths and weaknesses of the City and its economy, which have been the focus of the preparation of the Local Planning Strategy.

An Economic Development Strategy is required for the City which shall detail how the City might use its competitive position to successfully achieve economic growth and diversification. The Economic Development Strategy will be required to implement the Local Planning Strategy. In response, any future review of the Local Planning Strategy should respond to enable and facilitate the projects identified in the Economic Development Strategy.

Table 20: Key Existing & Potential Projects in the City of Karratha

Project	Strategic Impact
Major Infrastructure Projects (Cape Lambert, Gap Ridge)	Supports expansion of economic base.
Airport Expansion	Business and general tourism. Karratha as an administrative centre for major projects.
Dampier as High Amenity Residential & Tourist Location	Increases residential choice. General tourism – opportunity for resort development.
Dampier as a General Cargo & Marine Servicing Base	Marine servicing base for SMEs servicing economic base activity.
Anketell – General Cargo Capacity and associated General Industrial Land	Infrastructure for diversified economy and for further servicing of economic base.
Tertiary Education, Research base and associated Accommodation	Support for knowledge economy.
Telecommunications Infrastructure	Support for digital economy.
Excellence in secondary education	Karratha as a centre of high quality education.
Health Specialities / Aged Care	Regional services. Increased residential amenity.
Youth Facilities / Childcare	Increased residential amenity.
Urban Amenity - Karratha City Centre	Regional services. Increased residential amenity.
Waste Recycling / Re-use	Industry development building on economic base by-product.
Algae Farm/pilot Renewable Energy Projects	Illustration of a major diversification project.
Hotel/Tourism Projects	Business and general tourism. Karratha as an administrative centre for major projects.

Source: Syme Marmion | Economic Drivers Evidential Analysis Paper
RDA | Pilbara Plan

Employment

While the mining sector is an important employer, it is not currently the main one. The dominance of the construction sector as an employer in the City is illustrated in **Figure 32** below.

There was a very substantial increase in construction-related employment over the period 2006 to 2011, increasing by almost 2,700 over the period, while employment in the mining sector similarly rose substantially, by 2,470 workers. There were also relatively large increases in proportionate terms of administrative categories and of professional, scientific and technical services.

Economic activities driving employment around the main settlement areas are regional services and administration, LNG production, port and port-related transport operations and salt mining.

Table 21 – Roebourne Shire Employment 2006, 2011 and 2012

Employment by Industry Shire of Roebourne 2006, 2011 and 2012 (Persons Employed)

Industry sector (2006 ANZSIC)	2012	2011	2006
Agriculture, Forestry, Fishing	137	100	82
Mining	5,040	4,837	2,367
Manufacturing	950	743	515
Electricity, Water, Waste Services	423	505	252
Construction	5,246	5,017	2,332
Wholesale Trade	434	343	405
Retail Trade	1,209	906	790
Accommodation and Food Services	822	829	559
Transport, Postal, Warehousing	1,286	1,289	865
Information Media and Telecommunications	116	71	94
Financial and Insurance Services	107	65	109
Rental, Hiring and Real Estate Services	426	402	197
Professional, Scientific and Technical Services	1,019	911	506
Administrative and Support Services	743	694	397
Public Administration and Safety	1,431	1,196	609
Education and Training	931	845	634
Health Care and Social Assistance	994	751	422
Arts and Recreation Services	59	53	101
Other Services	610	544	293
Total industries	**21,983**	**20,101**	**11,529**

Source: National Institute of Economic and Industry Research (NIEIR) modelling; .Forecast .id

Fly-in-fly-out (FIFO) workforce

A significant challenge faced together by Pilbara towns and the resources sector is a rapid increase in employees and their families choosing fly-in-fly-out (FIFO) employment in preference to residentially based employment. It remains a significant proportion of the workforce employed in the Pilbara and there is no indication that this will change markedly. However, there are good indications that a very high proportion of the current FIFO workforce is in the construction sector and that the current high rate of short-term accommodation demand is driven by construction activity for major projects.

From 2014 onward, construction has slowed and employment requirements are for a skilled operational workforce and significantly reduced numbers of employees.

Syme Marmion and Co has forecast that there will remain a FIFO workforce of around 2,500 in the City over the long term. This would largely be a mixture of long term operations (principally LNG and port operations) and short term maintenance workers.

While major centres in the City are not close to most of the Pilbara operational mines – some FIFO workers may use Karratha, Roebourne and other settlements as a FIFO / Drive-In Drive-Out (DIDO) residential base to work elsewhere in the Pilbara. This may partly be the result of the indigenous employment programs of Fortescue Metals Group and Rio Tinto. There is some evidence of this – the 2006 census shows in the two big employment sectors of mining and manufacturing, employment self-containment of 85% and 81% respectively, with almost 500 workers in those two industries and almost 1,200 overall with their main residence in the City but their place of employment elsewhere. These will have the reverse effect on demand for community facilities to the incoming FIFO workers.

Information provided by Rio Tinto however, shows that the numbers of workers using Karratha as a residential base is far eclipsed by other locations: amongst regional WA, Rio FIFO workers are far more likely to have Busselton, Geraldton and Broome as a home base than Karratha. This is an area of opportunity for the City to attract a more permanent population by offering regional services and an attractive, affordable lifestyle.

6.2 Key Issues: Economy & Employment

Key economic and employment issues for the Local Planning Strategy include:

- Ensuring there is sufficient zoned and serviced industry and commercial land;
- Facilitating the development of small and medium enterprises (SMEs) in statutory planning;
- Facilitating the provision for land for small business, including incubation projects, clustering;
- Ensuring the needs of agri-business enterprises are accounted for in strategic planning;
- Identifying sites and infrastructure to support Karratha SHS as a centre of excellence and the establishment of tertiary education facilities and services in the City;
- Expansion of the health campus with incorporation of areas of specialisation;
- The expansion of aged care services and facilities in the City, including NGO support;
- Regional-level recreation / sports facilities;
- Implementation of the Karratha Airport Master Plan (as revised 2013), including regular international services;
- Accommodation for expanded government services; and
- Affordable accommodation and diversity of supply, for both residential and commercial accommodation.

Additional studies and strategies are required to support the objectives of the *Local Planning Strategy*:

- Formulating a digital strategy to enable remote and tele-working, improved e-health and e-education opportunities, and improved viability of regional services and administration.
- Formulating a comprehensive tourism strategy that addresses attractions, amenity, access, accommodation, activities, product and marketing.
- Promoting cultural activities and facilities.
- Formulating an Economic Development Strategy.
- Expanded secondary school, including boarding facilities;
- Placement of accommodation for FIFO workers (especially operational FIFO) to enable community engagement.

6.3 Local Profile: Retail, Commercial & Industrial

Function & Hierarchy

Retail and commercial facilities for the City are concentrated primarily in Karratha. Retail and commercial floor space in other settlements generally services the local community only.

Centro Karratha is the main shopping centre for Karratha and surrounding area residents. Centro Karratha is a fully enclosed shopping centre anchored by a Kmart and Target Country discount department stores, and Coles and Woolworths supermarkets. It also contains 56 specialty stores.

Dampier shopping centre requires refurbishment, with the only operating retail facility being an IGA express supermarket. Its major tenant is the Department of Customs Pilbara Regional Office. Other commercial and retail offerings include a hotel with restaurant, a sports club and a restaurant at the bowling club.

There are very limited retail services in the settlement of Roebourne. The Harding River Caravan Park has a small convenience store, and there is a small tourist shop at the Visitor's Centre and Old Gaol Museum. The only other retail amenities are a service station on the highway, a general store, and post office. A number of NGOs and government services are based in Roebourne.

Wickham has the most substantial retail offering outside of Karratha. It has a medium sized shopping centre with a Woolworths supermarket and a few small retail outlets, including a newsagent, service station, ATM and post office.

Point Samson has a modern well-serviced caravan park, an older and smaller caravan park, tavern, fish and chip shop, liquor and grocery store, and two short stay self-service accommodation facilities. Point Samson also has a seafood factory servicing the settlement's commercial fishing industry.

The 2009 Karratha Primary Trade Area and Retail Strategy prepared by SGS Economics and Planning provides a quantitative indication of the retail hierarchy by estimating retail floor space based on Gross Lettable Floor Area (GLFA). It determined 76 per cent of retail floor space was located in Karratha and an additional 9 per cent of retail floor space was accounted for in Karratha's industrial areas. **Error! Not a valid bookmark self-reference.2** below identifies the GLFA per retail category by settlement in the City as at 2009.

Table 22: Gross Lettable Floor Area in City of Karratha (2009)

Retail Category	Karratha	Karratha Industrial	Dampier	Wickham	Roebourne	Point Samson	Total
Supermarkets	8,360	0	1,700	1,800	0	0	11,860
Household Goods	6,005	0	0	0	0	0	6,005
Other Food	1,351	0	90	240	0	0	1,681
Other Retail	6,158	4,286	174	100	570	250	11,538
Department Stores	7,829	0	0	0	780	0	8,609
Hospitality & Services	4,372	241	120	280	0	950	5,963
Clothing	2,398	0	0	180	0	0	2,578
Total	36,473	4,527	2,084	2,600	1,350	1,200	48,234

Source: SGS Economics and Planning 2009

Drivers of Demand

The primary driver of demand for the City is projected population increase. In general, main drivers of retail demand include:

- Increase in household, family and individual incomes (particularly disposable income)
- Savings habits
- Age structure of the population
- Ratio of females to males
- Shopping habits
- Population growth
- FIFO workforce.

The size and related potential dollar spend of the population will be the main determinant of demand for future retail and commercial services.

Retail Demand

This analysis is based on the estimated allocation, by broad retail category (e.g. supermarkets, department stores / discount department stores, food specialties, bulky goods, etc), of 1.82 sqm per person. A conservative total provision figure of 1.82 sqm is adopted for the purposes of these estimates, being at the lower end of the range that is estimated nationally.

The allocation of floor space type provided within the City should have regard to the nature of the area and the potential for particular uses to be located within the City. In particular this should consider the critical mass required to provide for larger anchors stores and bulky goods and the relative isolation of the area.

Overall, it is considered that at least 80% of the total retail floor space needs of the City population should be provided within the Local Government area. It is noted retailers will also likely serve FIFO workers and visitors in addition. The remaining 20% represents expenditure which would escape (in net terms) to facilities located outside the City. This escape expenditure would be directed primarily to the roles of higher order centres located outside the study area (e.g. facilities within the Perth metropolitan area). Of course, if the local provision can be higher, local residents would benefit from such an outcome.

Across the various store types and retail categories, the level of self-containment of retail expenditure will fluctuate, reflecting the different roles of each type of retailer. Thus, for example, it is anticipated that a very high proportion all of food and grocery retailing should be catered for by retail facilities provided within the City (95 per cent). On the other hand, for the more discretionary types of retail expenditure, the level of self-containment is assumed to be lower. Overall, this is considered to be a conservative assessment as the extent of self-containment of non-food retail expenditure could potentially be higher than estimated.

Adopting the logic outlined above, the level of retail floor space provision (excluding bulky goods) within the City that is considered necessary as a minimum is estimated at 1.37 sqm per person.

Table 23: Retail Floorspace Provision per person

	2011	2013	2016	2021	2026	2031
Population						
City of Karratha	23,619	25,436	28,351	32,204	35,405	38,121
Floorspace Requirements Per Capita						
Resident Retail Floorspace Demand Per Capita (m^2)	1.37	1.37	1.37	1.38	1.39	1.39
Add-on Trade	0.21	0.21	0.21	0.21	0.21	0.21
Floorspace Demand						
City of Karratha	32,358	34,847	38,841	44,442	49,213	52,988
Add-on Floorspace Requirements						
City of Karratha	4,960	5,342	5,954	6,763	7,435	8,005
Total Retail Floorspace Demand						
Karratha District	23,282	25,612	28,482	33,810	38,157	41,867
Roebourne Town – City remainder	4,081	4,181	4,417	4,467	4,540	4,574
Dampier	1,795	1813	1,828	1,849	1,883	1,895
Wickham / Point Samson	3,200	3241	4,115	4,317	4,631	4,652
Additional Floorspace Requirements						
Karratha District	3,569	3,926	4,366	5,145	5,765	6,325
Roebourne Town – City remainder	615	641	677	680	686	691
Dampier	275	278	280	281	285	286
Wickham / Point Samson	491	497	631	657	700	703

Source: MacroPlan Dimasi

Bulky Goods Demand

Using the same methodology as the retail demand section above it is estimated that the minimum necessary bulky goods floor space provision per person in the City is 0.45 sqm. **Table 24** shows forecasted range for total likely bulky goods floor space demand to 2031. This calculation assumes the required level of bulky goods floor space per person grows modestly at approximately 1% per annum. By 2021 the demand for bulky goods is expected to increase to between 14,000 sqm to 15,000 sqm and by 2031 bulky goods demand is forecasted to grow to 17,000 sqm to 18,000 sqm.

Table 24: Estimated Bulky Goods Floorspace Demand 2013-2031

	2011	2013	2016	2021	2026	2031
Population						
City of Karratha	23,619	25,436	28,351	32,204	35,405	38,121
Floorspace Requirements Per Capita						
Resident Floorspace Demand Per Capita (m^2)	0.45	0.45	0.45	0.45	0.46	0.46
Add-on Trade	0.09	0.09	0.09	0.09	0.09	0.09
Floorspace Demand						
City of Karratha	10,629	11,446	12,758	14,492	16,286	17,536
Add-on Floorspace Requirements						
City of Karratha	2,126	2,289	2,552	2,898	3,186	3,431
Total Bulky Goods Floorspace Demand						
Karratha District	7,647	8,413	9,356	11,025	12,627	13,855
Roebourne Town – City remainder	1,341	1,373	1,451	1,457	1,502	1,514
Dampier	590	595	600	603	623	627
Wickham / Point Samson	1,051	1,065	1,352	1,408	1,533	1,540
Additional Floorspace Requirements						
Karratha District	1,529	1,683	1,871	2,205	2,471	2,711
Roebourne Town – City remainder	268	275	290	291	294	296
Dampier	118	119	120	121	122	123
Wickham / Point Samson	210	213	270	282	300	301

Table 25: City of Karratha Labour Force Assumptions

Year:	2011	2016	2021	2026	2031	Long Term/ 2051
Population	22,900	28,351	32,204	35,405	38,121	50,000
Population aged 15+	18,091	22,397	25,441	27,970	30,116	39,500
Labor Force*	12,121	15,006	17,046	18,740	20,177	26,465
Employed	11,636	14,406	16,364	17,990	19,370	25,406
White Collar	4,305	5,330	6,055	6,656	7,167	9,400
Blue Collar	6,051	7,491	8,509	9,355	10,073	13,211
Service/Sales	1,280	1,585	1,800	1,979	2,131	2,795

* Resident population Source: Forecast .id population / Macroplan ratios

Commercial Demand (Office)

Projected employment in the study area is assessed by analysing historical employment trends within the City along with projected changes in participation rates and occupation mix. Understanding the trends helps to define the requirement for local employment opportunities and underlying commercial floor space demand.

This analysis has assumed that the population will grow at a more realistic 1.5% pa and the economy is assumed to grow by 1% across all industry sectors. Aside from this, all variables are held constant (e.g. densities, household structure, dwelling types, labour force, skills, etc). The implication of this option is that there will be no change in existing levels of labour force containment. **Table 25** outlines the labour force assumptions applied for this analysis.

This section assesses the future demand for employment of white collar workers in the City and converts this to a commercial floor space requirement to support the levels of employment within the region. In meeting the needs of the local and regional labour force there are two primary stated aims and performance measures:

- Providing employment self-sufficiency (providing up to one job for every resident member of the labour force within the City; and
- Providing employment self-containment (increasing the proportion of resident workers who actually work within their local area or defined catchment).

Providing employment self-sufficiency does not necessarily equate to employment self-containment. However, benchmarking of ABS census statistics reveals that most municipalities of Australia that offer relatively higher levels of employment relative to their resident labour force tend to experience reduced levels of commuting outside. This is likely to be more exaggerated within the City given the level of FIFO workers to the region. However, this will most likely impact on the mining and blue collar related workers.

Table 26 below outlines the commercial land need based on the job forecast for white collar jobs.

Total commercial land demand is projected to increase by 16,905 sqm in 2031. The total additional floor space required by 2021 is forecasted to be 8,505 sqm. Almost all future commercial needs will be focused around Karratha as opposed to the other settlements, which are anticipated to receive relatively limited levels of growth.

This commercial land requirement is split into:

- Private Commercial: Additional demand for 7,694 sqm in 2031;
- Government: Additional demand for 4,360 sqm in 2031;
- Community Services: Additional demand for 4,107 sqm in 2031; and
- Utilities: Additional demand for 744 sqm in 2031.

Table 26: Employment Forecast by Sector – Full Time Equivalent

Year:	2011	2016	2021	2026	2031	2041	2051	Workforce Increase
Agriculture/ Fishing	71	75	78	82	86	95	105	
Mining	4,859	5,107	5,367	5,641	5,870	6,484	7,163	
Manufacturing	553	581	611	642	668	738	815	
Electricity/Gas/Water	448	471	495	520	541	598	660	
Construction	6,414	6,741	7,085	7,446	7,749	8,560	9,455	
Wholesale	232	244	256	269	280	310	342	
Retail	878	923	970	1,019	1,061	1,172	1,294	
Accommodation/Food	788	828	870	915	952	1,052	1,162	
Transport/ Postal/ Warehouse	1,331	1,399	1,470	1,545	1,608	1,776	1,962	
ICT	66	69	73	77	80	88	97	
Finance	39	41	43	45	47	52	57	
Rental	401	421	443	466	484	535	591	
Professional/ Scientific	914	961	1,010	1,061	1,104	1,220	1,347	
Administration	677	712	748	786	818	903	998	
Public Admin	1,047	1,100	1,157	1,216	1,265	1,397	1,543	
Education & Training	741	779	819	860	895	989	1,092	
Health	692	727	764	803	836	923	1,020	
Art & Recreation	54	57	60	63	65	72	80	
Other	541	569	598	628	654	722	798	
Total	20,746	21,804	22,916	24,085	25,063	27,686	30,582	**9,836**

Source: Economyid 2011 Work Force Profile. Employment by Industry imani estimated employment forecast on 1% pa growth in each sector

Table 27: Additional Office Floorsapce Demanded Projections 2016-2031

	2016 (m^2)	2021 (m^2)	2031 (m^2)	2041 (m^2)	2051 (m^2)
Private Commercial	1,827	3,869	7,694	12,380	17,538
Government	1,060	2,200	4,360	7,000	9,920
Community Services	1,002	2,060	4,107	6,594	9,359
Utilities	184	376	744	1,200	1,696
Total:	4,073	8,505	16,905	27,174	38,513

Source: Imani | Forecast .id

Industrial Snapshot

Industrial development has occurred in various locations throughout the City, which generally has been driven by the need to address local industrial land shortages, demand for suitable strategic industrial land, and also for capitalising upon natural advantages for industrial requirements (such as proximity to workforce, deep water port facilities, service corridors and road/rail connections to resources). To maximise appropriate use of industrial land the various functions and principal roles of the various industrial locations should be rationalised, which can be undertaken through an appropriate zoning framework in the Scheme to ensure the objectives and purposes of the zoned land reflect the intended purpose of the industrial location. Whilst encouraging the appropriate and orderly development of identified industrial locations, it will be necessary to discourage industrial uses from operating or establishing outside of these locations, without a strong and compelling planning rationale to support such a proposal. For example, establishment or agglomeration of industry along Tom Price Road / Warlu Road (i.e. Toxfree and Transpacific are currently established on Warlu Road) is not supported by the Strategy.

Table 28 provides a snapshot of the existing industrial areas within the City, as well as their primary function and current role.

Table 28: City of Karratha Existing Industrial Areas

Location	TPS 8 Zoning	Primary Function Existing / Proposed		Role
Karratha, Dampier & Surrounds				
Karratha Industrial Estate	Industry; Transient Workforce Accommodation	General Industry Transient Workforce Accommodation	E	General and light industry. Lower standard and specification of services / utilities compared to Gap Ridge.
Karratha Industrial Estate West (DA17)	Parks, Recreation & Drainage reserve; Conservation, Recreation & Natural Landscapes reserve	Vacant	E	Medium and long term General Industry development.
Karratha Industrial Estate Regals East	Conservation, Recreation & Natural Landscapes reserve	Vacant	P	Medium and long term General Industry development.
Karratha Industrial Estate North	Conservation, Recreation & Natural Landscapes reserve, Recreation & Drainage reserve	Vacant	P	Medium and long term Light Industry development.
Gap Ridge Industrial Estate	Strategic Industry; Industrial Development	General Industry Light Industry	E	Stage 1 designed primarily for transport and logistics. Stage 2 marketed for service provider and maintenance uses. Stage 3 marketed for General Industry. Stage 4 marketed for Light Industry.
Gap Ridge Industrial Estate North	Public Purpose (Airport) reserve; Rural	Vacant Extractive Industry	P	General and Light Industry lots responding to market requirements.
King Bay Industrial Estate	Strategic Industry	Strategic Industry & Harbour	E	Leased to Chevron, BP, Shell, Japan Development Australia, Woodside Energy, BHPB
Cinders Road Industrial Estate	Industrial Development	Industry Extractive Industry	E	Future land for industrial development.
Dampier Salt	Rural	Industry	E	Industrial land for Dampier Salt.
West Intercourse Island	Strategic Industry; Infrastructure reserve; Conservation, Recreation & Natural Landscapes reserve	Vacant	E	Future land for industrial development. Reserve 49120 and 49121 vested to DoP with no other registered interests.
Maitland Strategic Industrial Area	Strategic Industry	Vacant Strategic Industry & Downstream Processing Operations	P	Long term future supply of strategic industrial land.
Cape Preston Port	Conservation, Recreation & Natural Landscapes reserve Rural	Wharf & Railway Haulage	E	Strategic industry for Sino Steel magnetite facility, power generation, and wharf.
Eastern Corridor				
Cape Lambert (Point Samson)	Strategic Industry	Strategic Industry & Wharf	E	Leased to North Mining Ltd, Mitsui Iron Ore Development Pty Ltd, Sumitomo Metal Australia Pty Ltd, Robe River Mining Co Pty Ltd, Nippon Steel Australia Pty Ltd.
Anketell General Industrial Estate	Strategic Industry	Strategic Industry & Port	P	Anketell Point multi-user Port Facility (State Port). Strategic Industry for resource companies, support industries.
Johns Creek Boat Harbour & Laydown	Industry	Industry &Harbour	E	Leased to Westug Pty Ltd.
Wickham Townsite Industrial Area (Wilson Way)	Industry	General Industry	E	General Industrial development, no Heavy Industry (evident).
Wickham Mixed Business Area	Mixed Business	Vacant	P	Future land for Mixed Business development
Roebourne Mixed Business Area (Jager Street, Hall Street)	Mixed Business	General Industry	E	Location for industrial activity, including servicing for mining industry, logistics and other mechanical.

Source: CBRE (2013); TPS 8; Landgate (2014); DRAFT Roebourne Structure Plan (2014)

Industrial Demand

A key determinant of demand for industrial land is the size, composition and structure of the industrial economy. The City has a particularly unique industrial economy given its remote location and its position servicing the major projects of the mining and resources industry of the region. Blue collar workers (defined in this report as tradepersons, intermediate production and transport workers, and labourers) represent the primary employees in an industrial zone. Change in the size and location of 'blue collar' occupations is likely to provide an indication as to the quantum and requirements of industrial land.

There have been changes in the City's employment over the period 1991 to 2011. Over this period the proportion of workers in 'blue collar' occupations has grown relative to total employment. This is reflected in strong employment growth in the service sector, particularly for mining related occupations. Estimates for future industrial land requirements have a high variability. Forecasts are based upon trends in land use efficiency, floorspace efficiency and locational preferences of various industrial typologies. Syme Marmion and Co forecast land requirements based on trends experienced in the SW region of Western Australia, which is a more mature industrial development market.

Table 29 below summarises the forecast industrial demand for the next 15 years for additional general and light industry to be approximately 400 ha net. Allowing for a buffer of supply and land for infrastructure and roads the gross level requirement will be just over 800 ha by 2031.

Table 29: City of Karratha Industrial Land Demand, 2011 to 2031

	2011	2021	2031	2051
City of Karratha Workforce *(1)*	15,063	20,329	26,579	30,582
Employed in Light/General Industrial *(2)*	1500-2100	2000-2800	2600-3700	3000-4200
Nett Land Requirement *(3)* Light/General (0.11 ha/worker)	231	308	407	462
Gross Land Allowance *(4)*	474	640	836	960
Nett Land Requirement Heavy/Special *(5)*	-	-	-	-

Source: Syme Marmion and Co; Imani

Notes:

1. Employed residents plus FIFO/DIDO (2011 based on employment census by industry not FTE).
2. Assumes 10%-15% of workforce.
3. Based on current employment density at high end of employment range.
4. Allows for 30% buffer, 40% for roads, drainage services, etc.
5. Adequate land supply, no forecast for additional demand.

Heavy / Special industry demand is highly variable and subject to external project influences, making future demand difficult to accurately predict. The City, however, has a large supply of Strategic Industry zoned land currently unutilised, which should be sufficient to meet demand throughout the planning timeframe. In regard to Light / General Industrial land requirements, analysis indicates that the existing Karratha and Gap Ridge Industrial Estates will be sufficient to meet the bulk of light and general industrial land demand to the medium term (about 2021). Major new industrial areas to meet future demand include:

- Anketell – Anketell Port Master Plan, June 2014
- Gap Ridge North
- Karratha Industrial Estate Northern, Eastern and Western Expansion
- Karratha Airport industrial areas.

Industrial land at Roebourne and Wickham will also form an element of Light / General industrial land supply. These industrial areas will provide local services and employment to eastern corridor communities.

6.4 Key Issues: Retail, Commercial & Industrial

- Karratha is, and will remain, the primary retail and commercial centre for the City, with other settlements providing local level services and facilities to residents and visitors. Overall, the retail offering of the City should be able to provide for a minimum 80% of the population's retail floor space needs.
- Based on a moderate population growth scenario, it is estimated retail floor space demand (excluding bulky goods) will increase to:
  - Between 44,000 sqm and 45,000 sqm by 2021; and
  - Between 52,000 sqm and 53,000 sqm by 2031.
- Assuming a 1:3 ratio for floor space to land requirement for retail land use, approximately 16 hectares net land will be required to accommodate the ultimate retail demand at 2031. About 80% of this should be located in Karratha.
- Based on a moderate population growth scenario, it is estimated bulky goods floor space demand will increase to:
  - Between 14,000 sqm and 15,000 sqm by 2021; and
  - Between 17,000 sqm and 18,000 sqm by 2031.
- Assuming a 1:4 ratio for floor space to land requirement for bulky goods land use, approximately 7 hectares net land will be required to accommodate the ultimate bulky goods demand in 2031. Due to the critical mass threshold required to provide for bulky goods uses, it can be expected that this would be located nearly entirely in Karratha.
- Based on a moderate population growth scenario, it is estimated commercial floor space demand will increase to:
  - Between 27,000 sqm and 30,000 sqm by 2021; and
  - Between 37,000 sqm and 42,000 sqm by 2031.
- If three storey development in Karratha town centre is utilised to accommodate demand for private commercial office space (7,694 sqm by 2031), a 1:1 ratio for floor space to land area would be reasonable to assume and approximately 1 ha net land area will be required to accommodate core commercial demand to 2031. For government and community service activities office space, a ratio of 1:2 may be expected and an additional 1.5 ha net hectares will be required to meet secondary commercial floor space demand to 2031. The majority of future commercial demand will be focused around Karratha, as other settlements receive relatively limited growth.
- The current provision of Light / General Industry land is estimated to be sufficient to meet demands to the medium term, but additional land will be required to accommodate industry growth beyond 2021. It is anticipated this will be provided for adequately through planned projects, including Karratha Industrial Area expansion and Gap Ridge North in the first instances, although these areas require comprehensive planning prior to development.
- Existing and planned industrial areas should be appropriately zoned for light, general or strategic industry in recognition of their primary function to prevent encroachment of incompatible uses.
- Zoning of existing and planned Strategic Industrial Areas should include off-site buffer areas or appropriately define buffer areas within designated SCAs.

6.5 Local Profile: Tourism & Visitors

The Tourism category is an amalgam of activities across various industry sectors such as retail, accommodation, cafes and restaurants, cultural and recreational services. The tourism industry sector services the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited.

The tourism industry currently employs 750 people in the City of Karratha and accounts for 5.1% of total employment in the City. This is a much lower proportion than in tourist-oriented localities such as the Shire of Augusta-Margaret River, where one sub-category of tourism employment such as accommodation and food services accounts for over 13% of City employment.

There are many opportunities to increase tourism as a proportion of the total economy from its current fairly low base. In investigating how this might be achieved it is useful to look at the five 'A's of tourism, namely: attractions, amenity, access, accommodation and activities.

Attractions

A number of tourist attractions are identified in the City or directly accessed through the City:

- Cossack Heritage Townsite
- Cossack Heritage Trail
- Old Roebourne Gaol
- Yaburara Heritage Trail
- Millstream National Park
- Karijini National Park
- Mt Herbert, Chichester Ranges
- Burrup Peninsula
- Murujuga National Park
- Burrup Rock Art
- Stairway to the Moon (Hearson's Cove)
- The Dampier Archipelago
- The Montebello Islands

Attractions relate to the coastal and inland environment, as well as Aboriginal and European heritage. Many of these are world-class. The City has attractions that can form the basis of a viable and larger tourist industry.

Amenity

Tourist amenity in the way of services and facilities is variable across the City. It is not as advanced or comprehensive as some of its competitor locations. Interpretive facilities and information services are generally not widely available or well established. The City, however, has exceptional and unique natural amenity that provides opportunities to generate high amenity tourism destinations and experiences.

Access

In comparative terms accessibility to the Pilbara is very good. It has good regional road connections and, importantly, a busy airport with a range of interstate and intrastate connections, as well as prospects of international connections. However, airfares are comparatively high and if a discount airline were to operate the route it would be a tourist advantage.

Accommodation

The City is not a major established tourist destination in the way that, for example, Broome or Exmouth are. Lack of affordable, accessible tourist accommodation is a major contributing factor limiting the City in this sense. Challenges with respect to tourist accommodation include:

- The effects of a FIFO workforce making accommodation difficult to get and expensive;
- A lack of promotion as a tourist destination;
- Limited tourist-oriented resorts and facilities, with a small 'resort' and caravan parks at Point Samson being the notable exception – but these are a small fraction of the range and scale of tourist accommodation that is available in other similar localities. By comparison, Broome has a wide and extensive range of tourist accommodation and therefore gets much more attention; and
- Accommodation shortages have led a major component of the northern tourist market, namely the 'grey nomad' caravan and camping trade, to by-pass Nickol Bay and travel direct from Broome to Exmouth.

Activities

Tourist activities are comparatively underdeveloped in the City. In large measure they have been crowded out by the activities of the resource industries. An example is the very low availability of boats for tourist operations to off-shore islands in preference for resources off-shore work. This is an opportunity for expansion.

The City already undertakes or sponsors a range of events for the local community which are increasingly becoming drawcards for tourists, including:

- Cossack Art Awards
- Red Earth Arts Festival
- NAIDOC Week
- Karratha Community Celebration
- FeNaCLNG Festival

Following the path of the warlu, or Dreamtime sea serpent from the shores at Ningaloo, through the lush oases, soaring gorges, rugged ranges and ancient Aboriginal art of the Pilbara and Kimberley regions to Broome, the Warlu Way is proving a highly popular route that poses considerable tourism potential.

Tourism Sector Expansion

There are many opportunities for expansion of the tourism sector:

- Improvements and increases to provision of facilities for the caravan and camping segment. There is an opportunity to examine the possible re-use or re-orientation of existing TWA camps or, at least, the various short stay accommodation facilities which are in and around major centres in the City.
- Expansion of adventure tourism – fishing and diving – in the Dampier Archipelago and Montebello Islands. This would be based out of Dampier and Point Samson.
- Industrial tourism and business tourism. There is potential to increase visitation to the City in relation to business and industry, including conferences and training relevant to the regions mining and resources specialisation.

Cultural Tourism

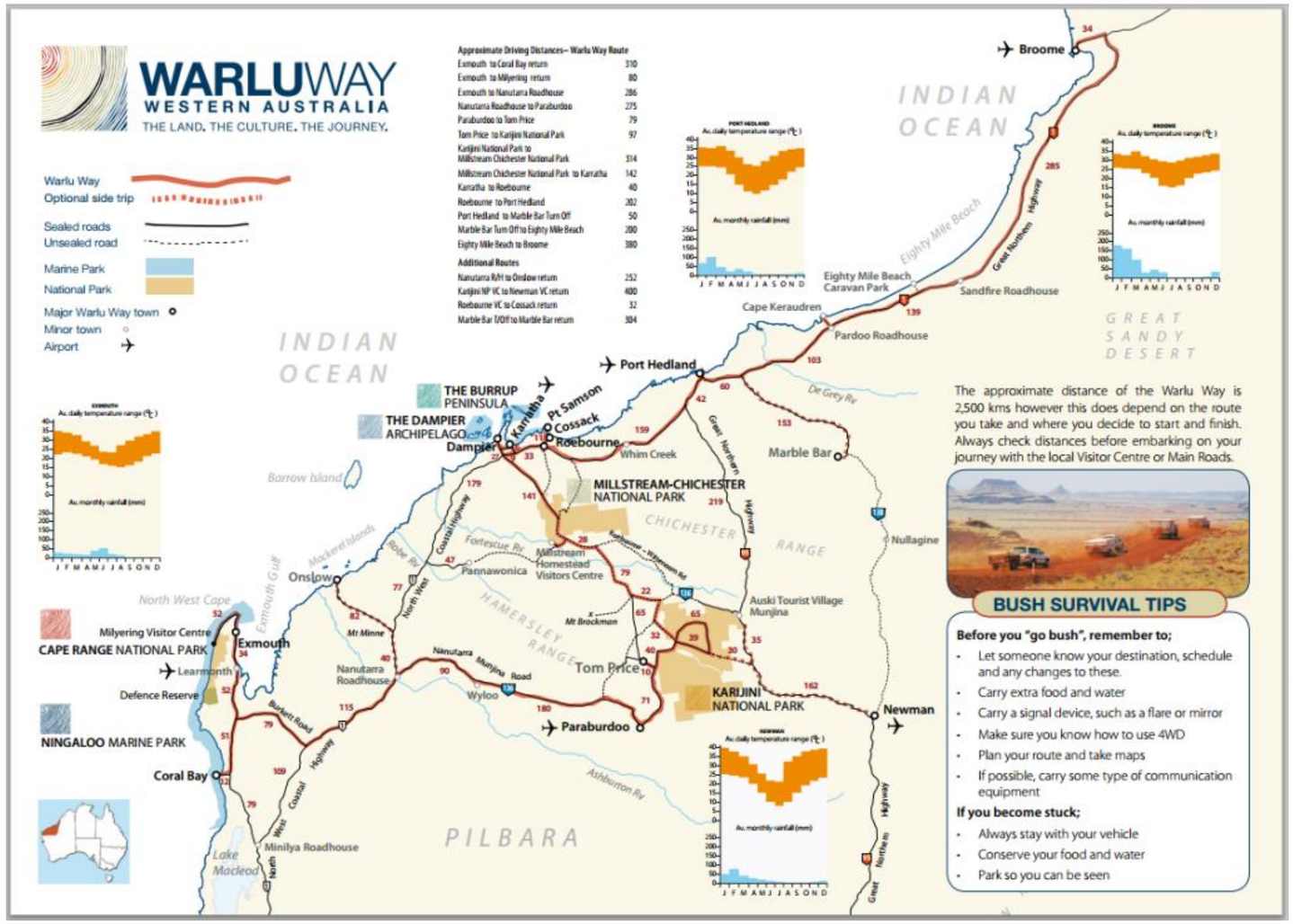
The City of Karratha has a strong Aboriginal cultural base that could be used to greater extent to expand tourism.

Roebourne town is a centre for numerous Aboriginal language groups, all of whom have unique traditional practices. Roebourne is home to the Roebourne Art Group and the Yinjaa-Barni Art Group which both have nationally and internationally renowned artists working and displaying art. Roebourne's outdoor amphitheatre is part of a developing cultural centre and the venue for local cultural events dance, music and theatre. A growing external appreciation of this artistic expression has begun to create a tourist attractor for Roebourne.

Two of the most visited cultural tourist sites in the area are the Burrup Peninsula and Dampier Archipelago. Both places hold great significance to the Traditional Custodians. The Murujuga Aboriginal Corporation (MAC) is currently looking at tourism prospects in this area through a Cultural Management Plan.

Ecotourism also presents a valuable opportunity for the City, and may be closely associated with Aboriginal cultural tourism through initiatives such as cultural bush tours. Some of these sorts of opportunities have already begun to emerge at a limited scale.

Figure 39 – WarluWay



Source:

6.6 Key Issues: Tourism & Visitors

- The City has several world-class quality tourism attractions to form the basis for a larger viable tourism industry. However, despite the natural amenity, tourist facilities amenity is currently inconsistent and not highly developed.
- Improvements to accessibility, particularly inter-State and international flight connections with the expansion of Karratha Airport will be important to opening up the tourism market. Intra-State flights are currently prohibitively expensive to the tourism market, and promotions or package deals that provide for discount tourist flights may provide another means to increase tourism.
- Lack of accessibility and affordability for tourist accommodation is currently a critical limiting factor, as FIFO workforce drive demand and prices up. The range and scale of tourist accommodation currently offered is a fraction of that available in other similar regional localities. Demand for accommodation is expected to ease with the winding up of the construction phase of major projects, and there may be an opportunity to re-use or re-orient existing TWA camps and short stay accommodation facilities in and around the City's major settlements for tourism accommodation.
- Tourist activities are comparatively undeveloped in the City and have also experienced crowding out by the resource industry. Expansion of adventure tourism activities, including fishing and diving in the Dampier Archipelago and Montebello Islands, present good opportunity for the City. Such activities would be based out of Dampier and Point Samson. A future marina development at Dampier could provide a strong base for adventure tours and could potentially accommodate cruise ship docking.
- Aboriginal arts and cultural tourism also present valuable opportunities for expansion of the tourism sector. This may combine with expansion of ecotourism through initiatives such as cultural bush tours or Burrup rock art viewing with the Traditional Custodians.
- A measure of success for the tourism industry in the City would be for it to be able to regularly house industry and academic conferences, including international conferences, of some size. If it could do this it would demonstrate that it has the requisite accommodation, facilities and transport connections to also appeal to a wider tourist market.
- There are several immediate requirements that will facilitate and enable expansion of the tourism sector. These include:
- An overall coordinated City tourism strategy – this could expand to a regional strategy for the Pilbara with the involvement of the PDC and RDA Pilbara:
  - Skills development;
  - Promotion;
  - A link with other areas (e.g. Broome, Exmouth) for packages; and
  - Additional accommodation and accommodation upgrades.
  - Longer term expansion of infrastructure will also be important to fostering the City's tourism sector. Projects include:
  - Dampier marina – a base for adventure tours and a cruise ship docking point; and
  - International airport – direct links to Asian capital cities.

7.0 Theme 3: Environment

7.1 Local Profile: Physical Environment, Climate & Natural Resource Management

Climate

The City of Karratha is described in the *Environmental Strategy* (Essential Environmental 2013) to have a tropical climate along the coastal areas, transitioning to an arid climate throughout the central and eastern parts.

An average climate profile for the City appears at **Figure 40**. Results indicate the hottest months occur between October and April, a period which experiences average maximum temperatures ranging from 35°C–37°C. Temperatures between May and September are milder, with average maximum temperatures ranging from 26–31°C. The City experiences cooler nights between May and September, with minimum temperatures ranging from 13–18°C. Diurnal temperature range increases with increasing distance from the sea. This results in more extreme maximum and minimum temperatures at inland locations.

Coastal areas receive higher rainfall, in comparison to the more arid desert areas in the central east of the Pilbara region. Rainfall is generally low (270-400mm) variable and over 50% of rainfall received is from cyclonic events during summer. The Pilbara coastline (Broome to Exmouth) receives tropical cyclones with a frequency and severity higher than anywhere else in Australia, with an average of two tropical cyclones crossing the Pilbara coastline each year.

The City experiences long dry periods and overall the region experiences the highest annual evaporation rate in Australia (Van Vreeswyk et al 2004, Essential Environmental 2013), which has implications amongst other things for water resources.

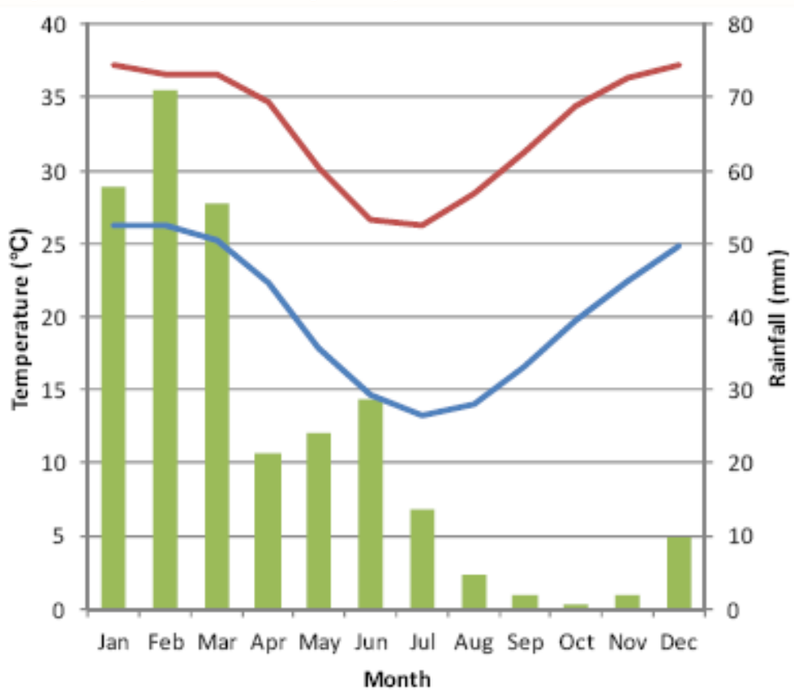
Predicted Climate Change

The Bureau of Meteorology (BoM 2013) has mapped changes in average temperature and rainfall since 1970 (Essential Environmental 2013). Since 1970, the BoM research indicates that the Pilbara region has experienced increasing temperatures and changing rainfall patterns, with declining rainfall in coastal areas and increasing rainfall inland. It is considered the increased rates of rainfall inland are related to an increased number of cyclones passing through the Pilbara. There is a trend of less frequent but more significant rainfall events. With long dry periods, soils become more hydrophobic whereby there is minimal retention of rainfall within the landscape and this can result in high velocity run-off (Essential Environmental 2013).

Various climate change models project an increase in temperature of slightly over 1°C by 2030, which will increase the rate of evapotranspiration in the region. Decreases in rainfall of approximately 4% across both summer and winter periods are projected, which may affect water availability. Projections for 2070 indicate a temperature increase of around 3°C compared with 1990 and a decrease in rainfall during the winter period (Loechel et al. 2011b).

Loechel et al. (2011b) also projects an increase in the severity of extreme weather events and storms, including an increase in the strength of tropical cyclones impacting the Pilbara. An increase in tropical cyclone intensity not only increases the degree of destruction at the centre of the cyclone but also the geographic area over which the cyclonic winds and flooding rains impact.

Figure 40 – City of Karratha Average Monthly Climate Statistics



Source: BoM 2013

Cyclone intensity and frequency will have significant implications for the City. Extreme weather events can lead to damage to buildings, property and infrastructure, and lead to loss of life in the community as well as livestock, flora and fauna. Disruption to oil and gas tanker schedules and disruption to exploration and production rigs will have broad-ranging economic implications. Operating costs for emergency services and emergency response are predicted to increase in relation to responding to more extreme weather events.

The coastal areas of the City are potentially vulnerable to changing ocean levels (astronomical tidal ranges, storm surges, wave set-up, sea level rise, tsunami). A study by the Department of Climate in 2009 found that:

- increased temperatures would result in a loss of work productivity;
- sea level rise would lead to increased flooding as well as increased maintenance costs for port authorities, coastal industries and infrastructure;
- lower rainfall would increase reliance on water source alternatives to groundwater or surface water; and
- increased incidences of damage from more frequent and extreme events.

Projections for Karratha provided by JDA et al. (2012) indicate the following:

- The projected climate conditions for 2060 include a 0.3 m rise in sea level, 10% increase in intensity and frequency of cyclones and a 0–20% increase in rainfall intensity for events greater than a 20-year ARI (Average Recurrence Interval) storm event; &
- The projected climate conditions for 2110 included a 0.9 m rise in sea level, 10% increase in intensity and frequency of cyclones and a 10–30% increase in rainfall intensity for events greater than a 20-year ARI event.

Coastal Processes

Coastal, low lying areas of the City are extremely vulnerable to inundation during tropical cyclones, storms and tsunami events. These areas are subject to very large tidal ranges, which coupled with the adjacent wide and shallow continental shelf, leads to the coastline being highly susceptible to storm surge and impacts from tsunamis (GEMS 2009).

Modelling scenarios considered in this *Strategy* are the 100-year ARI Stormwater Flood Extent and the 500-year ARI Storm Surge Extent. Selection of this data was based on providing worst-case scenario modelling to determine impacts from coastal processes in accordance with *State Planning Policy 2.6 State Coastal Planning Policy (SPP 2.6)*.

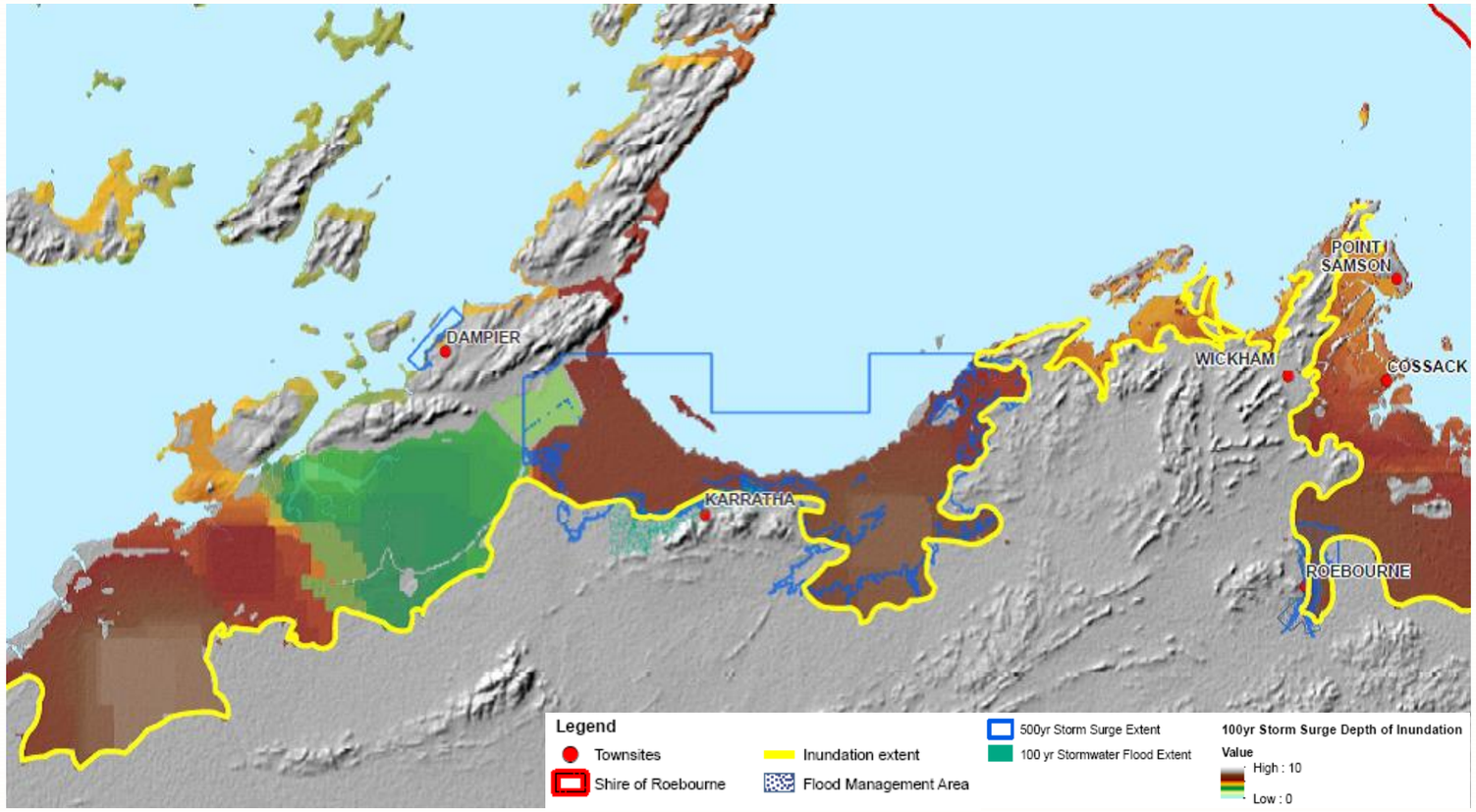
The 100-year ARI Stormwater Flood Extent shows those areas that will be affected by stormwater from an oncoming 100-year storm, essentially displaying the path of stormwater runoff and flooding.

The 500-year ARI Storm Surge Extent shows those areas affected by an oncoming 500-year ARI storm due to the combined impacts from rises in sea level, rivers, tides and wave action associated with wind stress and low atmospheric pressure. In the City of Karratha, these scenarios would normally be associated with tropical cyclones.

The following sources of available data were drawn on to create a City of Karratha coastal processes map (**Figure 41**) to determine those areas of the City subject to the affects of flooding and storm surge for the 100-year and 500-year ARI events in accordance with *SPP 2.6*:

- JDA et al. (2012a, 2012b), which provides a series of flood maps highlighting areas of Dampier and Karratha subject to flooding and storm surge impacts following the 100-year and 500-year ARI events;
- GEMS (2009), which indicates areas of the greater City subject to inundation following the 100-year ARI event, as well as the depth of inundation; and
- Data provided by City of Karratha indicates areas around the Roebourne townsite subject to storm surge inundation following a 500-year ARI event.

Figure 41 – Stormwater Flood Extent and Storm Surge Extent Modelling



Source: Strategen (2013); Topography: Geoscience Australia (2011); Imagery: GEMS (2009)

Coastal Flooding

Results indicate storm surge from a 500-year ARI event will affect the existing Karratha and Dampier townsites, particularly those areas situated at the northern and north-western outskirts respectively. Similarly, stormwater flood extent following a 100-year ARI event will affect both townsites.

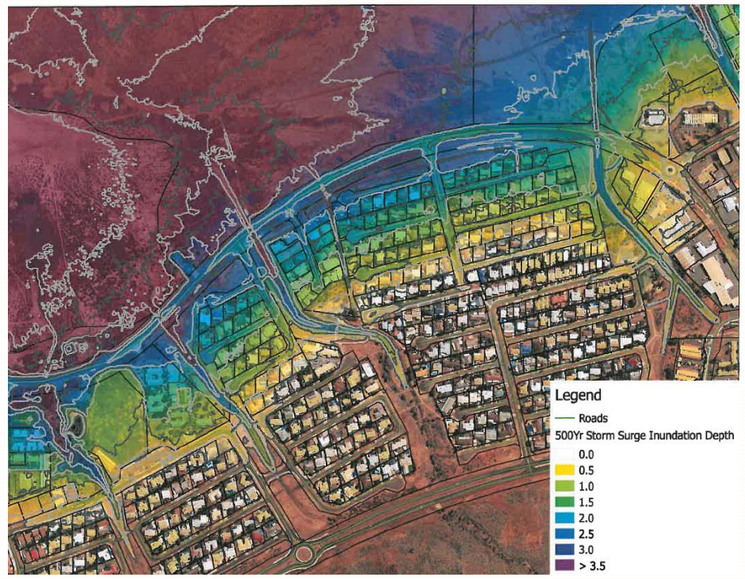
The eastern outskirts of the Roebourne townsite are marginally affected by storm surge from a 500-year ARI event, but the existing townsite lies outside the 100-year ARI event inundation line, which is generally associated with the Harding River to the east (Essential Environmental 2013).

The existing Wickham townsite is situated outside the 100-year ARI event inundation line, which will constrain future development to the east and northwest. Conversely, future development within the Point Samson and Cossack townsites will be significantly constrained due to the coastal location of each and associated inundation expected to occur from a 100-year ARI event.

Coastal processes and flooding are a key environmental constraints limiting land use and are expected to be a major factor in determining future planning and development outcomes in the region. Future development within areas of the modelled 100-year ARI Stormwater Flood Extent and 500-year ARI Storm Surge Extent is not advised; however, development is not necessarily restricted provided due consideration of coastal processes has been incorporated into building design, in accordance with adaptive management measures outlined in *SPP 2.6* and the City's agreed risk management process.

Development Policy No.19 – Storm Surge Risk sets out the means by which the City seeks to manage the risk for all land identified as being vulnerable to a 500 year ARI Storm Surge event.

Figure 42 – Example: 500yr ARI Storm Surge Inundation Depth (Pegs Creek)



Source: MP Rogers & Associates (2012); City of Karratha DP19 (2013)

Surface Water

The City covers numerous surface water catchments, including Fortescue River, George River, Harding River, Maitland River, Peawah River, Peter Creek, Robe River, Sherlock River, Turner River, Yule River and Coastal catchments. Coastal settlements of the City are situated within the Coastal catchment area.

All waterways in the City of Karratha are highly variable, flowing for only part of the year in response to larger, generally cyclonic, rainfall events. Major river systems of the City originate on higher ground to the south and traverse over the coastal plain, with most watercourses terminating in sand and mud flats some distance inland from the sea.

The major drainage system in proximity to coastal settlements of the City is the Harding River, which traverses Roebourne and discharges near Cossack. The Harding Dam, located upstream from Roebourne along the Harding River, is the only surface water source used as a major water supply in the Pilbara.

Neither Ramsar nor nationally important wetlands are located within the City.

The Department of Water (DoW), in carrying out its role in floodplain management, provides advice and recommends guidelines for development on floodplains with the objective of minimising flood risk and damage. DoW use the following guiding principles to ensure proposed development in flood prone areas is acceptable with regard to major flooding:

- Proposed development has adequate flood protection from a 100 year ARI flood;
- Proposed development does not detrimentally impact on the existing 100 year ARI flooding regime of the general area.

The Department of Water's recommended floodplain development strategy includes the following provisions:

1. Proposed development (i.e. filling, building etc.) that is located within the flood fringe is considered acceptable with respect to major flooding. However, a minimum habitable floor level of 0.5metres above the adjacent 100 year ARI flood level is recommended to ensure adequate flood protection.
2. Proposed development (i.e. filling, building etc) that is located within the floodplain and is considered obstructive to major flows is not acceptable as it would increase flood level upstream. No new dwellings are acceptable within the floodplain.
3. A failure to properly adhere to these recommendations will result in a greater exposure to risks of flood damage. This advice is related to major flooding only and other planning issues such as environmental and ecological considerations may also need to be addressed.

DoW assists local government in the establishment of floodplain management strategies based on these guiding principles and floodplain management principles. *Best Practice Principles and Guidelines* (CSIRO 2000) sets out principal objectives for floodplain management.

Groundwater

Because of the variability in rainfall and high evaporation rate in the Pilbara, groundwater is a very important water resource in the City. Groundwater occurs throughout the region but is most easily located and accessed near surface water drainage lines.

The key groundwater aquifers in the City are the Hamersley fractured rock aquifer, Pilbara fractured rock aquifer, Lower Fortescue Alluvial, Carnarvon – Birdrong, and Pilbara coastal saline aquifer. The aquifers on the coast are relatively small, typically receiving an annual recharge of less than 10 GL/yr. Allocation limits and water availability for these aquifers is presented in **Table 30**.

The fractured rock aquifers are harder to locate than the coastal aquifers and the amount of water available from them is difficult to predict. Water supplies in these inland areas can, therefore, be problematic both in quantity and quality (DoW, 2010). The water abstracted from these aquifers is mainly for mine use and mine dewatering purposes.

Table 30: Groundwater Allocation Limits

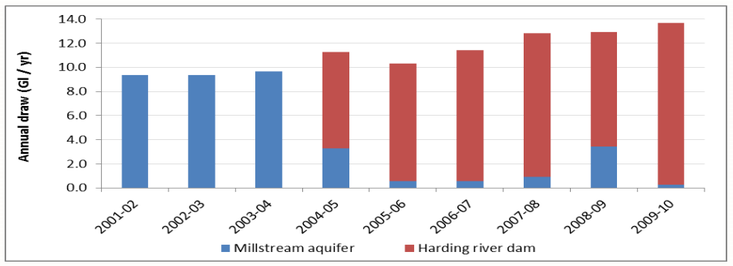
Aquifer	Allocation limit (kL/year)^	Availability (June 2013)**
Lower Fortescue Alluvial	6,600,000	Water available
Pilbara - Coastal Saline	2,000,000	Unknown
Pilbara - Fractured Rock	Not set*	Unknown
Hamersley - Fractured Rock	Not set*	Unknown
Carnarvon – Birdrong.	300,000	Fully allocated

Notes:
^Pilbara groundwater allocation plan draft for public comment (DoW, 2012a)
*For fractured rock aquifers, where most mining occurs, water availability will be assessed on a case-by-case basis through licensing (DoW, 2012a)
**Obtained from DoW's online Water Register: http://www.water.wa.gov.au/gqs/WaterRegister/

Water Source Protection Areas

Surface and groundwater resources of the City are contained within the Pilbara Surface and Groundwater Areas, which are proclaimed and protected under the Rights in Water and Irrigation Act 1914 (RiWI Act). In addition, there are two Public Drinking Water Source Areas (PDWSAs) in the City protected under the *Country Areas Water Supply Act 1947 (CAWS Act)*. These are the Harding Dam Catchment Area, which includes the Millstream aquifer (Protection Area P1); and the Roebourne Water Reserve (Protection Area not assigned). Any future development will need to consider potential impacts on these PDWSAs, as required under the *CAWS Act*.

Figure 43 – West Pilbara Water Supply Scheme: Total Scheme Draw Breakdown



Source: Essential Environmental (2013)

Water Supply Management

Water supply to the City is via the West Pilbara Water Supply Scheme (WPWSS), which comes mainly from:

- **Harding Dam** (primary source) located 23 kilometres south-east of Roebourne. In 2009/10 1343 ML was drawn from the dam; and
- **Millstream Aquifer** (secondary source) located 96 kilometres south of Karratha. In 2009/10 270 ML was drawn from the aquifer. There is growing concern however over the sustainability of the aquifer and the amount that can be drawn without affecting the Millstream's ecology.

Both sources rely on rainfall associated with summer cyclones for recharging. The Water Corporation is licensed to draw up a total of 15 GL per annum, with the source dependent on dam storage and aquifer levels. **Figure 43** provides a breakdown of the total WPWSS draw in recent years. Due to evaporation losses and high levels of sediment, the Harding Dam is not a continually reliable water source, and is only able to supply water at current levels of demand for approximately two years without a large recharge event (Essential Environmental 2013).

Taking into account the variability in recharge of the Millstream aquifer, the combined reliable yield for the scheme is 10 GL/year with 94% reliability. Current demand on the scheme however, is around 14 GL/year, which is nearing the scheme's maximum supply capacity of 15 GL/year. Demand is expected to increase to 18.5 GL/year by 2016 and 27.5 GL/year by 2031 in accordance with population demand projections (DoW 2012).

At these demand levels, there is little capacity to manage a drought, or extended period of less than average rainfall. In June 2010 the Water Corporation advised that the WPWSS was under extreme pressure to supply sufficient water to the towns and industry, placing supply security under a high level of risk.

In September 2011 the State Government secured an agreement with Rio Tinto to surrender its draw from the Millstream aquifer. Rio Tinto is to draw from an alternative water supply in the Bungaroo Valley reducing the industrial demand from the WPWSS, and augmenting the WPWSS with 10 GL of water from the Bungaroo Valley (until 2015). The long term security of this supply is not known.

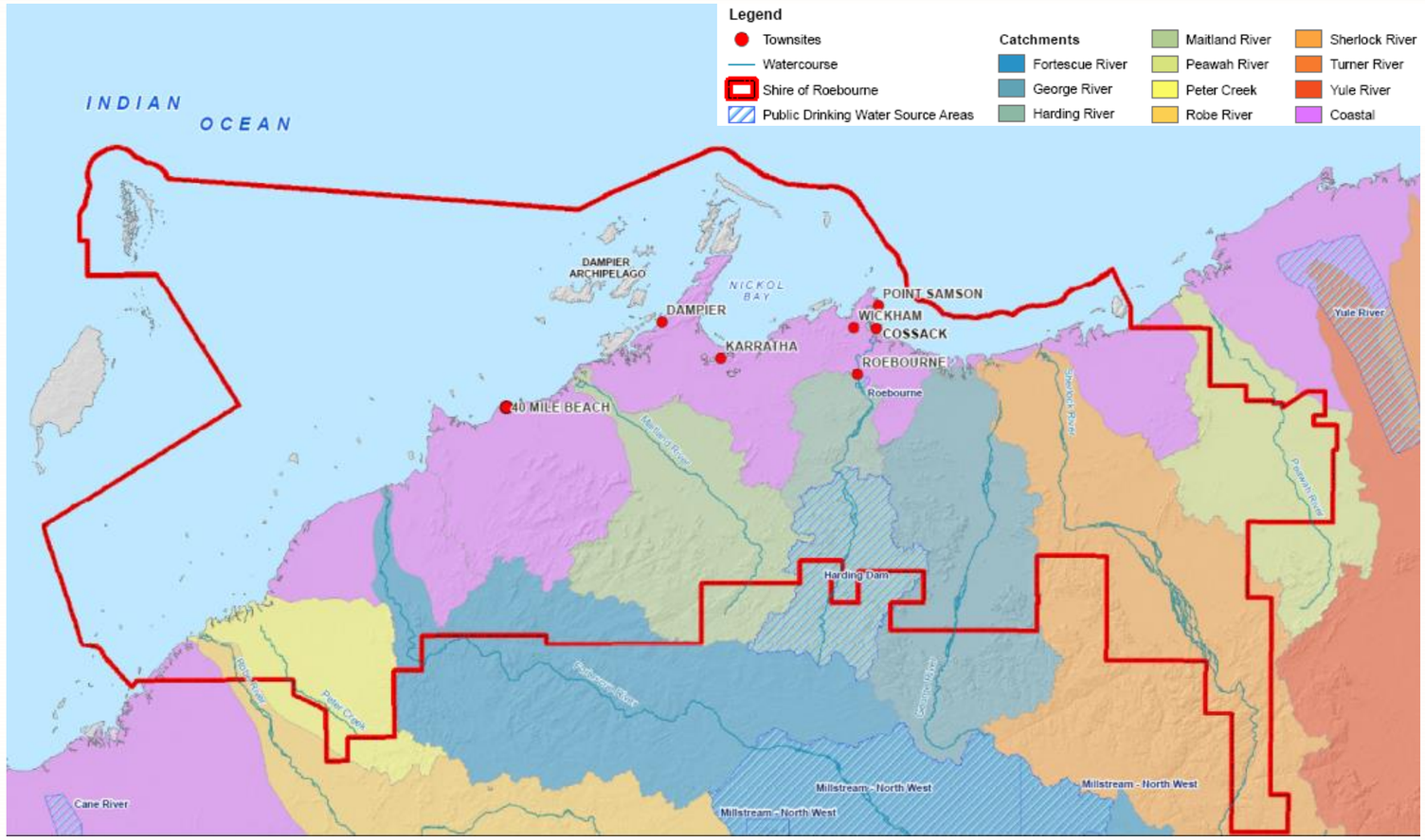
Currently, irrigation water for public open space is largely provided from scheme water, although it is proposed that wastewater from the upgraded Karratha wastewater treatment plant may be used to supply non-potable water to the Mulataga development or for use by the City. West Pilbara has a non-potable seawater supply scheme and desalination plant capable of supplying water for industrial use. The port facilities at Cape Lambert, Dampier and the Burrup Peninsula are the main industry users of scheme water.

Potential Water Supply Options

Haig (2009) provided a range of water supply options for the West Pilbara Water Supply Scheme to achieve future demand targets. These include:

- Lower Fortescue River alluvium: this is a well documented resource with early estimates of potential yield around 10 GL/year. However, a sustainable yield is probably much less than this and further work is required to assess any potential environmental impacts.
- Fractured bedrock aquifers: associated with the Sholl shear zone in the vicinity of the Upper Harding River have been explored at three locations. Estimates of total potential yield from the three sites range from 3–6 GL/year; however, significant work is required to prove up the resources.
- Maitland River and George River areas: minor groundwater resources have been identified. The resources are limited and have not been extensively investigated. The resources may have some potential as supplementary sources and future assessment work is warranted.
- Millstream aquifer system: this has been extensively investigated through drilling and test pumping and is used conjunctively with the Harding Dam as the West Pilbara Water Supply Scheme. Millstream aquifer has yielded 4 GL/year during drought periods without significant falls in aquifer levels. Yields of about 9 GL/year have been problematic, while yields at 14–15 GL/year have resulted in significant falls in aquifer levels. Due to the significance and sensitivity of the dependent ecosystems, the aquifer is managed using numerous criteria including mean minimum aquifer levels and rates of decline. When necessary, supplementation to maintain pools and springs is required. A numerical groundwater model has been developed for the aquifer to assess impacts, but this requires further work.

Figure 44 – Surface Hydrology and Water Supply



Source: Strategen (2013)

The use of water from the dewatering of mine sites should also be given consideration, potentially providing additional water sources to be used for purposes appropriate to its quality and volume.

The West Pilbara water supply scheme is expected to meet industry and growth (residential, commercial and light industrial) demand to 2018-19. A further source may be required if demand from industry growth is to be met. Use of water from dewatering of mine sites was one option identified as warranting further investigation.

In 2013 the Department of Water advised that future water demand for the City, it's coastal towns and ports are expected to be met through a combination of improved water efficiency and recycling, expansion of existing sources and new water sources, such as the West Canning Basin. When approached in late 2014 the Water Corporation advised that it expects the next water source for the West Pilbara Water Supply Scheme to be additional water from the Rio Tinto Bungaroo groundwater borefield, however work has not yet proceeded on this source as they believe it will be many years before the source is required.

A new desalination plant of up to 15 GL, on the Burrup Peninsula, was previously promoted as the most reliable short-term solution as it would be independent of climate factors. In 2014 the Water Corporation advised that desalination is unlikely unless the Bungaroo source proves too difficult/expensive to develop.

Currently around 3 gigalitres of spare source capacity exists in the Harding Dam and Millstream groundwater sources. Assuming the current growth rate (about 300 - 500 services or 1000 people per year) continues, the Water Corporation believe that this will be sufficient for another 10-15 years of growth. There are lots of factors to consider such as the;

- Amount of other industrial growth requiring a water supply service;
- Quantity of water used & number of people per service; &
- Ongoing growth rates.

The Water Corporation will continue to monitor growth and then make decisions accordingly. If the population rises to either the medium or high population forecasts by 2031, then a new water source will most definitely be required.

Ongoing improvements in water efficiency and recycling are important as they can help delay large investment in new water sources. Significant gains have been made over the past decade, for example Rio Tinto has reduced water used at the Dampier port by almost 30 per cent.

The Water Corporation has also implemented a program expected to save 3.4 GL/yr across the Pilbara and will continue to identify and implement further improvements. The water demand-supply balance will be reviewed with stakeholders at least every two years to determine if there have been any significant changes.

Landform & Topography

The Pilbara region contains a diverse range of landform features, from low mud flats, rocky promontories and sandy beaches of coastal areas, to inland desert areas characterised by stony ridges, abrupt escarpments and steep scree slopes, separated by stony, sediment plains.

Coastal settlements of the City are contained within an extensive coastal plain traversed by numerous north flowing rivers that drain the northern side of the Chichester Plateau. The coastal plain is generally alluvial and has varying topography including areas of extensive flat plains from 0–50 m AHD, low stony hills and flat top residual rock outcrops from 50–100 m AHD.

Each of the coastal settlements has been developed on low-lying areas of the coastal plain and avoids hilly or rocky areas. This has created ongoing flood, storm surge and drainage risks, which are expected to increase with the projected increase in tropical cyclone and storm activity in the area.

Geology & Land Systems

Key geological features of the City include limestone islands, coastal plains, coastal flats, beaches, dunes and mud and silt flats, which are described in detail in the *Shire of Roebourne Coastal Management Strategy (2011)*. Land systems occurring throughout coastal areas of the City include Boolgeeda, Calcrete, Cheerawarra, Granitic, Horseflat, Littoral, Macroy, Mallina, River, Rocklea, Ruth, Sherlock and Uaroo.

Soils

Numerous soil types are found on the Karratha coastline. Saline loams with shelly sands occupy areas of coastal flats which fringe the mainland coast. Major soils comprising the broad coastal plain of the region include alkaline red soils between Port Weld and the Fortescue River; brown loams and earthy loam soils in the area south of Cape Preston; deep cracking clays around Balla Balla River; and red earths, soils and light clays between Balla Balla River and Peawah River. The stony hills in the vicinity of Karratha, Cleaverville, Roebourne, Wickham and Point Samson have shallow, stony earth loams, although there are extensive areas without soil cover.

Acid Sulfate Soils

Much of Western Australia's acid sulfate soil material lies just below current water-tables. Continuing declines in annual rainfall, changes in land uses and increasing ground-water abstraction will lead to lower water-tables, resulting in possible widespread acid sulfate soil oxidation (DEC, 2013b).

Acid sulfate soil (ASS) risk generally decreases with increasing distance from the sea and watercourses/drainage lines. Although ASS mapping (refer **Figure 45**) suggests a significant presence of potential ASS along coastline and mudflat areas of the City, site investigations have yet to encounter any actual acid sulphate soils.

Contaminated Sites

Land owners, occupiers and polluters are required to report all known or suspected contaminated sites to the Department of Environment Regulation. Reported sites are then classified, in consultation with the Department of Health, based on the risks posed to the community and environment.

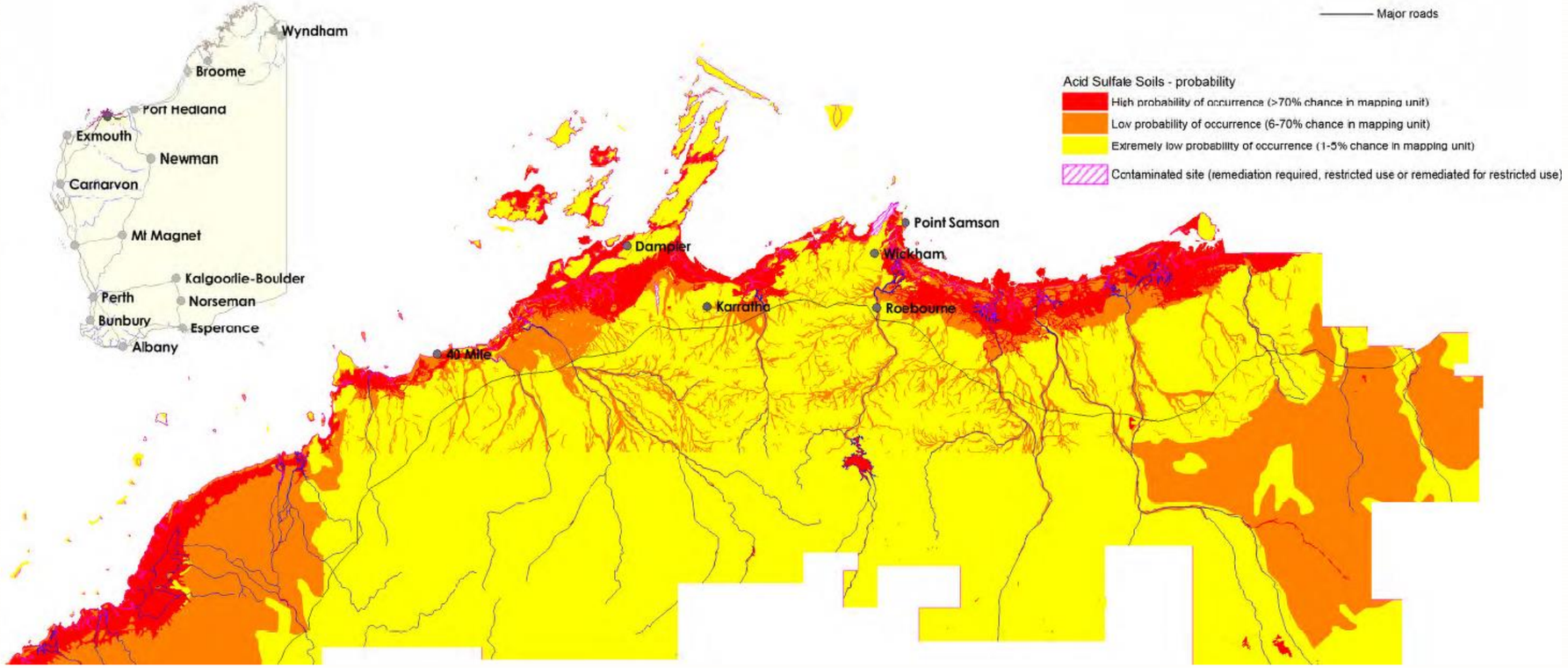
Figure 45 identifies the sites currently registered on the Department of Environment Regulation's *Contaminated Sites Database*. There are nine sites in the City, most of which are in relation to hydrocarbon contamination in soil and groundwater, metals and polychlorinated biphenyls in soil and asbestos in soil.

Other sites reported to the Department of Environment Regulation, including sites awaiting classification are recorded separately and have not been mapped in the *Environmental Strategy*.

There is a potential risk posed by the existence of sites that are contaminated, but are yet to be registered on the database. Contaminated material, due to inadequate operational practices in relation to past activities, could be present for unregistered sites within the City.

Point Samson is currently unsewered, which may have the potential to lead to contamination of land and groundwater.

Figure 45 – Acid Sulfate Soil Risk & Contaminated Sites



Source: Essential Environmental (2013)

Terrestrial Environmentally Sensitive Areas

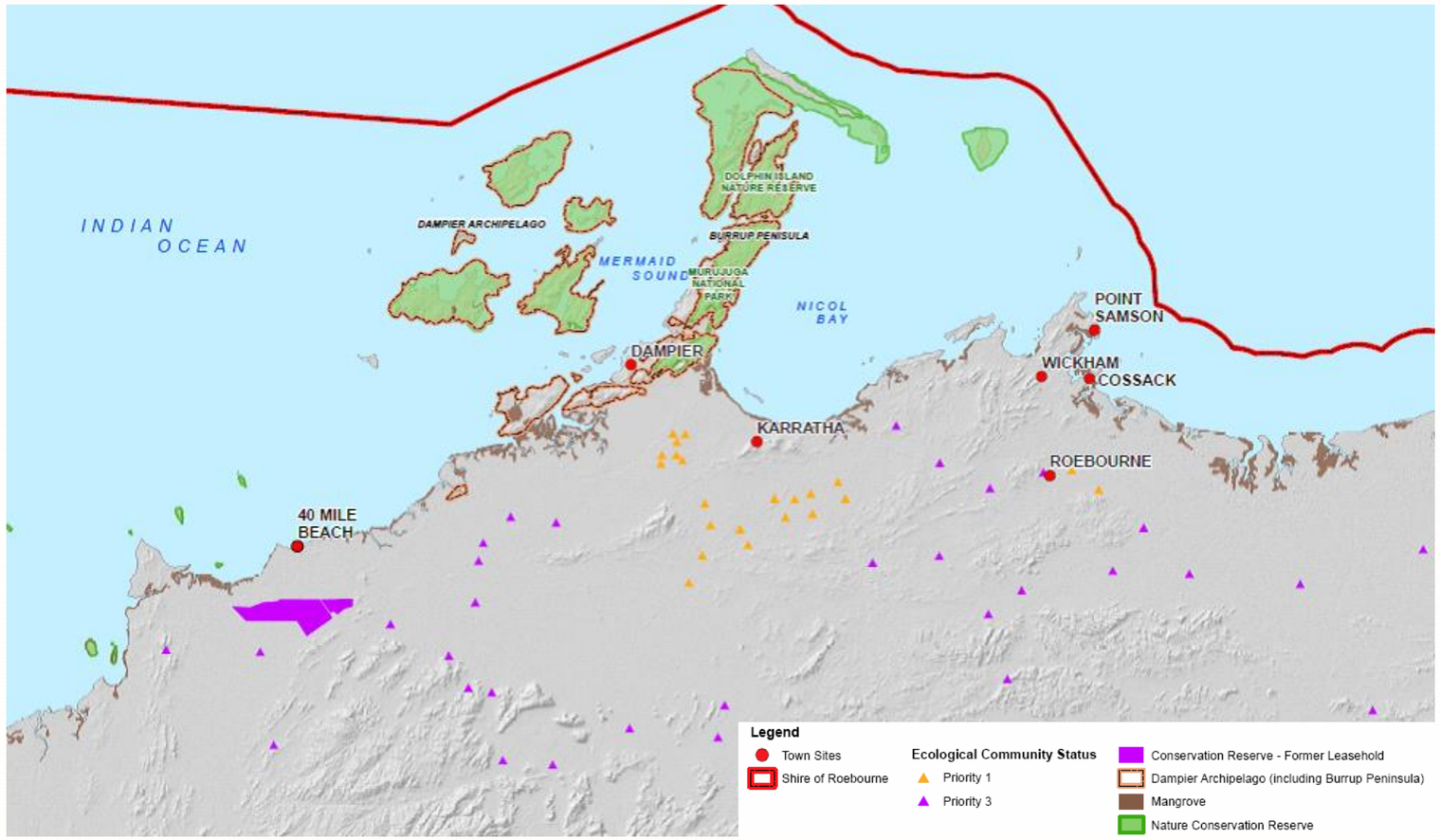
The City contains parts of the *Roebourne* and *Chichester Interim Biogeographical Regions (IBRA)*. The City is characterised by a diverse range of terrestrial, aquatic and marine landscapes, flora and fauna. Native vegetation within the City remains largely uncleared with the exception of areas for mining and associated infrastructure, as well as for townsite development. Pastoral use of land is classified as 'uncleared' however does not give an indication of vegetation condition.

Coastal areas of the City and offshore islands comprise significant native flora values and key habitat areas. The *Shire of Roebourne Environmental Strategy* (Essential Environmental 2013) has documented the biodiversity characteristics within the City of Karratha. Terrestrial areas of the Dampier Archipelago support a high proportion (approximately 32%) of the flowering plant species known from the Pilbara region. In addition, approximately 200 different vegetation associations have been described on the Burrup Peninsula, which is a reflection of the area's habitat diversity.

Coastal areas of the City, particularly the Burrup Peninsula and Dampier Archipelago, support a wide diversity of native terrestrial fauna, including over 100 species of sea and shore birds (many of which are migratory), as well as several mammal and reptile species. These relatively undisturbed terrestrial habitats of the Burrup Peninsula and Dampier Archipelago comprise numerous threatened fauna species; some of which are protected under the *State Wildlife Conservation Act 1950 (WC Act)* and/or the Australian Government *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

Environmentally sensitive areas comprise National Parks, conservation reserves, threatened/priority ecological communities and key habitat areas for native flora and fauna. Many different environmentally sensitive areas occur throughout the City, particularly along coastal areas, and are depicted in **Figure 46** and summarised as follows. These areas are all significant natural assets of the City, to be preserved, protect and celebrated into the future.

Figure 46 – Environmentally Sensitive Areas



Source: Strategen (2013); Topography: Geoscience Australia (2011)

- **Burrup Peninsula Conservation Reserve:** 60 km^2 in area with significant conservation and environmental values. The peninsula contains a diverse range of flora and fauna and provides an undisturbed habitat for many species endemic to the Pilbara. Much of the peninsula remains in a relatively untouched state. The area is also rich in aboriginal heritage sites and cultural values. The Burrup Peninsula contains the world's richest known concentration of rock art and as such, is a conservation resource of international significance. Its management is governed by the *Burrup Peninsula Conservation Reserve Draft Management Plan 2006–2016*.
- **Murujuga National Park:** covering 4913 ha within the Burrup Peninsula, the park is privately owned by the Murujuga Aboriginal Corporation and jointly managed with the Department of Parks and Wildlife. The park is also ecologically and biologically diverse. Major landforms and habitats within the park include steep scree strewn granophyre and gabbro hills, narrow valleys, sandy and rocky shores, mangroves, mudflats and sea cliffs. Triodia pungens hummock grasslands predominate, and there are numerous other vegetation communities of limited distribution. Several threatened and migratory species are known to frequent the area and are protected under state and national environmental laws. The *Murujuga National Park Management Plan 78* provides guidance on management of the park.
- **Dampier Archipelago Nature Reserves:** comprising of 42 islands, islets and rocks lying within 45 km of Dampier, twenty-five of the islands are incorporated into four nature reserves, including one *Class A* reserve, one *Class B* reserve and two *Class C* reserves. Management of the nature reserves is guided by the *Dampier Archipelago Nature Reserves Management Plan 1990-2000*.
- **Mangroves:** located along various stretches of City coastline they are considered regionally significant arid zone mangroves. They act as nursery, feeding and breeding grounds for marine fauna and as buffer zones against wave action, reducing erosion and storm surge damage to coastal areas. They are considered an integral part of coastal and marine processes.
- **Ecological Communities:** five *Priority Ecological Communities (PECs)* have been identified in the City, including Roebourne Plains gilgai grasslands; Roebourne chenopod association; Wona Land System; Burrup Peninsula rock pile communities and the Horseflat Land System. Each *PEC* has an associated buffer which need to be confirmed with DPaW prior to any potential disturbing activities, particularly in Roebourne, which is situated adjacent west of a *Priority 3 PEC*. There are no Threatened Ecological Communities in the City.
- **Turtle Nesting Sites:** the most significant turtle rookery beaches are located around the Cape Lambert development near Wickham. Based on limited surveys, Bell's Beach (also known as Back Beach) near Wickham is considered the most significant turtle nesting beach in the Cape Lambert area, with 90–100 Flatback turtles nesting each year. Cooling Water Beach at Cape Lambert also has turtle nesting, with 10–15 Flatback turtles nesting each year. These beaches comprise about 10% of nesting female Flatback turtles within the region. Small numbers of Green and Hawksbill turtles also nest on these beaches. There are also significant nesting beaches offshore from the City within the Dampier Archipelago, notably Rosemary Island, which potentially hosts the largest rookery of Hawksbill turtles globally.

Marine Environment

The mainland coastline of the City of Karratha stretches for approximately 350 km and contains a diverse range of ecosystems. These marine waters fall within the Northwest Shelf Province of the Northwest Marine region, an area that supports a complex range of habitats including rocky coastlines, sandy substrates with mangroves and seagrass, and a number of islands and associated reefs. These habitats support a high diversity of marine wildlife, including significant populations of state and nationally protected marine mammal, reptile and shark species.

Key protected areas include the Dampier Archipelago Marine Park and Cape Preston Marine Management Area. Management of these specially protected marine areas is guided by the *Indicative Management Plan for the Proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area*.

The *Shire of Roebourne Coastal Management Strategy Position Paper* (Landvision 2011) sets out the City's objectives for the management of its coastline. The *Position Paper* identifies a series of projects that are recommended to be commenced as interim measures prior to the preparation of Foreshore Management Plans for the designated recreational activity nodes of Dampier Foreshore, Hearson Cove, Karratha Back Beach, Wickham Back Beach, Point Samson / Sams Creek area and Cossack / Settlers Beach.

Foreshore Management Plans have now been prepared for 40 Mile Beach, Karratha, Point Samson and Cleaverville providing guidance for the management of human use impacts on the respective foreshores. The Management Plans have been advertised and are in need of final adoption and implementation. Future development of coastal townsites of the City will need to be cognisant of the management recommendations outlined in these plans.

Invasive Species

Introduction of weeds, pests and feral animals can lead to loss of vegetation, habitat and biodiversity, including flora and fauna, as a result of increased competition for food, water, soil and land. Key animal species of concern in the City include the horse, house mouse, black rat, feral cat, red fox and rabbit. Environmental weeds also require a substantial management effort to control. Key weed species include buffel grass, prickly pear, Parkinsonia and mesquite.

Bushfire Risk

Pre-European burning of spinifex grasslands was once common practice for indigenous communities. This no longer occurs to the same historical extent however, and consequently, fuel loads throughout the City have accumulated and pose an increased bushfire risk to life, property and the environment.

These altered fire regimes have the ability to significantly impact on existing settlements and biodiversity values of the City. Fires, which may be ignited accidentally by visitors or from lightning strikes, have the ability to cause widespread damage, particularly when they occur in the hotter months of the year. Many native plants have evolved fire-related adaptations over time, such as fire-induced flowering or smoke-induced germination. Problems occur when ecosystems are burnt too often and can lead to loss of biodiversity through inadequate recovery and reproduction times for many plants and animals.

Fires can also exacerbate or cause additional threatening processes to occur such as soil erosion, release of particulates to the atmosphere and weed invasion. Fires also result in the release of greenhouse gases (EPA 2007).

As such, wildfire risk to life, property and the environment must be a key consideration for any future development in the City, in particular for those areas in proximity to long unburnt spinifex grassland fuels.

A restricted fire season exists all year within the City. Lighting fires is not permitted without a permit from the City. Pastoral land managers are responsible for management of their pastoral lands in order to prevent bushfires, as notified by local government. The Department of Parks and Wildlife is responsible for the management of conservation areas in order to prevent bushfires. Wildfire risk to life, property and the environment must be a key consideration for any future development in the City.

Air Quality

Port facilities, particularly those for iron ore shipment, are recognised as having the potential to impact on ambient air quality, as a result of particulates (dust) and emissions from ships. These impacts may result in declining air quality, pollution of adjacent land and waters and impacts on biodiversity.

While the air quality in the majority of the City is considered generally to be good, there are a variety of industrial activities in the coastal centres of Karratha, Dampier and Cape Lambert which may impact on air quality. The 2004 Pilbara Air Quality Study found that industry was the single largest contributor to emissions in the airshed in Karratha, contributing 95% of the volatile organic compounds, 82.3% of the oxides of nitrogen and 19.6% of the carbon monoxide (DEC 2004). Significant sources of emissions to air on the Burrup Peninsula include the North West Shelf Joint Venture; Rio Tinto's iron ore export facility; and Burrup Fertiliser's ammonia plant. The air quality of these locations is mapped in the *Environmental Strategy* (Essential Environmental 2013).

Noise

Noise pollution has been an issue in the Pilbara, particularly in areas where mining and industrial activity are adjacent to residential and tourist areas. Similar to air quality, noise created by industrial activities has increased with the expansion of port operations in locations in the Pilbara (DSD, 2010). The construction phase of expansions in particular, both in port precincts and associated transport corridors, can result in significant noise pollution issues.

Noise pollution results in a decrease in amenity, risk to community health associated with elevated noise levels, impacts on fauna and conflict between land owners and adjacent industry. Noise pollution and management has not been addressed in the City. In time it is expected that the findings of the Port Headland Dust Taskforce will provide further guidance for both acoustic and air quality issues that will require management as the City continues to grow.

7.2 Key Issues: Physical Environment, Climate & Natural Resource Management

- Low-lying coastal locations of major settlements present vulnerability to coastal processes. Several areas of existing development in Karratha, Dampier, Roebourne and Point Samson are confirmed to be inundated by 1:100 or 1:500 year ARI events. Impacts of climate change have the potential to further increase coastal vulnerability. Climate change projections suggest increased occurrence and severity of tropical cyclones for the City area into the future. Future planning needs to adopt the coastal hazard risk management and adaptation planning measures provided for by *SPP 2.6* to minimise risk associated with coastal processes.
- Future water demand is projected to exceed current water supply available through the WPWSS. There is a critical need to implement augmentation of the WPWSS through the State Agreement with Rio Tinto to draw from the Bungaroo Valley, and to investigate the long term sustainability of this source and alternative potential future water sources. Wastewater recycling for residential and public open space irrigation, as well as industrial uses should also be increased to reduce demand on the WPWSS.
- Native vegetation of the Abydos Plain vegetation type occurs in the locality of the City's major settlements and may provide habitat for conservation significant fauna. Urban expansion will need to be cognisant to avoid disturbance of significant native vegetation and fauna habitat areas. Disturbance around identified *Priority Ecological Communities* and their buffers should also be avoided.
- Coastal environments of the City are highly valued for their (often competing) aesthetic, recreational, cultural, economic and ecological values. Coastal planning needs to identify appropriate areas for sustainable use of the coast for tourism, recreation and industry uses, while also protect, conserve and enhance areas of landscape, ecosystem and cultural significance. Mangroves and turtle nesting beaches are particularly significant coastal habitats, which need to be protected from disturbance and future development.
- There is a need to ensure conservation and environmental values of the Dampier Archipelago Nature Reserves, Burrup Peninsula Conservation Reserve and Murujuga National Park are preserved and balanced with the impacts of adjacent industry on the Burrup Peninsula. Residual impacts of industrial uses to protected marine waters, particularly Dampier Archipelago Marine Park and Cape Preston Marine Management Area, also need to be mitigated.
- Spinifex grassland fuels create potential for risk of wildfires. Wildfire risk needs to be further investigated, and where necessary, management measures to minimise wildfire risk should be implemented.

7.3 Local Profile: Urban Design, Character & Heritage

Housing Typology & Character

The predominant housing typology within the City is single storey detached dwellings (75%). When compared with the Western Australian average of 80%, the City appears to have a relatively high proportion of medium and high density residential housing. In reality, this statistic is largely a result of the various forms temporary workers or short-stay accommodation facilities.

Housing for the most part falls into two distinct age brackets and associated characters. The first major phase of dwelling construction occurred from 1970 to 1988. The construction style had generally a short term build mindset, consisting of lightweight metal, with minimal consideration of shading and insulation. More than 4,000 dwellings constructed during this period are still standing. The result is a widely aging stock.

The second major growth phase commenced recently, in 2008, and has seen 250 to 350 new dwellings built per year since. The typology of this new housing stock ranges from large two-storey 4 x 2's, to smaller duplexes, to apartments in the Karratha City Centre. The character of dwellings is generally similar to that of current projects in the Perth metropolitan region, and does not readily demonstrate a regionally specific character.

A short-term build mindset and lack of unique character and climate appropriate design features characterise a wide proportion of the City's existing dwelling stock. Providing locally appropriate housing that contributes a distinct character of dwellings will be important to the development of attractive and sustainable settlements for the City.

Residential Neighbourhoods & Streetscapes

Throughout the City's settlements residential streetscapes are generally adequately presented and landscaped, but without exceptional character or amenity (depending on the age of building stock and suburb). Residential neighbourhoods have minimal street-facing fencing. Dwellings are generally setback considerably from the street. Boat and caravan parking is prevalent throughout residential neighbourhoods, and reflects the lifestyle of a large proportion of the community. Connectivity of residential neighbourhoods is often limited, with irregular street networks and frequent provision of drainage areas dividing residential cells. Footpaths through residential neighbourhoods are infrequently provided.

Town Centres

Most of the City's settlements have town centres with street-facing development contributing to a regional town feel. The City centre revitalisation focussed upon Sharpe Avenue (anchored by the Pelago Towers, The Quarter, Warrambie Estate, and the future Civic Precinct) is steadily introducing a main street character that will vastly improve town centre atmosphere within Karratha. Town centres are generally more accessible to both pedestrians and vehicles than residential neighbourhoods.

Settlement Specific Character Attributes

Aside from the commonalities of urban design and character discussed above, each settlement contains its own specific character attributes, which are briefly summarised in **Table 31.**

Table 31: Character Attributes Specific to Individual Settlements

Settlement	Character Attributes
Karratha	Abundant public open space – the Lazy Lands project run by the Pilbara Cities Office has identified 61 pieces of excess public open space to be redeveloped as residential infill. Distinct difference in the character of housing in old and new residential suburbs. Two storey dwellings slightly more predominant in the newer residential suburbs. Centro Karratha internalised shopping mall major retail precinct. New Sharpe Avenue main street and multiple dwelling development in town centre set to change orientation and focus of town centre.
Dampier	Town centre interaction with the coast: Hampton Harbour and the Dampier Archipelago. High proportion (nearly 10%) of high density units and apartments, reflecting the considerable number of older apartment style buildings located along Hampton Drive and Hill Road which are dated and detract from amenity of area. Residential areas are setback from the coast. High amenity location with potential to attract high end residential and tourist markets.
Roebourne	Strong indigenous heritage and artistic culture contributes to character. Several heritage buildings presenting to street contribute to historic regional town main street amenity. Substantial proportion of housing low quality and poorly presented. Some residential properties contain boundary fencing to the street frontage that detracts from the appearance of the streetscape. Town centre fronts and interacts with the Harding River.
Wickham	Town centre not well defined and demonstrates a character typical of mining towns developed in the 1960-1970s mining boom era. Development setback substantially from road, discouraging pedestrian activity. Relatively low proportion (39%) of single dwelling residential development overall. Road layout and design provides for poor vehicle connectivity.
Point Samson	Dwellings designed for tourist / recreation lifestyle, with large alfresco areas. Most of the settlement's residential development extends along the coast, maximising coastal lifestyle. Some houses built on stilts in response to coastal vulnerability. Well presented streetscapes and landscaping. Quaint coastal fishing village atmosphere.
Cossack	Largely abandoned with few remaining buildings. Buildings that remain of significant heritage value. Current land use limited to low-key tourist site seeing, local fishing, accommodation and functions. Low lying nature of the land poses a significant constraint.

Aboriginal Heritage

It is recognised that Aboriginal people have been living in the Pilbara for over 30,000 years. The traditional cultural and ecological knowledge of Aboriginal people is now being collated and presented in an accessible manner for all people. The Department of Aboriginal Affairs currently documents more than 2000 Aboriginal heritage sites across the City of Karratha.

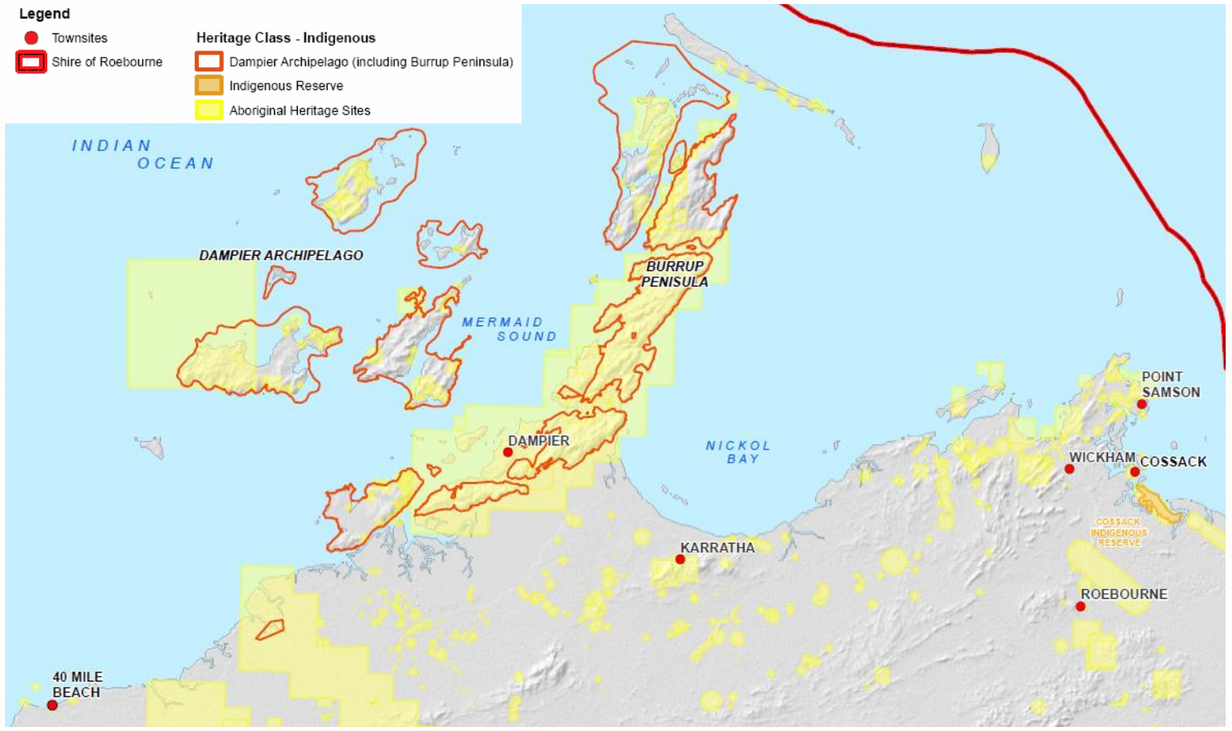
In the mid 1900's the Yindjibarndi (Tableland People) resettled around Ieramugado (Yindjibarndi name for Roebourne) which was Ngarluma Country (Coastal People).

The Traditional Custodians speak of the Wharlu Song which tells the story of how the Yindjibarndi and Ngarluma people come to be living on country together:

"A great storm rose towards Ieramugado. The sea snake had come inland, the Gurran Gurran bird leading him. At day break Ieramugado was under water. The Yindjibarndi people thought they would be killed by the coastal sea snake (Wharlu), so they called up the freshwater snake from the Fortesque River to save him. The snakes fought a long battle in the sky and the freshwater snake pushed the sea snake back to the sea and the Yindjibarndi people were allowed to stay in Ieramugado."

'Exile of the Kingdom' abstract - Roger Solomon (deceased), Ngarluma and Yindjibarndi Elder

Figure 47 – Cultural Heritage Sites



Source: Strategen (2013)

At present, the majority of Yindjibarndi and Ngarluma people living in the City of Karratha undertake traditional practise and remain well connected to their country.

The Burrup Peninsula and Dampier Archipelago also hold great Aboriginal significance and MAC is currently producing a *Murujuga Cultural Management Plan (MCMP)* which will provide more information about the cultural heritage of this area. The *MCMP* has a two year timeframe and work began on it in August 2013. It will record and document the Aboriginal connection to this country, outline the correct protocols for activity, and explore management strategies for the long term protection of this important area.

Aboriginal heritage is a critical consideration in respect to future planning. Aboriginal heritage sites, which are protected under the *Aboriginal Heritage Act 1972*, are scattered throughout the City, including settlement areas. They are particularly concentrated on the Burrup Peninsula, covering the entirety of this area. **Figure 47** shows the location of all documented Aboriginal heritage sites in the vicinity of the City's major settlements.

Development should be avoided in areas containing Aboriginal heritage where possible, and any area identified to contain Aboriginal heritage requires further site specific investigation and satisfaction of the *Aboriginal Heritage Act 1972* requirements prior to development. Council and developers should continue to investigate ways of protecting and incorporating significant features of Aboriginal heritage into new developments, such as that proposed for Mulataga.

European Heritage

Europeans first explored the City of Karratha area in 1861. It was initially settled by pastoralists, and also harboured a pearling industry. The first mining began in 1873, with the discovery of copper, followed by gold in 1887. Growth of the locality slowed until the discovery of iron ore in the 1950s. The 1960s and 1970s were a period of significant growth for the City, with Dampier, Karratha and Wickham all built to support the newfound mining industry.

The City of Karratha has unique European heritage, with considerable significance, which is documented in the City's *Local Government Heritage Inventory (LGHI)*. The *LGHI* documents heritage only since the beginning of European settlement, and includes sites of contemporary significance. Aboriginal heritage is dealt with separately, under the *Aboriginal Heritage Act 1972.*

The *LGHI* was created in 1996 under the auspices of the *Western Australian Heritage Act 1990*. Its preparation incorporated substantial research and community consultation. There are 73 listed heritage sites included on the *LGHI*. Most are located in and around Roebourne and Cossack, and include sites such as the Roebourne police station and gaol, churches, post offices, cemeteries, and station houses. Other notable sites include homesteads such as Karratha Station, and sections of the Dampier Archipelago and Burrup Peninsula. Some of those sites included on the *LGHI* are also listed on the *State Heritage Register*.

The Cossack Town Site Precinct is a particularly renowned heritage site in the City, which is listed on the *State Heritage Register*. It comprises all of the land within the area bounded by Wickham Street, Dampier Street, Pearl Street, Ward Street, Pilot Street, Perseverance Street, Settlers Beach Road to the Cemetery at Lots 422 & 433, and the foreshore to the high water mark (including the Land Backed Wharf). It consists of buildings and archaeological sites dating from the 1870s. Its historical significance is based upon its status as a frontier settlement and the first port in the North West of Australia. It documents the impact of European settlement on Aboriginal life and evidence of multicultural society. The town is currently recognised as a *Special Control Area* in TPS8.

Retention & Enhancement of Character & Heritage

The City has a unique heritage, considered worthy of recognition and celebration. Its character is underpinned by its history, and many of the opportunities for further enhancement of the City's character come from its historical buildings and features. Accordingly, preservation and recognition of key heritage sites and buildings is critical. Where at all possible, sites listed on the City's *LGHI* should be preserved and restored in keeping with their original character. Redevelopment of heritage sites should be discouraged or restricted to preserve heritage significance.

Areas of particularly strong heritage significance, such as the concentration of heritage buildings in Roebourne town centre, should be recognised and protected. The suitable protection mechanism may be a *Special Control Area* designation under the Town Planning Scheme similar to that used for Cossack. Appropriate identification and protection of this heritage character area will ensure existing heritage sites are preserved and further enhanced through careful consideration of the existing built environment and complementary planning for surrounding development.

Aspects of the existing landscape, particularly hills and viewscapes are important character features, which planning should seek to preserve. These unique characteristics make essential contributions to visual amenity both within the City's major settlement's and across its vast landscapes.

There is scope to improve character of the City's settlement areas through urban design and built form design. Landscaping and appropriate ground covers have a significant role in impacting amenity of public spaces. The recently prepared *Pilbara* and *Karratha Vernaculars* provide principles for design which consider the unique environment, climate, culture and lifestyle of Karratha and the Pilbara region.

The *Pilbara Vernacular* aims to address the challenges of the existing built form across various Pilbara settlements. It identifies particular challenges in the relatively limited stock of heritage character buildings and in a large proportion of existing building stock reaching the end of its useable lifespan. The *Pilbara Vernacular* is based upon the following 'Pilbara values':

- Responding to climate;
- Incorporating the natural environment;
- Building on the Pilbara character and identity;
- Enhancing liveability; and
- Mobilising for change.

While the *Pilbara Vernacular* is not prescriptive, it aims to create a set of design strategies for housing and built form (predominantly single and grouped housing) and public space which are responsive to the local landscape, environment, climate and culture, and establish a sense of place in the region. It sets out parameters of design that will enhance future development across the Pilbara, whilst also acknowledging the unique characteristics of individual settlements.

The *Karratha Vernacular* provides a set of design principles to create a new paradigm for development in Karratha. The principles for design consider the unique environment, climate, culture and lifestyle of Karratha and the Pilbara region. While the *Karratha Vernacular* was developed specifically for the Karratha city core and Mulataga developments, it is a useful document to consider in respect to development across all of the City's settlements. All future development in Karratha, as well as across the City more generally, should consider the design principles recommended by the *Karratha Vernacular*.

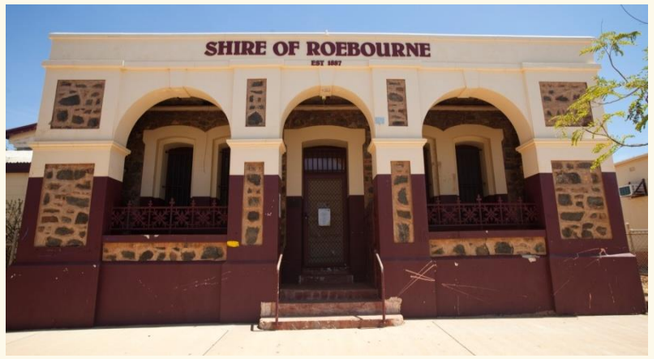
For the first time in the City's history, the *Karratha Vernacular* formally addresses public realm and built form design. In respect to public realm, it encourages activity in the public spaces and streetscapes and recommends climate appropriate responses, including water sensitive urban design, mitigation of hot westerly breezes and shade provision. In regard to built form, the *Karratha Vernacular* recommends stack effect, shading, orientation and other design features that respond to the region's climate. When taken holistically, the portfolio of design principles addressed by the *Karratha Vernacular* are intended to contribute to development practices that will deliver social benefit to the City of Karratha community. The realisation of the *Karratha Vernacular* in future development across the City will enhance the character of streetscapes, public places and built form in all settlements by providing for:

- Street level activation and vibrancy with a mix of uses;
- Climate appropriate building design with efficient cooling and passive ventilation;
- Incorporation of wind and solar power systems;
- Recognition and celebration of Aboriginal heritage;
- Iconic and recognisable places of human scale; and
- Climate appropriate landscaping and design features.

The principles put forward in both the *Pilbara* and *Karratha Vernaculars* are sound, valuable considerations for establishing a City specific climate appropriate built environment character for the City of Karratha. What is now required is a planning mechanism to ensure delivery of these principles. Detailed Area Plans and Design Guidelines for recent residential expansion areas have sought to achieve this to some level within individual residential estates. The City would benefit from a more coordinated approach to design guidelines that could be enforced through a Local Planning Policy or provisions under the Town Planning Scheme. Caution must, however, be exercised to ensure that the requirements of design guidelines are affordable to implement, and reflective of the desires of the community.

7.4 Key Issues: Urban Design, Character & Heritage

- Existing housing character and typology is widely characterised by aging single dwelling stock that suffers from a lack of unique character or climate appropriate design. There is a demonstrated desire from the community for more locally appropriate and environmentally sustainable housing. Affordable ways to deliver such product need to be considered and implemented.
- Each of the City's major settlements demonstrates its own unique aspects of character. These unique attributes are largely defined by the differing roles of each settlement, from the major regional service centre down to the coastal tourism and fishing village, as well as the unique history of each settlement. Existing character, including heritage, is an essential consideration for the future enhancement of character within each of the City's settlements.
- Aboriginal cultural heritage is an important component of the City's heritage and Aboriginal heritage sites are prominent across the City. These are often located within and around major settlement areas. Development should avoid disturbance of any Aboriginal heritage site where possible. Where unavoidable detailed investigation of the significance of Aboriginal heritage sites must be undertaken and consent of the Minister must be sought under Section 18 of the *Aboriginal Heritage Act 1972* prior to disturbance.
- Heritage sites listed on the *LGHI* should be conserved wherever possible, and planning provisions that encourage preservation of heritage significance should be applied to maintain and enhance heritage character. Heritage character, particularly concentrations of heritage buildings in Cossack and Roebourne present opportunities for tourism sector expansion, and a focus to ensure the amenity of these heritage character areas should be employed.
- Built form and urban design present opportunities to improve existing character and shape a distinctive and sustainable built environment responsive to the unique environment, climate, culture and lifestyle of the City. The design principles of the *Pilbara Vernacular* and *Karratha Vernacular* put forward the basis for this. Consistent statutory measures for implementation are now required to achieve the vision of those documents.



7.5 Local Profile: Rural Land

Crown Land & Rural Land Tenure

The vast majority of the City of Karratha local government area consists of rural land, used primarily for pastoral grazing and the harvesting of natural resources. The majority of rural land remains in Crown ownership with very limited freehold rural land within the City. Crown land may be unallocated or reserved for a specified purpose, generally being a public purpose.

Most of the City's rural coastline is contained with public reserves under the *Land Administration Act* that are then reserved in TPS8 for *Conservation, Recreation and Natural Landscapes*. Other public reservations in rural areas include those for roads, infrastructure or public purposes such as water supply. Despite the various reserves, Unallocated Crown Land (UCL) remains prominent across the City.

The limited amount of freehold rural land in the City contributes to a relatively simple pattern of subdivision. The majority of rural lots are very large tracts of land, and only occasional smaller freehold lots exist. One area where rural land is subdivided into several freehold lots and held by multiple owners is Cossack. The Cossack townsite was subdivided, but never grew beyond its historical townsite establishment. Avoiding fragmentation of rural land (as promoted by State Planning Policy 2.5) is critical to enabling a coordinated approach to future planning and urban expansion.

Several types of tenure exist over the City's rural Crown land, and in some cases settlement areas. Native Title, Pastoral Leases and Mining Tenements are widespread and in some instances constrain potential for urban expansion.

Native Title

The City of Karratha sits within the fully determined *Ngarluma/Yindjibarndi (WAD6017/96) Native Title* claim area. The *Ngarluma/Yindjibarndi Native Title Claim* was determined by the Federal Court on 2 May 2005. Accordingly, the majority of Crown land across the City is subject to Native Title.

The litigated determination of the *Ngarluma/Yindjibarndi Native Title* claim resulted in the establishment of the *Ngarluma Aboriginal Corporation (NAC)*, the Registered Native Title Body Corporate for the Ngarluma portion of the Determination Area. The *Yindjibarndi Aboriginal Corporation (YAC)* is the Registered Native Title Body Corporate for the Yindjibarndi portion of the Determination Area. Together *NAC* and *YAC* are the legal entity that holds the Native Title rights of the Native Title holders, including the right to protect and care for sites and objects.

The claim area is bordered by the Hamersley Ranges to the south, Maitland River to the west, Balla Balla and Peawah Rivers to the east and its northern boundary includes the Dampier Archipelago. The area excludes only limited portions of the Karratha, Dampier and Wickham settlements, and can therefore significantly impact land release and approval timeframes for urban expansion.

The *Ngarluma People Application (WAD165/2008)* was registered with the National Native Title Tribunal on 31 July 2008. The application covers settlement areas not currently included in the *Ngarluma/Yindjibarndi Determination*. The application has been progressing through mediation and has now been listed for a consent determination hearing on 25 June 2015.

In addition to the Federal Court determination and National Native Title Tribunal application, various *Indigenous Land Use Agreements (ILUAs)* exist within the City. *ILUAs* are voluntary agreements made under the *Native Title Act 1993* between people who hold, or claim to hold, Native Title in an area and other people who have, or wish to gain, an interest in that area. They are negotiated, flexible and without litigation.

Plan 7 depicts the Native Title determination and Indigenous Land Use Agreement areas in the locality of major settlements in the City.

Aboriginal Communities

There are three Aboriginal communities in the City, being Cheeditha (located just north of Roebourne), Weymul and Mingullatharndo (both of which are located in more remote rural areas). Weymul Community exists on a freehold lot within the Mount Welcome pastoral lease and is managed by the Weymul Aboriginal Corporation, established in 1999 to represent the Ngarluma people who are the traditional owners of the Ngarluma region of the Pilbara. Mingullatharndo Community is located approximately 10 km east of Roebourne and 1 km south of North West Coastal Highway.

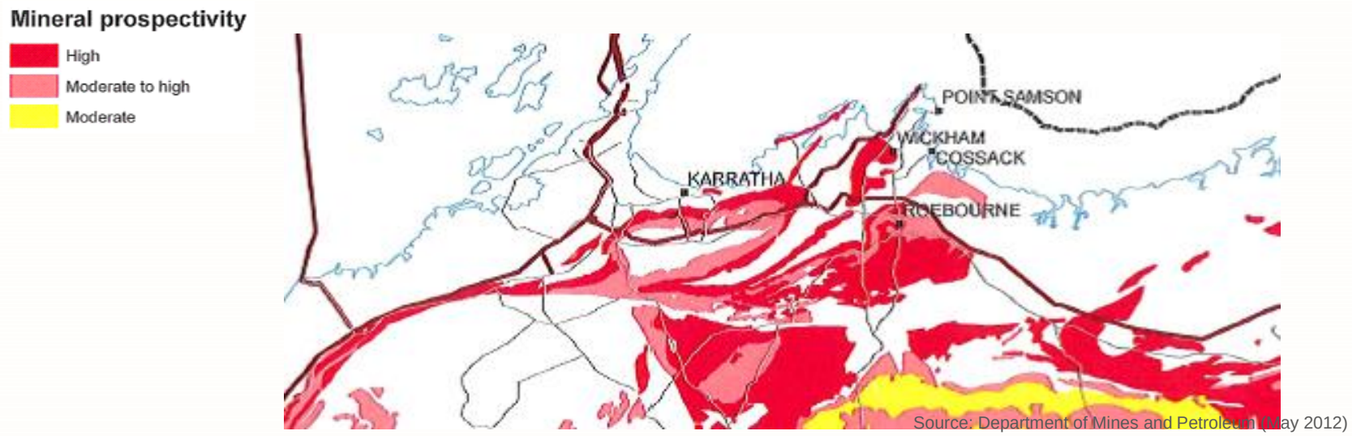
While these communities form a relatively small proportion of the City's population, it is important that these settlements are also recognised through the *Local Planning Strategy* and Local Planning Scheme frameworks. Future planning and infrastructure provision will need to be undertaken by the State Government. Community Layout Plans have been adopted by the WAPC for two of the three communities. These plans require review prior to being endorsed by the City.

Mining Tenements

Access to mineral, petroleum and geothermal energy resources is of State economic importance. At present, the mineral and petroleum resources sector provides both direct and indirect employment for most of the City's communities, and the sector supports many commercial, industrial and social enterprises. Access to mining tenements is critical. Planning for urban expansion and growth must take into account the competing interests for access to these resources, related infrastructure corridors and port facilities. Mining and petroleum legislation and State Agreements provide statutory requirements regarding such access. The City of Karratha is widely covered by various pending and live mining tenements which impact land release and availability for urban development.

Plan 8 depicts pending and live tenements in the vicinity of the City's major settlements. Each tenement must be considered on an individual and site-specific basis with proposals for urban expansion. **Figure 48** provides an indication of mineral prospectivity in the vicinity of the City's major settlements, which may be a consideration for any proposal over an area subject to mining tenements.

Figure 48 – Mineral Prospectivity in the City of Karratha



Source: Department of Mines and Petroleum (May 2012)

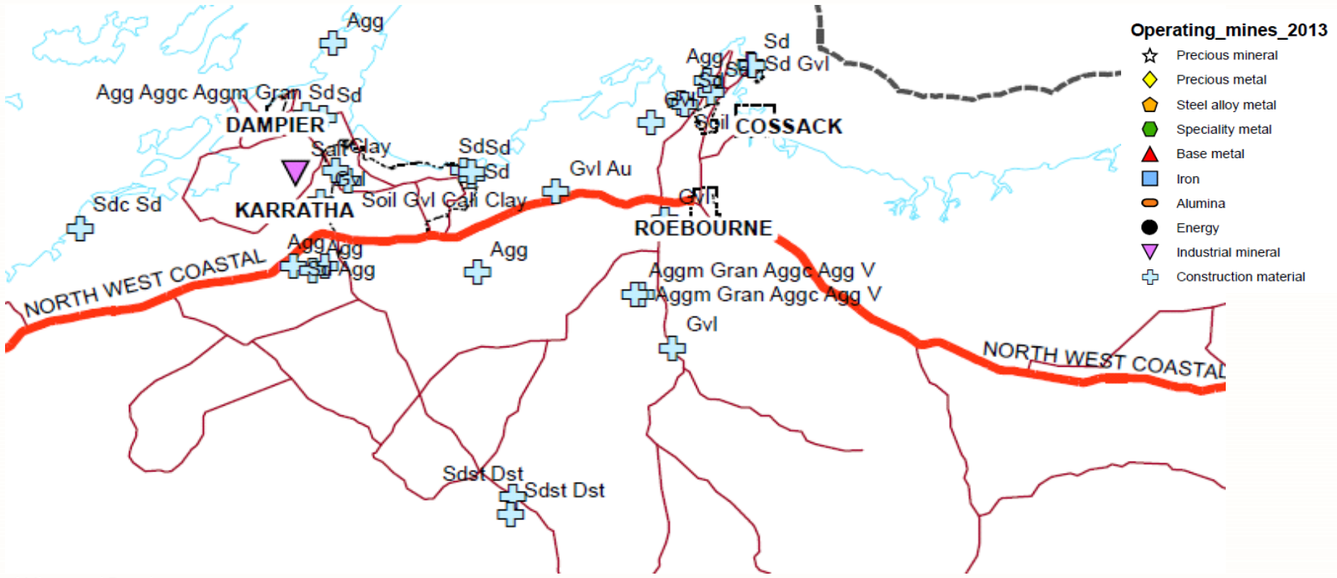
Basic Raw Materials

On Crown land, construction materials are defined as a 'mineral' and therefore require a mining lease under the *Mining Act 1978* for extraction of the mineral. Mining of material for new infrastructure will be required such as for fill facilitating urban and industrial development, roads, bridges, telecommunications etc. Local planning schemes cannot prohibit or affect the granting of mining tenements (mining leases and exploration licences) or the carrying out of any mining operation authorised by the *Mining Act 1978*.

The Department of Mines and Petroleum (DMP) has prepared mapping *Resource Potential for Land Use Planning Basic Raw Material Resources Karratha* (2014) that identifies tenements for basic raw materials, crown reserves for basic raw materials, active, inactive and proposed quarries and pits. The DMP has prepared a data package *Karratha – Port Hedland, 2014: Basic Raw Material Resources* which provides information on the potential availability of basic raw materials (BRM), including sand, gravel, limestone, limesand, crushed rock and dimension stone, as well as mining tenements for BRM and locations of quarries and pits on Crown Land. There are no known extractive industry licences issued by the City on freehold land.

Sand is an important resource and there are existing mining tenements for sand around Karratha, south of Roebourne, at Point Samson and south of Wickham. It is essential that immediate protection is afforded to existing tenements and licensed extractive industries, as it is important to ensure basic raw materials are conveniently accessible and in proximity to the townsites and areas of industrial development for efficient extraction and logistics. In the absence of detailed modelling, the DMP recommends a conservative approach to considering generic buffer distances for sand quarries/pits. It is considered that 500m buffer distances to extraction areas be applied, pursuant to the EPA Guidance Statement 3 *Separation Distances between Industrial and Sensitive Land Uses* (2005). **Figure 49** depicts the distribution of currently active BRM extraction sites in the vicinity of the City's major settlements.

Figure 49 – Operating Mines, including Basic Raw Materials (May 2012)



Source: Department of Mines and Petroleum

Pastoral Leases

Pastoral leases, granted under the *Land Administration Act 1997*, allow Crown land to be used for the purpose of grazing livestock. Seven pastoral leases exist across the City, covering the majority of its land area. The Mount Welcome and Karratha pastoral leases are located in closest proximity to the City's settlement areas; however the current alignment of these leases do not limit future growth area requirements.

All pastoral leases in Western Australia expire in 2015, but can be renewed subject to conditions regarding sustainable management and development of the land. It is understood that at the cessation of those leases, three areas of the Mardie, Karratha and Pyramid pastoral stations are proposed to be incorporated in the conservation estate (*Murujuga National Park*). Recognition and protection of those portions of land will be necessary in the forthcoming scheme, via inclusion within a suitable conservation reserve.

Economic diversification, particularly in the form of tourism that celebrates the unique environmental setting of the City, without compromising existing pastoral operations is an area of significant potential. To do so requires the granting of separate special leases, a framework for which is currently under review by the Department of Lands.

Agriculture & Primary Production

The *State Planning Strategy* recognises the increasing expansion of the agricultural sector in the Pilbara region and highlights the State wide future aspiration for local access to fresh food derived from well-managed environments. Two potential Agricultural Priority Management Areas (APMA) were identified in the late 1990's on the basis of suitable soils and potential for water resources, being:

- Roebourne Plains (in the vicinity of the Harding River); and
- Fortescue River Mouth (in the south west corner of the City).

Identification of these areas was not intended to 'restrict' agricultural development to these areas but instead provide a guide as to where development may occur in the future, subject to further investigations.

The concept of APMA has been replaced in the current State Planning Policy 2.5 – *Land Use Planning in Rural Areas (2012)* and associated rural planning guidelines by High Quality Agricultural Land (HQAL) and Priority Agricultural Land (PAL).

The Department of Agriculture and Food (DAFWA) does not currently have any HQAL information for Karratha. This is unlikely to be rectified in the near future, with DAFWA's current focus being on a number of other areas considered to be of greater strategic importance. Land resource information for the City is focused on the pastoral values of the land including the native vegetation on which pastoral activity depends. DAFWA do not have any land capability information relating to horticulture, cropping and grazing of modified pastures. Intensive agricultural opportunities are reliant on more detailed information relating to soil types and water resources which are being assessed as part of the *Pilbara Hinterland Agricultural Development Initiative (PHADI)*, a Royalties for Regions project.

Despite their lack of development DAFWA indicate that the two APMA areas retain potential for agricultural development. Generally land under pastoral lease, managed by DPAW or UCL, to-date these areas have been considered suitable for irrigated pasture (Rhodes Grass). More work is needed however, to determine suitable pasture species for fodder which are not potential invasive species away from irrigated areas. Other crops and pastures will also be examined under PHADI. A change in use currently requires a diversification permit, however the Department of Lands is seeking to reform this process so as to encourage new developments such as irrigated agriculture.

Algae Industry

Potential also exists for economic development in the algae farming industry which converts algae into biofuel, omega-three and animal feed protein. Maitland Estate, south west of Karratha currently has the land capacity to produce at least 600 metric tons of biomass per month. Whilst Aurora Algae, who ran a pilot project from this site has divested its interest, potential remains for another company to utilise the location. The City offers ideal conditions for algae production, with abundant sunlight and carbon dioxide inputs.

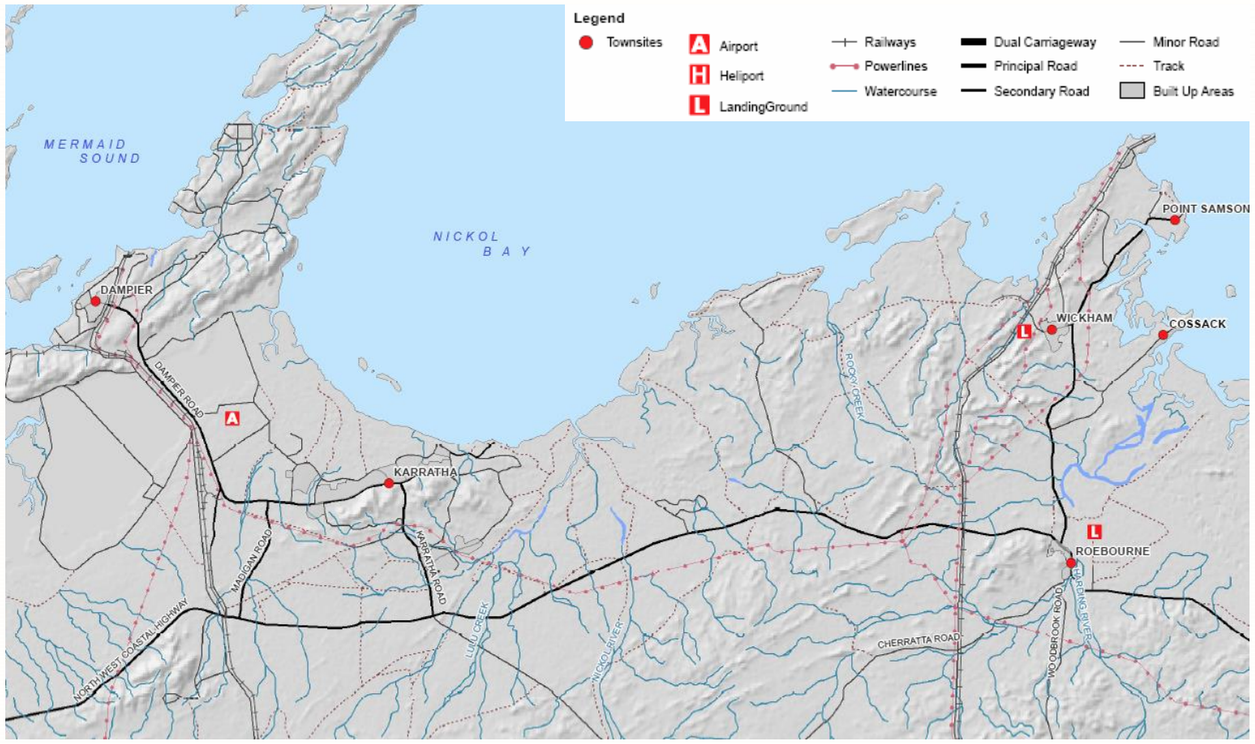
Industry & Infrastructure Buffers

Salt, iron ore, magnetite and natural gas are important mineral and energy resources for the City of Karratha. The City comprises a considerable amount of heavy and special industrial land uses to accommodate the extraction, processing, transporting and servicing for these industries. Industrial land uses at the Burrup Peninsula, Cape Lambert, Cape Preston, and future Anketell Port take up extensive areas of otherwise rural land outside of existing settlements.

Industrial land uses need to be managed carefully, as they have the potential to create off-site emissions, which may adversely affect surrounding residential and sensitive uses. Impacts include gas, noise, dust, fumes, and odour, affecting air quality, health and safety standards, and amenity of those areas. State *Planning Policy 4.1 State Industrial Buffer Policy* addresses the need and mechanisms to plan for both on-site and off-site buffers. Industry regulation is generally approached on a case-by-case basis, where the onus is on the proponent of the industrial land use. *EPA Guidance Statement No. 3 Separation Distances between Industrial and Sensitive Land Uses* provides guidelines as a basis to consider impacts resulting from various industrial land uses. The *Environmental Protection (Noise) Regulations 1997* provide standards for noise emissions.

The current extent of major infrastructure located throughout coastal areas of the City is presented in **Figure 50**.

Figure 50 – Infrastructure & Servicing



Source: Strategen 2013

The same policy and regulations are applicable to infrastructure uses, which may adversely affect surrounding residential and sensitive land uses, such as wastewater treatment plants and power stations. Buffers to such infrastructure are a critical consideration for future planning. While a buffer does not necessarily need to exclude all development, it should restrict sensitive land uses and ensure only mutually compatible (generally industrial or infrastructure based) land uses are located within buffer areas. *Eco-Industrial Precincts* are an emerging concept promoted by Water Corporation, encouraging collocation of mutually compatible eco-industrial uses within wastewater treatment plant buffer areas. This may include solid waste and wastewater recycling facilities, renewable energy facilities, other public utilities, industry, agriculture, research facilities, public open space and nature conservation reserves.

Infrastructure reserves are recognised under TPS8 to protect key infrastructure corridors such as gas pipelines, power lines and rail lines. Infrastructure reserves are designated for much of the infrastructure within the City, but not all. Various power lines exist without infrastructure reservations in remote rural areas, as well as around major settlement areas. There is a need to consolidate a record of existing power infrastructure and to review infrastructure reserves to ensure key infrastructure corridors are adequately identified and protected from encroachment. Consideration must be given to the appropriateness of reservation as a mechanism for protection from encroachment given the potential for compensation implications.

7.6 Key Issues: Rural land

- Extensive areas of the City comprise unallocated Crown land, which is affected by several types of land tenure; Native Title, Pastoral Leases and Mining Tenements. Land tenure, particularly Native Title and Mining Tenements, is a critical constraint to urban expansion that must be considered and resolved early in the planning process to progress expansion in a timely manner. Each proposal for expansion must be considered on individual merit in light of site specific issues.
- The City has three established Aboriginal communities outside of its major settlements. Coordination of planning for infrastructure and services to sustain these remote populations is an important aspect of planning for rural areas.
- The City provides an ideal environment for algae production, with abundant sunlight and carbon dioxide outputs. This presents a valuable opportunity for economic diversification and development of an extensive land area for this purpose should be encouraged.
- It is critical that the *Public Drinking Water Supply Areas* identified for the City, and particularly that relatively close to settlement south of Roebourne, are protected to reduce risk to the *West Pilbara Water Supply Scheme*.
- Appropriate planning needs to be applied to reduce pressures associated with high demand of BRM resources. Cost of fill currently critically constrains housing affordability. Access to BRM is currently limited and a comprehensive strategy to secure BRM supply is required. Additionally, current Western Australian development practices, largely reliant on retaining walls, flat building sites and compacted sand pads reinforce the need for BRM. Flexible planning provisions allowing alternative building techniques may be effective in reducing need for sand fill and retaining walls in dealing with flood and other site constraints.
- Major Heavy and Special Industrial land uses located at the Burrup Peninsula, Cape Lambert, Cape Preston and future Anketell Port must be managed appropriately so as to enable growth of the City's minerals and energy sector, while also protecting amenity for surrounding sensitive land uses. *SPP 4.1* and industry regulation must be applied consistently to mitigate gas, noise, dust, fumes, and odour emissions, which affect air quality, health and safety standards, and amenity.
- Infrastructure, such as wastewater treatment plants and power stations, also present adverse impacts for surrounding residential and sensitive land uses. Buffers, in accordance with *SPP 4.1* must be incorporated, but should not preclude all land uses. Strategic Resource Areas should be used to encourage collocation of compatible land uses. This may include solid waste and wastewater recycling facilities, renewable energy facilities, other public utilities, industry, agriculture, research facilities, public open space and nature conservation reserves.
- There is a need to coordinate identification and reservation of all key infrastructure corridors throughout the City to ensure major gas pipelines, power lines and rail lines are provided with appropriate buffers and protected from incompatible encroachment.

8.0 Theme 4: Infrastructure

Timely provision of infrastructure provides a solid economic base for the City, justifies relevant City expenditure and underpins land use planning framework. A fundamental aspect of this Strategy is to link infrastructure priorities to forecast population growth and related demands.

The Annual population growth review with its emphasis on increased and careful monitoring of the spatial aspects of population growth will underpin capital investment decisions. Short term decisions to preserve required road corridors and other infrastructure corridors are essential towards the delivery of infrastructure to facilitate an ultimate population of greater than 50,000.

The integration of this careful monitoring of population growth into growth management strategies will assist the City in its long term capital expenditure planning. This improved information base will strengthen the City's position when advocating for improved infrastructure and provide a sound basis to assess social and economic impacts of large resource projects as they arise.

Each of the different infrastructure classes have different characteristics in terms of supply, demands and the age of the existing infrastructure.

The Strategy acknowledges the need to protect existing and adequately plan for future, key infrastructure which serves the Pilbara Region and/or is part of the wider State network. The Strategy recognises the importance of adequate capacity of infrastructure and public utilities to support growth and the need for compatibility of adjacent land uses to ensure long term operation of this infrastructure.

There is an increasing need for the forward planning and integrated infrastructure delivery and the robust scheduling of infrastructure, to support the growth of the population and Karratha's industries. It is important that there is an alignment between planned growth and planning of service infrastructure to ensure efficient, economical and timely delivery of services. This requires ongoing consultation and coordination between the City, the development industry and service agencies.

Encouraging the private sector to invest in infrastructure or to provide more open access to existing infrastructure will help to spread the investment cost and reduce the potential for duplication and redundancy. This is particularly relevant to power infrastructure, where major resource companies frequently supply and reticulate their own power independent of the NWIS.

Sufficient and timely infrastructure and service provision is essential to the community and economic development of the City.

The major issues for each class of infrastructure including current capacity and the state of the current infrastructure are summarised in **Table 32** and are discussed in further detail below.

8.1 Local Profile: Infrastructure Services

Water

The City of Karratha, including all of its major settlements, rely on the West Pilbara Water Supply Scheme (WPWSS) which sources surface water from the Harding Dam (approximately 40km inland) and groundwater from the Millstream Wellfield (approximately 100km inland). These two sources operate together throughout the year, while water from Harding Dam is used as the preferential source when availability and quality allow.

In June 2010 the Water Corporation advised that the WPWSS was under extreme pressure to supply sufficient water to towns and industry, placing supply security under a high level of risk. In response, the water source has recently been augmented through a $330M investment by Rio Tinto which extract water from the Bungaroo Valley borefield, transferring it into the existing water supply scheme. Water from these sources is treated and then transferred by large trunk mains to the storage tanks at the various townsites.

KRS notes that in 2011 and 2012, the Water Corporation reviewed its long-term water planning for the West Pilbara WSS and for the Karratha scheme, based on a planning horizon of 2040. The long term plan identifies the need and approximate timing of various upgrades and expansions to meet anticipated demands. The water scheme plan provides for staging of capital works and includes options to vary the planning based on the rate and spatial distribution of demand over time.

In 2013 the Department of Water advised that future water demand for the City, its coastal towns and ports are expected to be met through a combination of improved water efficiency and recycling, expansion of existing sources and new water sources, such as the West Canning Basin.

When approached in late 2014 the Water Corporation advised that it expects the next water source for the West Pilbara Water Supply Scheme to be additional water from the Rio Tinto Bungaroo groundwater borefield, however work has not yet proceeded on this source as they believe it will be many years before the source is required. Desalination is unlikely unless the Bungaroo source proves too difficult / expensive to develop.

Table 32: Summary Current Infrastructure Capacity

Settlement	Water	Waste water	Electricity	Telecommunications
Karratha	All settlements in the Shire of Roebourne are serviced by the West Pilbara Water Supply Scheme, which is nearing capacity and vulnerable to climate changes.	Currently constrained, but upgrade projects will deconstrain growth.	All settlements are serviced by the North West Interconnected System which is sufficient to meet demand to 2015, and will need expansion to the ATCO Karratha facility to meet forecast demand from 2016 onwards.	
Dampier		Aging infrastructure needs replacement/ upgrading.		
Wickham		Sufficient capacity for foreseeable growth.		NBN rollout Sept 2016
Point Samson		Sufficient capacity for foreseeable growth.		NBN rollout Sept 2016
Roebourne		Sufficient capacity for foreseeable growth.		
Legend	Constrained with additional investment required			
	Constrained, but investment is already underway or committed to upgrade infrastructure networks.			
	Sufficient capacity to meet foreseeable demand.			

Currently around 3 gigalitres of spare source capacity exists in the Harding Dam and Millstream groundwater sources. Assuming the current growth rate (about 300 - 500 services or 1000 people per year) continues, the Water Corporation believe that this will be sufficient for another 10-15 years of growth. There are lots of factors to consider such as the;

- Amount of other industrial growth requiring a water supply service;
- Quantity of water used & number of people per service; &
- Ongoing growth rates.

The Water Corporation will continue to monitor growth and then make decisions accordingly. If the population rises to the Forecast .id prediction of 38,000 people by 2031, then a new water source will most definitely be required.

Ongoing improvements in water efficiency and recycling are important as they can help delay large investment in new water sources. Significant gains have been made over the past decade, for example Rio Tinto has reduced water used at the Dampier port by almost 30 per cent.

The Water Corporation has also implemented a program expected to save 3.4 GL/yr across the Pilbara and will continue to identify and implement further improvements. The water demand-supply balance will be reviewed with stakeholders at least every two years to determine if there have been any significant changes.

West Pilbara also has a non-potable seawater supply scheme and desalination plant capable of supplying water for industrial use. The WPWSS is expected to meet industry and growth (residential, commercial and light industrial) demand to 2018/19. A further source may be required earlier however, if demand from large industry growth is to be met and non-potable options are not discovered.

Besides headworks infrastructure, the existing water distribution and reticulation network also require significant upgrade in order to achieve the planned housing densities.

Wastewater

To meet the demands arising from forecast growth, several parts of the City's wastewater systems, including treatment plants, major gravity sewers, wastewater pressure mains and wastewater pumping stations require substantive upgrade or replacement in order to deal with expected additional wastewater flow.

KRS notes that in 2011 and 2012, the Water Corporation undertook a substantial review of its long term wastewater infrastructure planning and capital expenditure program, with particular focus on the Karratha settlement. Based on a number of available land use planning studies and inputs at the time (being the peak of the resource boom), the review considered various options to guide the Corporation's future capital investment decisions, over a 50 year horizon.

Karratha currently has three waste water treatment plants (WWTPs) as follows:

- Karratha WWTP No.1 (K1 – situated to the south-east of town it accepts and treats flows from the eastern area of town): licensed capacity of 2.3 M>/day.
- Karratha WWTP No.2 (K2 – situated to the south-west area of town it treats flows from the western half of the town): licensed capacity 3 ML/day.
- Karratha WWTP No.3 (K3 – located within and servicing the small Karratha Light Industrial Area catchment), limited capacity of 70 KL/day.

KRS notes that the K1 and K2 are both operating close to their maximum capacity and the Corporation has undertaken separate planning and committed substantial capital towards upgrading to improve treatment capacity at K1. Upgrading to a maximum capacity of 10Ml/day, is currently underway. Long term planning for the system include options to consolidate the WWTPs at one location and to possibly decommission K2.

Under current upgrades, Water Corporation projects to have a wastewater recycling capacity of 2.19 GL/year of 'Class A' water and 1.28 GL/year of 'Class C' water by 2015. A dual reticulation project for Mulataga is advanced and expected to supply 0.9 GL/year of recycled wastewater to the residential development. Water Corporation is also investigating opportunities to set up a reuse facility to supply treated wastewater for industrial purposes such as dust suppression and road construction. This would reduce the costs of plant upgrades, as well as reducing the amount of new scheme water required.

The Karratha settlement also benefits from an existing non-drinking water (treated effluent) distribution network delivering water purely for public open space irrigation purposes. Upgrades to the level of treatment provided at the WWTP as well as an increase in capacity will increase the availability of this resource, however *KRS* notes that there is substantial competition for this resource and as a result only limited expansion of the treated effluent system is likely.

A separate Karratha Effluent Reused Scheme investigation is currently underway which will prioritise public open spaces for irrigation and develop designs for expanded and more efficient distribution.

Apart from Point Samson, other settlements in the City have smaller scale facilities for treating wastewater to meet the needs of their local communities. The existing WWTP in Dampier has reached capacity and the end of its lifespan. The facility is located on the foreshore near the town centre, so will require relocation with its upgrading. It is currently managed by Rio Tinto and does not meet standards for Water Corporation to take on. The wastewater situation in Dampier presents a significant constraint to any future growth of Dampier, and will require resolution in the short term prior to any growth of Dampier.

Roebourne's WWTP has capacity to accommodate a population of about 1,200, and is planned for modest expansion. Wickham has recently received upgrades to its WWTP to allow for growth at Wickham South. Water Corporation also has plans for further modest expansion of Wickham WWTP, but will require further upgrading to accommodate growth in the medium to long term. Point Samson currently has no wastewater treatment, and such facilities would only become viable with at least 300 dwellings – a size Point Samson is not expected to reach over the planning horizon of this *Local Planning Strategy*.

Electricity

In most electricity systems, utilities rely on major industry to be the foundation of the load, justifying additional investment. In the Pilbara, major industry generally provides its own power generation infrastructure. For example Dampier and Wickham are serviced through the Pilbara Iron (Rio Tinto-owned) network.

Karratha, Roebourne and Point Samson are supplied with electricity through the North West Interconnected System (NWIS). Characteristics of the NWIS that make it atypical of electricity systems are:

- Unpredictable and uneven load growth associated with project-based development;
- Mixed public and private ownership of different parts of the transmission network without a unifying system management agreement;
- Prevalence of off-grid self-generators; and
- Lack of regulation.

Horizon Power, the State-government owned corporation that supplies and distributes power through the NWIS system, does not have secure long-term access to sufficient generation capacity to meet expected demand of the City. Additional supply to meet the demand is therefore required to avoid significant shortfalls to meet peak demand periods. Significant investment in temporary power generation followed by investment in new power generation capacity will be required in the short and medium term to meet demand. The Department of Finance has established a Pilbara Power Project Board to support development of a whole of government solution to addressing future power supply requirements in the Pilbara Region.

Currently underway, the Pilbara Underground Power Project is a partnership project that seeks to better ensure a reliable power supply in cyclone affected areas, by replacing ageing overhead electricity infrastructure with underground networks. The program includes upgrading existing 11 kV (above ground lines) in both the Karratha and Roebourne settlements, to 22kV (underground lines) that will increase the capacity of the system form 5 MVA to 8.5 MVA (40%).

In Karratha, the *KRS* indicates that this would accommodate supply to an additional 3,000 houses once complete, with existing and temporary power stations and substations considered sufficient to meet this increase in demand.

Peak load for Horizon Power on the NWIS network was estimated at 122MW for 2011. Based on the average load growth of five per cent, forecast demand for residential and industrial needs will be 142 MW in 2013 and 187 MW by 2020. There are a number of stand-alone power generation facilities across the City and the wider Pilbara Region that are not connected to the NWIS. Accessing these assets would increase efficiencies by making use of surplus capacity, meaning less need to invest in new generation sources and line losses could be reduced. This would still require a considerable investment in transmission capacity to transport the power to the load centres.

In addition to consolidating and securing the generation supply, Horizon Power is planning to focus on expanding the existing 220 kV transmission network and catering for the existing and future loads. To increase power capacity Horizon Power has also investigated the following alternatives:

- Build own operate (BOO) funding (or borrowing) from State Government;
- Power purchase agreement (PPA) with an Independent Power Producer; &
- PPA with a company supplying power for its own use (e.g. CITIC Pacific).

A report issued by the Australian Centre for Renewable Energy (ACRE) (now administered by the Australian Renewable Energy Agency) in October 2011 identified the significant potential for renewables, particularly wind and solar, in the Pilbara. The ACRE report also identified the need for exploration, mapping and monitoring of renewable energy resources in the Pilbara.

The City has a comparative strength in its potential for renewable energy resources and planning for coordinated power provision for the Pilbara should seek to ensure this potential is utilised.

Telecommunications

Karratha's telecommunications exchange and tower is located in the town centre on Balmoral Road, south of Morse Court. A communications reserve is also located on View Road, south of Millstream Road. This site accommodates the Telstra satellite station. Telstra and Optus have recently installed, or are planning to establish additional mobile phone towers to improve coverage and address reliability issues. Generally, other mobile phone providers do not provide coverage within the City at this time.

Internet connection speeds are reasonable compared to other regional centres. Access to higher download speeds however is somewhat limited at present. Widespread access to high speed internet is an important infrastructure consideration that will allow the City to connect and remain competitive with other areas of the State. High speed broadband is critical to facilitate establishment of local businesses.

KRS notes that the Karratha settlement is considered a 'fibre' area by NBN Co., which is an area considered to be of a high enough density for current copper wiring to be replaced with fibre optics. Existing subdivision will receive a mixed technology system consisting of fibre to the node (the pit on the street connecting fibre optics to copper wiring for individual houses), with existing copper from the node to households remaining in place. Mixed technology fibre to node upgrades have not yet been constructed in Karratha and at present the NBN Co. Is yet to announce when these upgrades will take place.

Where new subdivisions comprise over 100 houses however, they will receive a fibre connection directly to each household, with Horizon Power having an agreement to install NBN conduits in conjunction with its underground power program.

Although there is some uncertainty with the change of government as to how the NBN will be delivered, it is expected to be delivered in some form and will provide the capacity for high quality teleconferencing facilities and digital hubs.

Alternative strategies to improve the region's telecommunications infrastructure include sharing private networks, for instance high flow data connections used for resource projects. Public sector partnerships could provide a greater service area by mobile and broadband providers agreeing on territories for each to cover.

The City's Operational Economic Development Strategy 2014-16 has flagged the necessity for a City-wide Digital Strategy to provide a strategic vision for the City's future. The Strategy is expected to be enabled by enhanced broadband access and digital technologies.

Waste Disposal

The City has experienced considerable growth in recent years and reports an increase of over 50% in waste volumes over the last five years. There is currently minimal recycling of waste in the region, with only 1% being recovered for recycling and the rest sent to landfill. A particular challenge is managing the large amount of waste produced by industry. Consequently the City requires the following facilities to accommodate general and industry related waste:

- A comprehensive waste recycling and disposal plan; and
- A Class IV waste management and hazardous waste disposal facility.

A review of waste management services was completed in April 2010. The review includes a number of recommendations regarding upgrades to existing facilities, resourcing and investigations into emerging technologies. The Pilbara councils are also considering options to divert waste to recycling and to use waste to produce energy. Emerging innovations that could be utilised to improve the solid waste disposal practices include:

- **Incineration:** a "clean" technology which could be coupled with some other industry or process that also produces or needs heat energy;
- **Recycling:** new technologies to sort & separate out good materials from solid waste piles;
- **Re-use:** encouraging retail discounts for using your own materials; coffee cups, shopping bags, etc;
- **Design Life:** stop making products that have a "design life" and fail much sooner than they could; and
- **Traditional Landfills:** are very clean and safe today, but simply use up large areas of land.

Ongoing capital works investment in the region's solid waste infrastructure, in the medium to long-term, will be required. This includes provision of coordinated waste management facilities that incorporate new technologies.

Irrespective of the above, the capacity of the City's 7 Mile Tip is expected to meet demand well past 2031. Also, potential to transport 90% of waste to proposed Port Hedland for processing at waste to energy plant (New Energy Corp), which reduces landfill but by-product (ash) will still be transported back to Karratha for disposal.

8.2 Key Issues: Infrastructure Services

- Lack of coordination between developers and utility providers has been a challenge to the City in recent years of rapid growth. While there have been a number of critical infrastructure constraints for the City that have delayed development, in general these either have been, or are currently being, addressed through significant capital investment to upgrade services. Dampier, however, still remains critically constrained from growth by its aged infrastructure, which is at its maximum capacity.
- The projected demand growth, particularly for water and electricity in the region, will require an ongoing investment program to ensure capacity is matched to growth.
- Wastewater recycling and reuse projects, such as the Karratha Treated Waste Water System, will help to reduce the consumption of scheme water, while also providing for the 'greening' of the urban environment. Given the constraints on water supply, wastewater recycling and reuse should be made a priority.
- Encouraging the private sector to invest in infrastructure or to provide more open access to existing infrastructure will help to spread the investment cost and reduce the potential for duplication and redundancy. This is particularly relevant to power infrastructure, where major resource companies frequently supply and reticulate their own power independent of the NWIS.
- The City's natural environment affords significant potential for wind and solar renewable energy generation. There is a need to further investigate this potential with exploration, mapping and monitoring of renewable energy resources so that these alternative power resources can be implemented in future. Any coordination of the NWIS system through the Pilbara Power Project Board should incorporate planning for future renewable power resources.
- Total waste production in the City has increased over 50% in the last five years, and only 1% of waste is currently being recycled. Waste management services were reviewed in 2010, and recommendations for upgrading facilities and investigating emerging waste technologies need to be implemented to improve the City's waste management practices to be more sustainable.
- Further telecommunications improvements, including enhancement of mobile voice and data network coverage as well as broadband, are required for the City to diverse its economy and remain competitive with other areas of the State.

8.3 Local Profile: Transport

Airports

There are currently four airports in the Pilbara Region located at Karratha, Port Hedland, Newman and Paraburdoo. Karratha is currently WA's busiest regional airport for passenger movements, with 800,000 passengers per year. There is also an airstrip at Roebourne, as well as a number of smaller airstrips throughout the City as shown in **Figure 51**. It should be noted that the expansion of Rio Tinto's Cape Lambert Port Operations has since resulted in the closure of Wickham Airport.

In 2013 the City of Karratha adopted the *Karratha Airport Master Plan & Land Use Plan 2013-2033 (KAMP 2013)*. Based on the adopted medium growth model current passenger numbers are forecasted to increase to 1.8 million passengers by 2031-32. Low and high growth forecasts ranging from 1.0 to 2.5 million passengers per year were also calculated and depended on various factors, including commencement of construction projects in the region, FIFO workforce changes and growth in non resource related air travel.

KAMP 2013 provides the strategy for Karratha Airport to accommodate forecasted growth and corresponding capital development when required to meet demand.

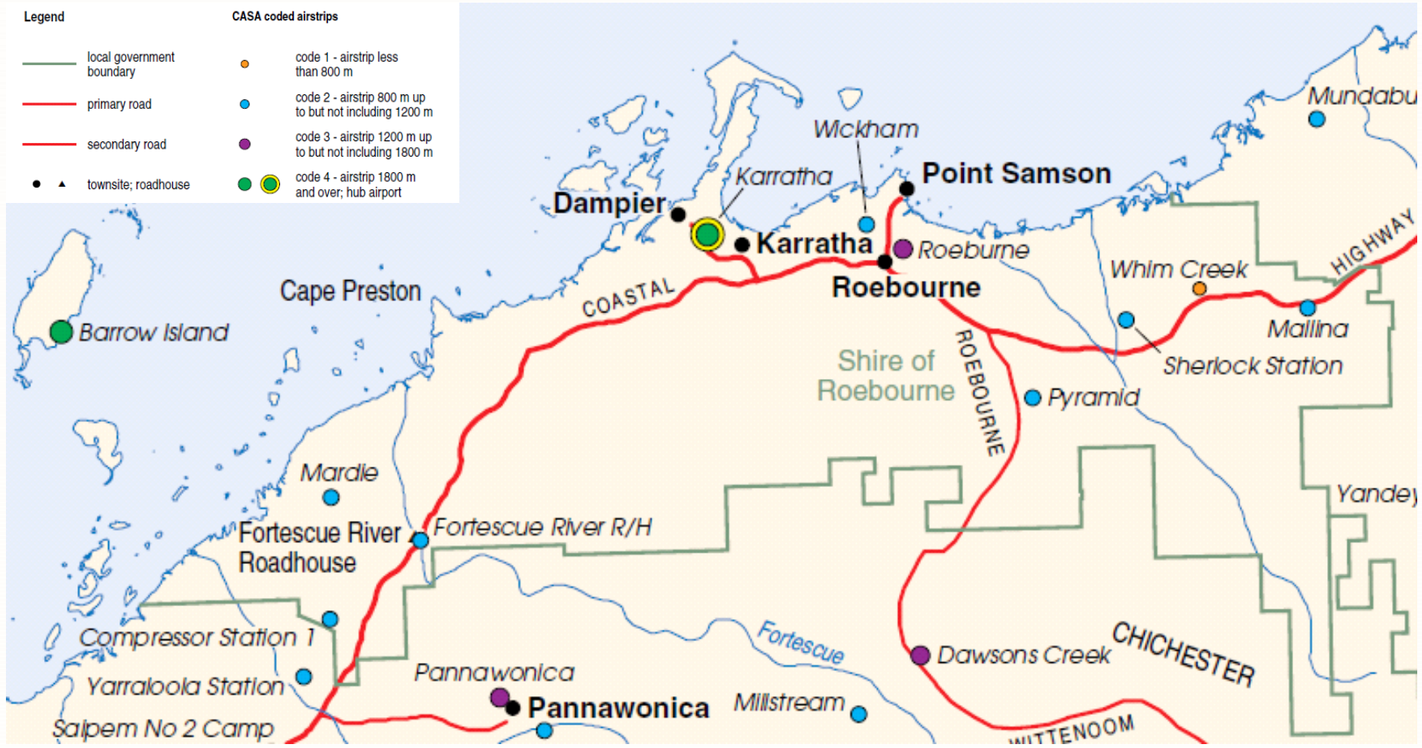
The current capital improvement programme, the Passenger Terminal Upgrade project commenced in 2014. When completed, it will provide new cafes, a bar, other lettable concessional areas, additional toilets, combined arrivals and departures lounge, security enhancements and baggage claim to enhance amenity for passengers. The upgrade will also provide the capability for international flights and for airline lounges should airlines deem them viable.

As passenger numbers grow additional capacity increases will be required at the existing passenger terminal and Regular Public Transport (RPT) apron in future. There is a limit to the capacity for expansion of existing facilities however, so *KAMP 2013* reserves space on the south side of the airport for possible relocation of passenger operations, including a new passenger terminal.

KAMP 2013 also identifies the potential for commercial development of available airport land that is not required for future airport operations. Land on the north side of the airport would be developed first with the larger areas south of the airport in the longer term depending on demand.

Revision of the existing Special Control Area based on the N70 and ANEF contours will be required to ensure compatible uses develop adjacent to the airport enabling long term continued operation and future expansion.

Figure 51 – Existing Airports & Airstrips in the City of Karratha



Source: Regional Profile: Pilbara Framework (WAPC, 2009)

Note: Wickham Airport has since closed.

Ports

The recently formed Pilbara Port Authority operates as a corporatised entity under the *Port Authorities Act 1999*. The non-port authority port, Port Walcott (Cape Lambert) was established under the *Shipping and Pilotage Act 1967*. In general, non-port authority ports comprise one or more single-user export facilities operated by private resource companies. These ports and related facilities are operated with limited guidance from the State Government.

It is important to note the tonnages for some of these ports are substantial and further add to the State's existing and future port throughput. Port Walcott located at Cape Lambert is of particular significance, exporting more than 111 million tonnes in 2013/14. A proposed expansion at Port Walcott is part of a plan to raise Rio Tinto's annual production in the Pilbara to more than 350 million tonnes per annum by 2015. To achieve this, the Port Walcott port capacity will be expanded to handle an additional 120 million tonnes per annum.

The important role of these ports to the economy of the City and the Pilbara Region needs to be recognised, as does the need to protect transport corridors into the Ports to ensure continued operation. Furthermore limited capacity exists for the expansion of existing industrial areas adjacent these ports, thus it is of critical importance that they be limited to use directly associated with the port and not for uses that can be accommodated in other industrial areas.

Future construction of the Anketell, Balla Balla and Cape Preston East Ports, and their associated Strategic Industrial Areas will further enhance the resource export potential of the City.

Rail

Within the City of Karratha there are a number of private heavy haulage rail lines that transport iron ore to the existing ports of Dampier and Port Walcott (Cape Lambert). These rail lines carry the vast majority of the iron ore volumes exported from these three ports. While the tonnages carried are substantial, these rail lines are privately owned and operated.

Two new railway lines are proposed to link the planned new Anketell Port and Strategic Industrial Area. As per existing rail lines, these routes require protection inclusive of sufficient buffers from encroaching development in accordance with State Planning Policy 5.4 – *Road and Rail Transport Noise and Freight Considerations in Land Use Planning.*

Of significance to the City of Karratha is the level of delay that can be experienced at major rail crossings, where freight trains can be in excess of 1.4km and require several minutes to pass over the road. Importantly however, there are no locations of freight rail lines crossing non-primary roads.

Primary Roads

The primary road system within the City of Karratha falls under the control of Main Roads Western Australia. Whilst Main Roads are responsible for maintenance and upgrading of these roads, any delays and capacity constraints may have significant impacts to local roads providing alternative routes.

From a regional perspective the key challenges are the growing pressure caused by the overall increase in traffic movements caused by population expansion and the demand to move freight. The movement of freight is further complicated by the growth of pre-assembled, large module transport across the road network to service the needs of the resource sector.

Other issues include the reliability of the network due to flooding and significant delays at existing and future railway level crossings.

Freight Network

Freight movement in the City is dominated by the movement of iron ore from mines to ports, primarily by rail, and movement of other goods to mines, towns and industrial areas mainly by road.

Two existing Rio Tinto railway lines transport iron ore to two of the state's highest export tonnage ports at Dampier and Cape Lambert. Two more mining company railway lines are planned from mine sites to the planned new Anketell Port and Strategic Industrial Area located between Karratha and Cape Lambert.

Dampier Port had a throughput of 168 million tonnes in 2011 and is projected to increase to 230 million tonnes per annum by 2030. Port Walcott at Cape Lambert handled 68 million tonnes in 2011 and Rio Tinto plans for the port's capacity to increase by 120 million tonnes per annum by 2030. The new Anketell Port will be capable of expanding to 350 million tonnes per annum if required. The recently constructed Port Preston (approximately 60km southwest of Dampier) could potentially be expanded in future as well. For the proposed Forge Resources Magnetite project near Whim Creek one of the options under consideration would involve potential new port facilities at Balla Balla (approximately 100km east of the planned Anketell Port).

Figure 52 provides an indication of road freight growth from 2012 to 2030 within the City, although it should be noted that this is based on the existing road network and does not include the planned Karratha Western Bypass (west of Madigan Road) and the new access road planned from North West Coastal Highway to Anketell Port and SIA (beside the proposed railway shown).

Figure 53 overlays the routes of key transport infrastructure upgrades including Aketell, with a particular focus on the Cape Preston East and Bungaroo South Mines project.

Road Network

The existing regional road network linking settlements within the City of Karratha and beyond is illustrated in **Figure 54**.

The primary road system within the City of Karratha falls under the control of Main Roads Western Australia. Whilst Main Roads are responsible for maintenance and upgrading of these roads, any delays and capacity constraints may have significant impacts to local roads providing alternative routes.

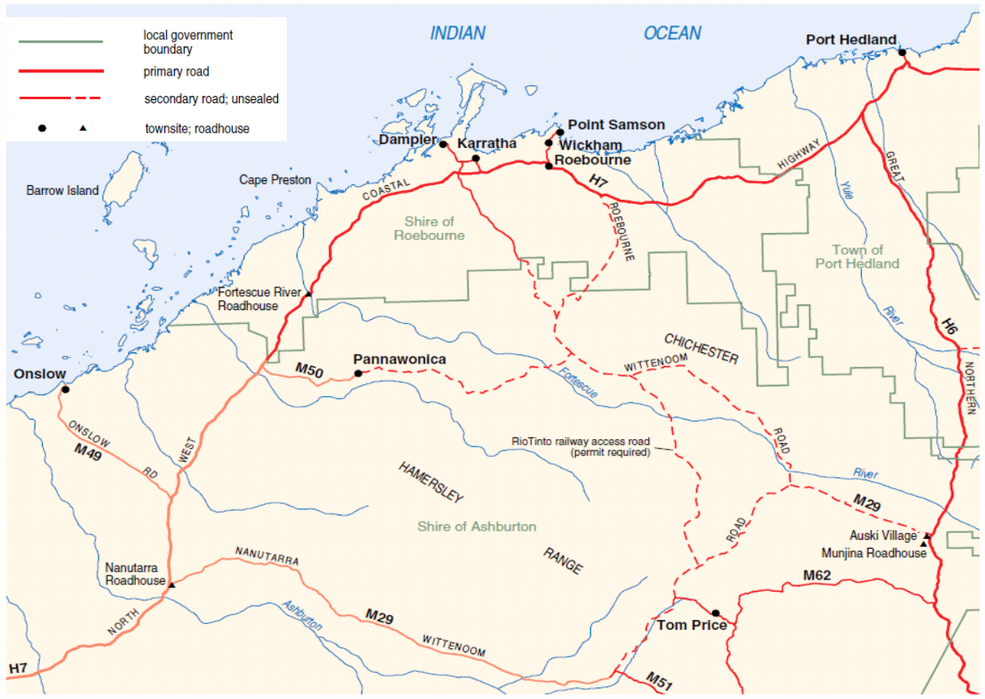
From a regional perspective the key challenges are the growing pressure caused by the overall increase in traffic movements caused by population expansion and the demand to move freight. The movement of freight is further complicated by the growth of pre-assembled, large module transport across the road network to service the needs of the resource sector.

Other issues include the reliability of the network due to flooding and significant delays at existing and future railway level crossings.

Existing traffic volumes on the road network are illustrated in **Figure 55**. The figure highlights the much higher traffic flows, of 10,000 to 12,000 vehicles per day (vpd), on Dampier Highway compared to most other roads in the City. The high proportion of heavy vehicles is also noted.

A variety of movement network improvements are necessary to accommodate future growth within the City. This improvement is required at many levels, with priorities identified in the following section.

Figure 54 – Existing Regional Road Network



Network Upgrades

The existing road network system within Karratha entails connectivity issues due to Radburn layout and flood ways. The proposed road network strategy recommended in *KCN* aims to improve connectivity and permeability for all modes of transport.

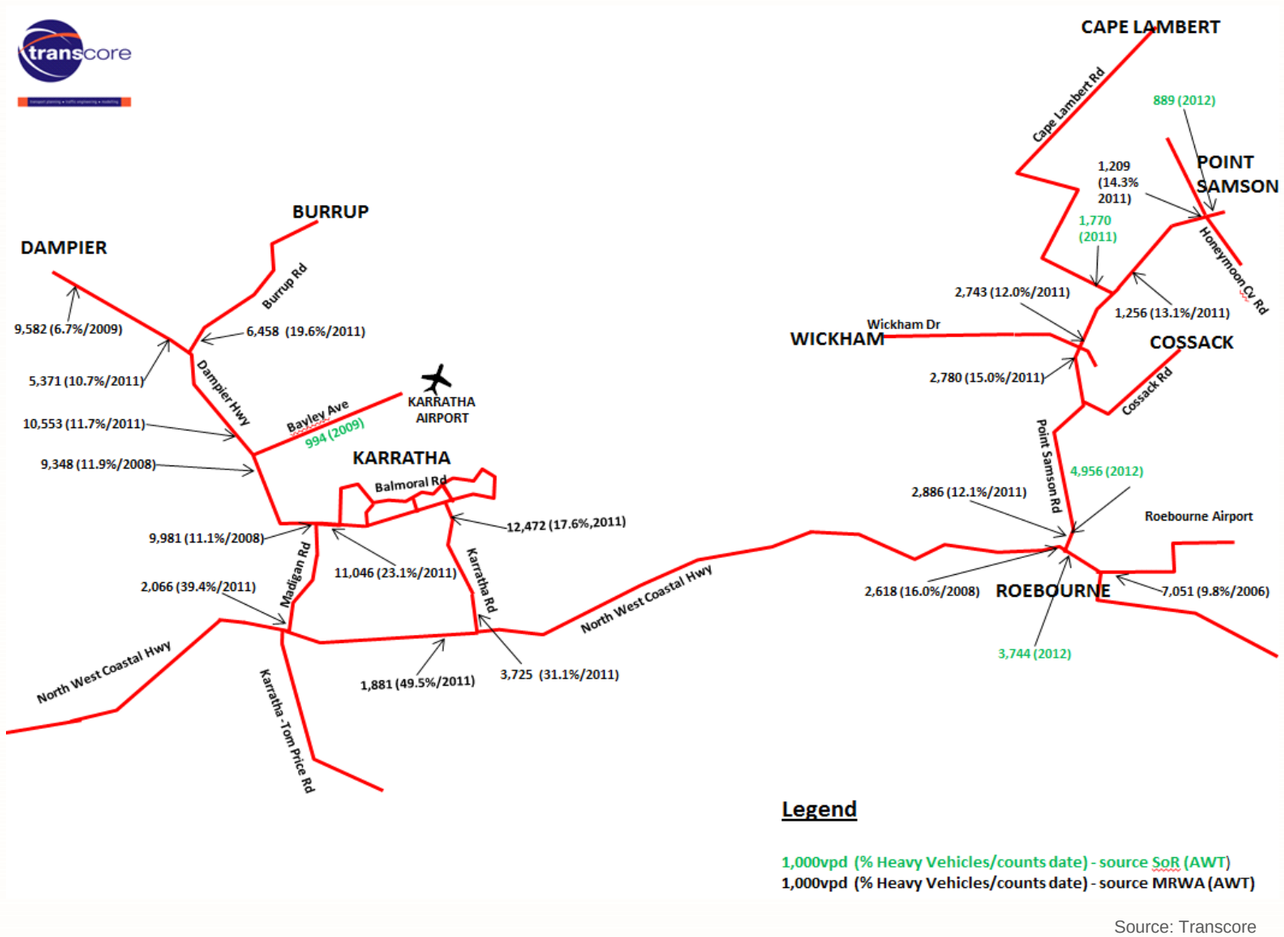
In July 2014 Riley Consulting reviewed the operational capacity of the Regional Road network based on a predicted annual increase in traffic volumes of 3% to the year 2031, and a doubling in truck movements in line with freight forecasts. An assessment of the future traffic movements to the local road network (non regional roads) was also undertaken based upon the population projections discussed earlier in this report.

Based on a population of 35,268 by 2031 (exclusive of FIFO), current ABS data indicating 2.9 persons per household, the standard residential trip rate of 8 trips per dwelling (equating to 2.7 trips per person), forecasted traffic increases for each settlement are expected to be in the order of the following:

- Karratha +9,839 persons
  - Mulataga (65% increase) +17,267 vehicle movements per day
  - Gap Ridge/Madigan (35% increase) +9,298 vehicle movements per day
- Dampier +850 persons +2,295 vehicle movements per day
- Wickham / Point Samson +820 persons +2,216 vehicle movements per day
- Roebourne +125 persons +338 vehicle movements per day

Whilst this work contains differences in the population growth of different centres (in particular Dampier whose infrastructure constraints weren't fully understood at the time) it doesn't alter he conclusion that forecast traffic increases as a result of the population expansion are significant within the Karratha townsite, but increases to other towns are not high and can generally be accommodated by the current road network.

Figure 55 – Existing Traffic Volumes between Major Settlements



Source: Transcore

Based on the traffic modelling undertaken, the Strategy anticipates that the following road links should be constructed or upgraded by 2031 to meet the future demand of the land use scenario considered by *Local Planning Strategy*:

- Dampier Hwy/Millstream Rd (Searipple Rd to Maitland Rd) – dual carriageway (4 lanes).
- Balmoral Rd (Millars Rd to Warambie Rd) – dual carriageway (4 lanes).
- Point Samson-Roebourne Rd (Roebourne to Wickham) – dual carriageway (4 lanes).
- Roebourne northern highway realignment (Point Samson-Roebourne Rd to North West Coastal Hwy) – construct as 2-lane road (to reduce traffic volumes including heavy vehicles on the corresponding section of Point Samson-Roebourne Rd in Roebourne townsite).
- Roebourne southern bypass (North West Coastal Hwy to North West Coastal Hwy) – construct as 2-lane road (to reduce traffic volumes including heavy vehicles on the corresponding section of North West Coastal Hwy in Roebourne townsite).
- Karratha Western Bypass (Dampier Hwy to Madigan Rd) – construct as 2-lane road (to reduce heavy vehicle traffic on the corresponding section of Madigan Rd in Karratha townsite).
- New road link from Millstream Rd southward though the Mulataga area to the Karratha Industrial Area and Karratha Rd – construct as 2-lane road (to keep traffic volumes on the northern section of Karratha Rd below 10,000vpd as the Mulataga area continues to develop).
- Millars Rd (Balmoral Rd to Karratha Airport) – upgrade to sealed road standard (2 lanes).

Level of Service Definition

The Level of Service concept was developed in North America to assess the operation of major road links. In Australia the concept has been adopted as a simplistic measure of road and intersection performance. Based on the USA Highway Capacity Manual (HCM) the letters A through F, with A being the best and F being the worst, designate the performance level as follows;

A: free flow. Traffic flows at the posted speed limit and motorists have complete mobility between lanes.

B: reasonably free flow. Posted speeds are maintained, maneuverability within the traffic stream is slightly restricted.

C: stable flow, at or near free flow. Ability to maneuver through lanes is noticeably restricted and lane changes require more driver awareness.

D: less stable flow. Speeds slightly decrease as traffic volumes slightly increase. Freedom to move within the traffic stream is more limited. Minor incidents are expected to create delays. The lowest preferable Level of Service for arterial roads.

E: unstable flow, operating close to capacity. Flow becomes irregular due to limited usable gaps in the traffic stream and speeds rarely reach the posted limit. Any disruption to traffic flow, such as merging traffic or lane changes, can create a shock wave affecting traffic upstream. Any incident will create serious delays.

F: forced flow. This Level of Service typically indicates more demand than capacity. The road would be considered as congested.

It is also known that at some future time MRWA will provide a diversion to Madigan Road and provide grade separation at Dampier Road. This proposal would not be expected to impact traffic patterns, nor is it likely to significantly improve journey times.

A potential new road linking Dampier Road through to Balmoral Road using Millars Road has also been muted. No alignment has been developed and it is known that major flooding would occur on this link. The road would provide a convenient connection between the town centre and the airport, but may result in higher than desirable traffic movements through residential precincts.

These upgrades are all in addition to those necessary to service the future Anketell Port project, the road network planning for which is to be undertaken in the latter half of 2014. Indicatively, the industrial uses could generate between 15,000 to 25,000 additional vehicle movements per day, necessitating the provision of up to three single two lane roads or one four lane divided road.

In addition North West Coastal Highway will require upgrading to a four-lane divided road between the future port and Karratha, as will De Witt Road between the Highway and Karratha. Due to expected impact, it is the City's position that these upgrades need to precede commencement of the port.

A new four-lane divided coastal road had also been suggested on the basis that it would provide a more direct connection, however this would create pressure for large trucks to use the coastal road between the port and Gap Ridge / Burrup Peninsula which would have a negative impact to the Karratha townsite. In light of the above, and the recent downturn in the price of iron ore, this road is not expected to eventuate within the planning horizon of this Strategy.

Other key movement network improvement initiatives embraced by the Strategy include:

- Improved connectivity across culs-de-sac and the Radburn layouts found in Karratha and Wickham – this includes roads, footpaths and bikeways;
- Increased shade provision for footpaths and bikeways;
- Public transport must be considered as a priority within settlements as well as across the City; &
- The provision of adequate truck breakdown areas;

Sealing of the Karratha to Tom Price Road beyond the City's boundary to improve road safety and reduce journey times, in recognition of the Regional Centre role of Karratha to the West Pilbara.

Table 33: MRWA Roads Current Operation Characteristics

Road	Volume [1]	HGV	PCU value	Pavement	Type [2]	LoS	2031 volume [3]	LoS	Comments
Burrup Road	8,483	20%	8,990	7.9m	S1	D	16,434	E	Duplication required
Dampier Highway E Broadhurst	13,548	11%	14,054	2 X 7.2m	DCC	A	25,058	A	Very good operation
Dampier Highway west Karratha Rd	16,792	13%	17,519	2 X 7.2m	DCC	A	31,448	B	Good operation
Dampier Highway west Madigan Rd	11,754	11%	12,197	2 X 7.2m	DCC	A	21,753	A	Very good operation
Dampier Road north of Burrup Rd	5,431	7%	5,562	7m	S2	C	9,763[A]	D	Acceptable operation
Dampier Road south of Bayly Ave	10,765	19%	11,392	2 X 7.2m	DCC	A	20,794	A	Very good operation
Karratha - Tom Price Road	1,351	34%	1,470	7.1m	S1	A	2,768	A	Very good operation
Karratha Road - north Highway	6,571	21%	6,990	7.2m	S1	C	5,655[B]	C	Good operation
Karratha Road south Millstream	14,291	9%	14,745	7m	S1	E	20,082[B]	E	Duplication required
Madigan Road	4,035	37%	4,411	7.2	S1	B	8,348	C	Good operation
NWCH at Karratha	4,098	45%	4,528	7m	S2	B	8,668	C	Good operation
NWCH east Roebourne	1,213	35%	1,321	7m	S2	A	2,491	A	Very good operation
NWCH west of Karratha	1,360	37%	1,488	7m	S2	A	2,816	A	Very good operation
NWCH west Roebourne	5,495	21%	5,839	7m	S2	C	10,709	D	Acceptable operation – Affected by Anketell Port
Point Samson Rd South Wickham	5,345	28%	5,760	6.5m	S3	C	10,734	D	Acceptable operation
Point Samson Rd	1,628	11%	1,691	6.5m	S3	A	2,243[C]	A	Very good operation
Roebourne-Wittenoom Road	29	11%	31	-	S5	A	54	A	Seal will be required

[1] Volume is the PCU flow. PCU's adjust all vehicles to reflect the equivalent volume of cars (HGV = 3).
[2] Refer Appendix A for road types and LoS definition
[3] 2031 volume at 3% growth per annum or base volume + known development
(A) Riley Consulting Dampier Townsite Expansion report July 2013
(B) Riley Consulting Karratha Light Industrial area expansion report
(C) Riley Consulting Point Samson structure plan traffic report

Source: Riley Consulting (2014)

Public Transport

Both *KCN* and the *KSR* note that the lack of effective and viable public transport and bus services in Karratha has contributed to the total dominance of motor vehicles. *KCN* recommends and the *KSR* seeks to facilitate the route of a public transport service (Bus Route 1 in **Figure 56**), in the form of a high frequency bus service, which would connect the far east and far west ends of the town and pass through the town centre.

Bus Route 1 provides additional road links in the areas currently affected by Radburn layout and aims to improve accessibility and connectivity. In time, it is suggested that the service be expanded to connect the newer emerging residential areas (refer Bus Route 2).

KSR notes that community input during engagement was relatively lukewarm regarding a regular bus service through Karratha's older inner suburbs, hence there appears to be relatively low perceived need for such a service at this time. Public Transport is considered to be a critical component of successful and vibrant activity centres and communities and is central to the long term *KCN* vision.

Improved bus services between towns in the City is also considered important, particularly in facilitating non-car-based access from the other towns to the regional facilities available in Karratha.

Parking

Currently demand for parking supply is not expected to be an issue in Karratha due to the significant number of parking bays available at different locations including the town centre. Parking surveys undertaken by Transcore for *KCN* showed that the highest overall parking occupancy across the whole town centre was 55% on Friday (12AM-1PM) and 53% on Saturday (1PM-2PM). The main shopping centre car parks (966 spaces including disabled and loading zones) are up to 73% full on Friday and up to 85% full on Saturday.

Parking supply in the heart of the city centre should be rationalised to match observed demand. It should be recognised that drivers will first try to find parking in the most conveniently located parking areas close to major destinations, such as the shopping centre and the main street. Logical routes from these inner parking areas to outer parking areas are therefore necessary to efficiently act as additional parking at peak times. Decked and underground parking and concealed parking areas (behind buildings) are initiatives promoted to further improve the space utilisation and appearance of the city centre areas. The same principle is applicable for other towns in the City.

Local Planning Policy DP18 – Karratha City Centre Parking Policy prescribes mechanisms for the supply and management of parking within the city centre in accordance with the objectives outlined in *KCN*.

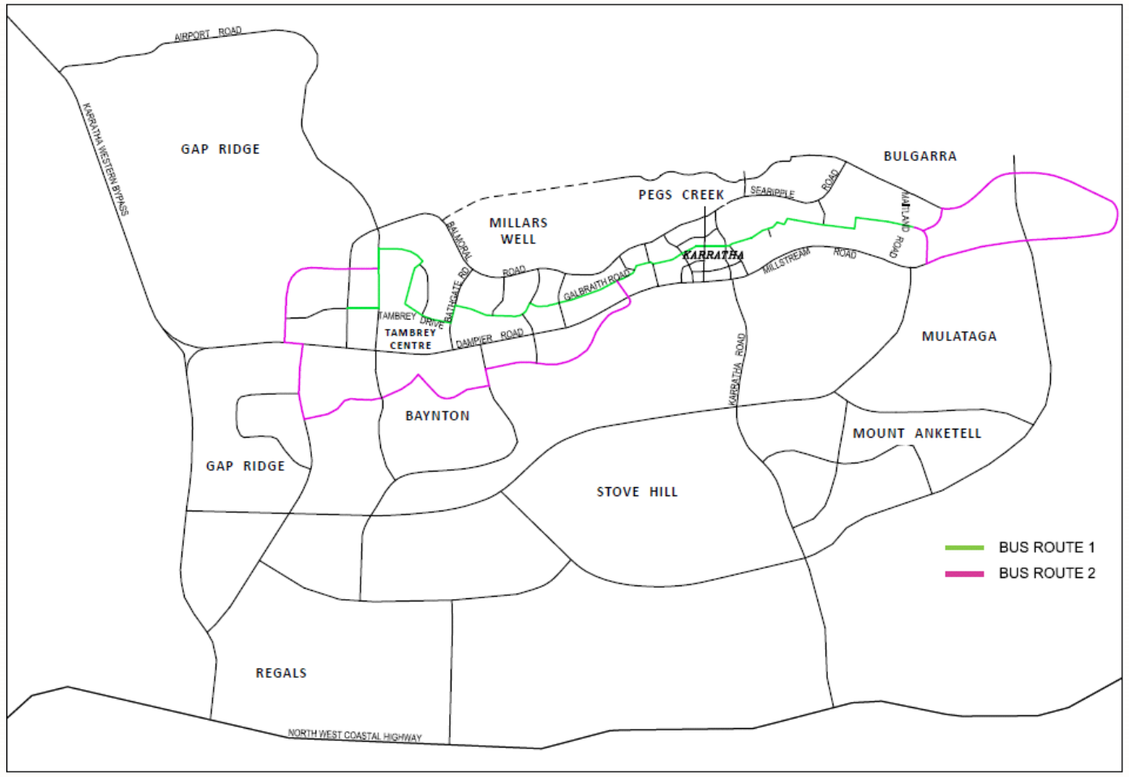
Bicycle & Pedestrian Networks

KCN also recommended provision of pedestrian and bicycle facilities in accordance with Liveable Neighbourhoods principles, including the network of shared paths shown in **Figure 57**.

Final alignments and staging arrangements form the subject of the *City's Future Works Report (Footpaths 2013-2023).* The recommendations of this report are acknowledged and regarded in the KSR as essential to underpinning the core KCN principles of a walkable, connected, sustainable and healthy City.

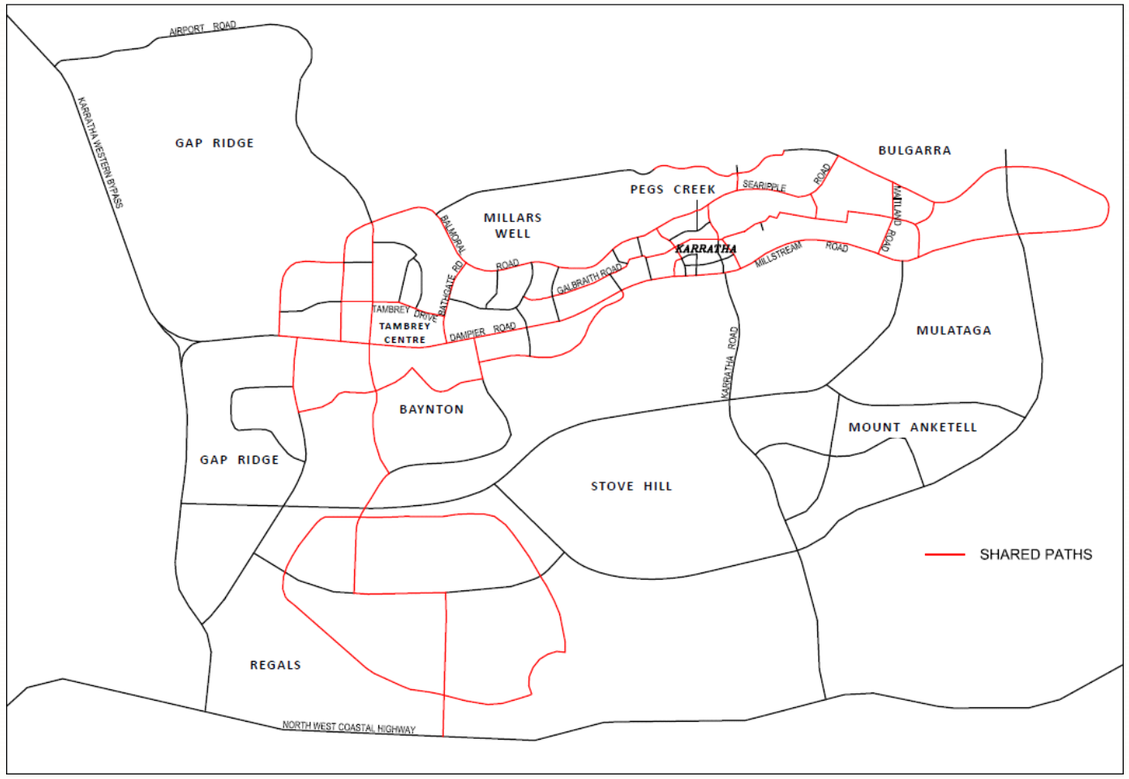
Other towns in the City will remain much smaller than Karratha, so non-motorised transport modes such as walking and cycling remain a viable option for movement around the town. Public transport would not be warranted in those smaller centres, but good pedestrian and cyclist facilities should be considered essential in smaller towns.

Figure 56 – Proposed Public Transport Routes for Karratha



Source: Karratha City of the North, Volume 2: City Growth Plan (2010)

Figure 57 – Proposed Shared Path Network for Karratha



Source: Karratha City of the North, Volume 2: City Growth Plan (2010)

Land Use / Transport Integration

Urban centres around the world are sustained because they provide sufficient access to different land uses, activities and opportunities distributed in the urban area. As these land uses grow however, integration becomes more difficult to maintain. Transport routes to outer areas become more congested, dispersed and costly. Increasing the proximity of land uses to each other, including more mixed use centres, as well as technology can improve accessibility without increasing car usage.

The City of Karratha has experienced rapid growth on the back of minerals and energy sector economic growth over recent years. Growth of the City is projected to continue, and providing sustainable transport infrastructure in line with land use growth is essential.

Movement between different land uses depends on their location and available transport. In the past, improving transport links such as duplication of Dampier Highway has improved access. This option is becoming more expensive to maintain, not only in financial terms but also in environmental and social terms, as different centres in the City grow.

Integrating land uses and transport can deliver a more sustainable City with a high quality of life for current and future residents. Over the next 15+ years, the City of Karratha population has the potential to increase to between 38,000 and 50,000 people. The locations chosen for development to accommodate these people, and the transport available to them, will determine whether the current high rate of car use can be regulated. As Karratha and the other major settlements of the City grow, more land is cleared for urban use and more motor vehicles impact on the air quality. Generally, people want home, work and essential services including schools, medical facilities, shops, public transport and parks to be within a 10-20 minute trip.

Truck Breakdown Areas

Main Roads has classified the road network in regard to truck movements. The Restricted Access Vehicle (RAV) networks cover the State and specify what size vehicle may use each road. At locations where long vehicles (road trains) are not permitted, there is a need to provide breakdown areas where trucks can disassemble the road train into acceptable lengths to reach the load destination.

The provision of breakdown areas is a function of the Main Roads RAV system and as such breakdown areas should be provided (by MRWA) at locations where the RAV network changes. Within the City of Karratha breakdown areas could be required (in order of priority) at:

- North West Coastal Highway at De Witt Road and/or Madigan Road ;
- Point Samson-Roebourne Road south of Wickham;
- Karratha Light Industrial Area;
- Dampier Highway by Kangaroo Hill Access; &
- Gap Ridge.

A new facility may also be required for the Anketell Port project in the vicinity of Cleaverville Road. The facility would service the port and deliveries to Wickham.

Main Roads policy for the provision of truck breakdowns areas is where the MRWA road network requires the provision of a breakdown area, it would be provided by Main Roads. Where the local road network requires the provision of a breakdown area, it should be provided by the City. Thus where a RAV route terminates, but a road under the control of Main Roads continues, Main Roads would provide a breakdown area. Where, for example, a district road connects with a Main Road, the requirement for a truck breakdown area is a need of the district road and thus would be provided by the City. Main Roads acknowledge there is a need to assess truck breakdown areas on a realistic basis and each location should be assessed on its merits and reasons for requirement.

8.4 Key Issues: Transport

- A number of strategic transport issues for the Pilbara region have been identified in State Government planning studies, but most of those items are outside of the direct control of the City of Karratha and beyond the scope of this *Local Planning Strategy*. The City can only manage or control development on privately owned (or non-State Government owned) land. The City needs to be an informed partner in the wider mining and industrial development of the City and in State Government policy development that has implications for the City.
- Most of the transport-related challenges and opportunities for the City relate to roads rather than the other types of transport infrastructure. Previous reports for Karratha, in particular, have identified a range of transport-related challenges and opportunities relevant to the City, which also relate to the principles of land use / transport integration.
- Upgrading of Dampier Highway to dual carriageway standard from Karratha to Burrup Road was required for the current traffic volumes of 10,000 to 12,000 vpd on this road, and has now been completed. Planning of the future Karratha Western Bypass is in progress although construction is currently indicated as a long term project (2020+). It is recommended that the threshold of 10,000 vpd be used as a realistic threshold for determining when road upgrading to dual carriageway is required in this regional context.
- At Roebourne a bypass (around the southwest side of town) may be further considered upon the generation of sufficient traffic demand.
- Based on the traffic modelling undertaken for this *Local Planning Strategy* it is anticipated that a number of road links will be constructed or upgraded by 2031 to meet the future demand.
- Future provision of public transport in Karratha and between centres is also a key issue. *KCN* recommended a basic public transport service in the form of a high frequency bus service that would connect the far east and far west ends of the town and pass through the town centre, with potential extension to other new residential areas as they develop. Improved bus services between towns in the City should also be considered particularly to provide non-car-based access from the other towns to Karratha's regional facilities.
- At Dampier the proposed Dampier Marine Services Facility involves a new jetty and land-backed wharves to accommodate increased cargo movements. The proposed Dampier Marina project will be a significant recreational boating facility with residential and tourist accommodation. Both would place additional demand on transport links and access in this area.
- In all towns provision and upgrading of pedestrian and bicycle facilities is strongly recommended. The WAPC's Liveable Neighbourhoods policy provides appropriate guidance, including a network of shared paths alongside the busier roads and footpaths alongside most other local roads.
- Proposal to transport 90% of waste to Port Hedland for processing and return of ash to City will result in a significant increase in truck movements between Karratha and Port Hedland which have not currently been factored into road network strategy, which may necessitate a review in future.

9.0 Opportunities & Constraints Mapping

Analysis of the physical and administrative constraints upon development forms an important component of the *Local Planning Strategy* preparation process. This process also importantly involves identification of opportunities for growth. Opportunities may be specific, or may arise in the form of areas unaffected by constraints to development. Opportunities and constraints mapping, therefore, plays a critical role in informing the debate on spatial form aspects of development of the City. Plans 11 to 16 map opportunities and constraints to development, focusing primarily on the main settlement areas of the City.

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