

Nickol West, Karratha Revised Development Plan

August 2013

Prepared for
Otan Karratha Pty Ltd

DOCUMENT HISTORY AND STATUS

Nickol West: Revised Development Plan (10/032)		Rev	Reason	Date Issued
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		2	Shire Adoption	08.11.2011
		3	WAPC Endorsement	14.02.2012
		4	Proposed GH Modifications	29.07.2013
In association with: The Civil Group Wood & Grieve Transcore Whelans Airport Master Planning Consultants		5	Shire Adoption	27.08.2013

CERTIFICATION OF AGREED MODIFICATIONS

IT IS HEREBY CERTIFIED THAT PURSUANT TO CLAUSE 7.2.13 OF THE SHIRE OF ROEBOURNE TOWN PLANNING SCHEME NO.8, THE NICKOL WEST DEVELOPMENT PLAN (AS MODIFIED) WAS ADOPTED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

.....19 November 2013.....
Date

.....
.....

An officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005*

AND

BY RESOLUTION OF THE SHIRE OF ROEBOURNE, MADE 19 AUGUST 2013, THE COMMON SEAL OF THE SHIRE OF ROEBOURNE WAS HEREUNTO AFFIXED IN THE PRESENCE OF:

.....
FIONA WHITE-HARTIG
Shire President

.....
.....

CHRIS ADAMS
Chief Executive Officer



LEGEND

- SUBJECT SITE
- R17.5
- R20
- R30
- R60
- POS
- DRAINAGE
- DUAL USE / SHARED PATH
- SUBJECT TO DETAILED AREA PLAN
- SECTION 70A ROAD TRAFFIC NOISE MEMORIAL TO BE APPLIED

NOTES

1 A SECTION 70A MEMORIAL SHALL BE APPLIED TO THE TITLE OF ALL RESIDENTIAL ALLOTMENTS CREATED WITHIN 80M OF DAMPIER ROAD, ADVISING FUTURE OWNERS OF THE NEED TO CONSTRUCT HOUSING IN ACCORDANCE WITH AS3671 (ACOUSTICS - ROAD TRAFFIC NOISE INTRUSION - BUILDING SITING AND CONSTRUCTION).



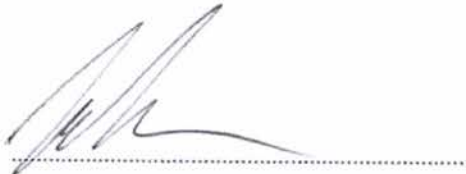
This Structure Plan is prepared under Part 7 of the Shire of Roebourne Town Planning Scheme No.8

CERTIFICATION OF AGREED DEVELOPMENT PLAN

IT IS HEREBY CERTIFIED THAT:

THE AGREED REVISED NICKOL WEST DEVELOPMENT PLAN WAS ADOPTED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

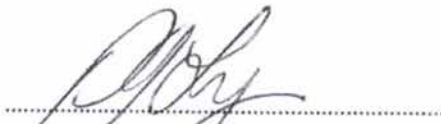
20 March 2012



An officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005*

AND

BY RESOLUTION OF THE SHIRE OF ROEBOURNE, MADE 24 OCTOBER 2011, THE COMMON SEAL OF THE SHIRE OF ROEBOURNE WAS HEREUNTO AFFIXED IN THE PRESENCE OF:



Deput

FIONA WHITE-HARTIG
Shire President

PETER LONG



COLLENE LONGMORE
Chief Executive Officer

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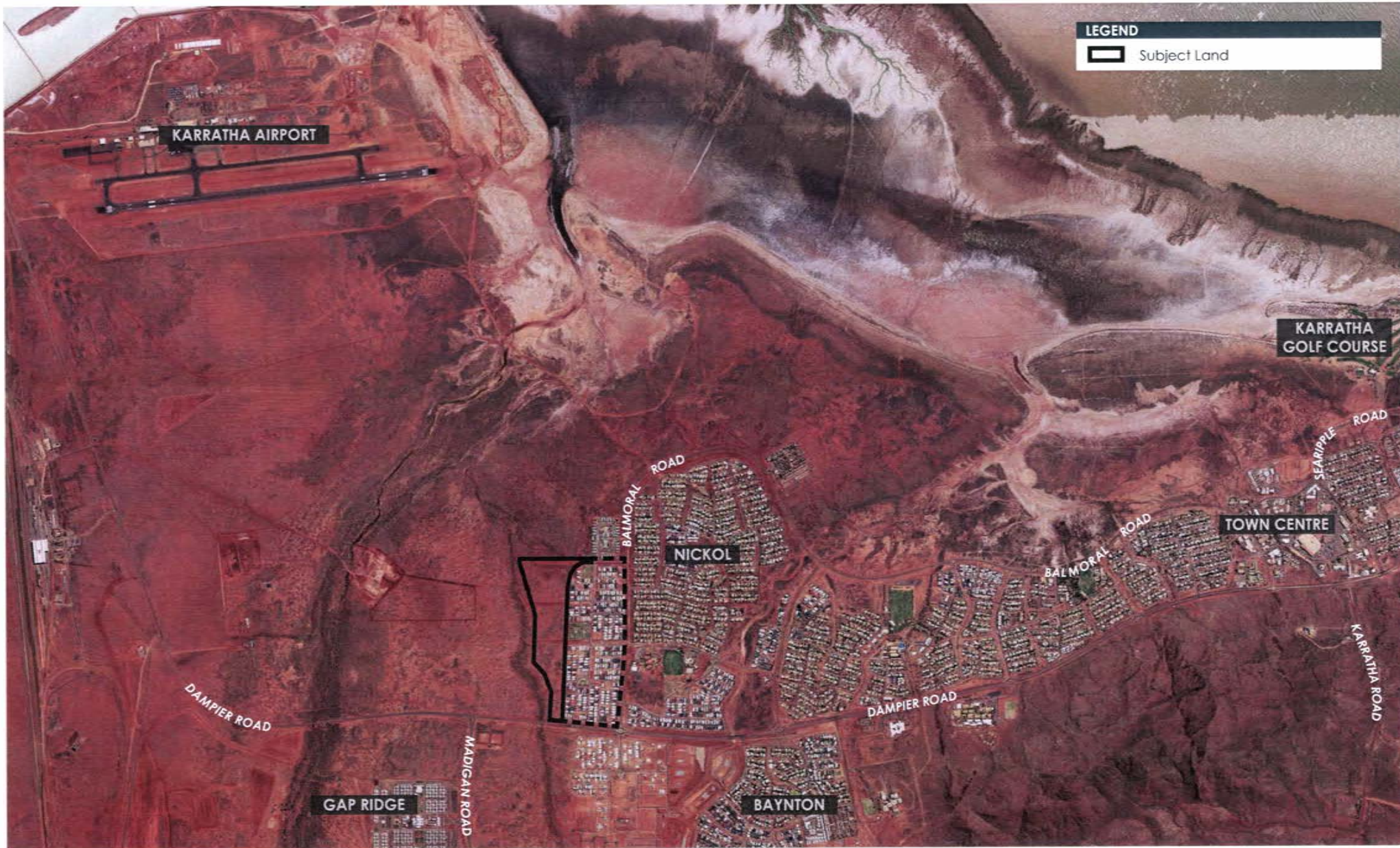
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- E. Servicing Report

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- 3. Karratha City Growth Plan
- 4. Issues & Opportunities
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- 6. Revised Development Plan
- 7. R30 Grouped Dwelling Concept
- 8. R60 Multiple Dwelling Concept
- 9. Movement Network Plan
- 10. Existing Services
- 11. Indicative Staging Plan



LEGEND
 Subject Land

LOCATION PLAN
 Nickol West
 A Pindan Pty Ltd Project

0m 200 400 600m
 s: 1:35000@A4
 d: June 2011
 j: 10/032

figure
01

1 INTRODUCTION

1.1 BACKGROUND

This Revised Development Plan (RDP) has been prepared on behalf of Otan Karratha Pty Ltd, whom have a contract to purchase Lot 517 Dampier Road, Karratha from the State, upon conversion of the land to freehold title and approval to subdivide the land for residential purposes. The subject land represents the second phase of the Nickol West development area bounded by Dampier Highway to the south, Broilga Meander and Kingfisher Way to the east, Rankin Road to the north and Madigan Creek to the west (refer to **Figure 1**).

A Development Plan (DP) for the combined Nickol West development area was initially approved in 2006. Whilst the eastern two-thirds of the area has been progressively developed over the past five years, the western third of the DP (the subject of this proposal) was delayed pending the resolution of Native Title issues and gazettal of an appropriate land use zoning across the site.

On the 2nd March 2011 confirmation was received that the Aboriginal Cultural Materials Committee had considered the matter and resolved that Area 21291 (a clam shell in proximity of the development area) was not a site and would not be listed on the Department of Indigenous Affairs Heritage Sites Register. Cogniscent of this likely outcome, on the 14th February 2011 the Shire of Roebourne resolved to adopt Scheme Amendment No.20 (which rezones the land from 'Rural' to 'Urban Development'), for final approval, paving the way for urban development of this residual landholding.





At the same time, Council resolved to advise future developers of the Nickol West landholding of its expectation for further detailed information to be submitted at the next stage of planning/development. The information requested is for a comprehensive Urban Water Management Plan for the site (inclusive of a detailed hydrological assessment of the adjacent creek line) and noise modelling of the impacts of Karratha Airport, for which a Special Control Area is identified in TPS 8 over the northern half of the property. These matters are discussed in further detail in the relevant sections below.

1.2 PURPOSE OF THE REPORT

Development Plans are forward-planning documents that resolve regional and/or localised issues concerning land use and infrastructure and are often prepared as a precursor to extensive subdivision and development.

Recognising the length of time since the Nickol West Development Plan's adoption and the significant change in the market that has occurred since the DP was designed in 2006, the primary motivation behind the Revised Development Plan is an attempt to improve land efficiency and accommodate a greater variety of housing product that better accommodates the burgeoning needs of the region's rapidly growing Resource Sector labour force, and the dwelling and population aspirations expressed in the Shire's "*Karratha - City of the North*" strategic document.

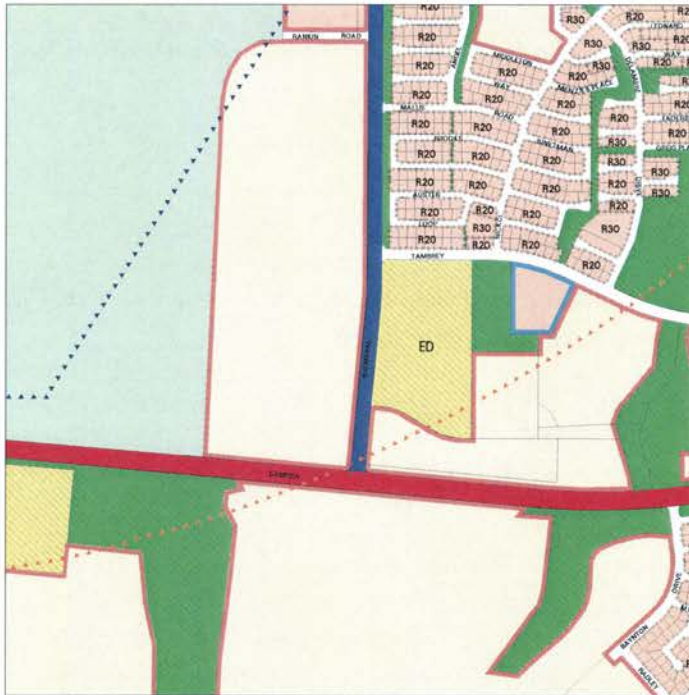
This RDP has been prepared in accordance with Section 6.4 of Council's Town Planning Scheme in order to facilitate urbanisation of the subject site, being its transition from rural to urban land use. Through the use of graphics and supporting technical data, the DP recommends the preferred:

-  pattern of land use;
-  network and hierarchy of roads;
-  public open space network; and
-  servicing strategy for the precinct.

PROPOSED SCHEME MAP

SHIRE OF ROEBOURNE TPS No:8 Amd No. 20

DAMPIER ROAD, KARRATHA



EXISTING ZONING



PROPOSED ZONING

LEGEND

LOCAL SCHEME RESERVES

- STATE AND REGIONAL ROADS
- DISTRICT ROADS
- PARKS, RECREATION AND DRAINAGE
- PUBLIC PURPOSES DENOTED AS FOLLOWS:
 - C CEMETERY
 - ED EDUCATION

ZONES

- RESIDENTIAL
- TRANSIENT WORKFORCE ACCOMMODATION
- URBAN DEVELOPMENT
- TOURISM
- RURAL
- RURAL RESIDENTIAL

OTHER

- R20 R CODES
- AIRPORT OBSTACLE HEIGHT LIMITATION AREA SCA
- AIRPORT NOISE RESTRICTION SCA

DWG: LCP NIC-7-03A DATE: 25.05.10






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Once endorsed, the RDP will become the new reference document for all future subdivision and development within the subject site. It has been prepared with due regard to the requirements of Council's Scheme and is supported by a range of technical reports including traffic, noise and hydrological analysis that can be found in the Appendices to the rear of the report.

As required by the Department of Planning, the RDP has also been prepared in accordance with the requirements of Liveable Neighbourhoods Edition 4, and has been structured in accordance with the Department's DRAFT Structure Plan Preparation Guidelines.

1.3 PROJECT TEAM

This Development Plan has been prepared by Taylor Burrell Barnett (TBB) in collaboration with:

 The Civil Group	Civil Engineering and Water Management
 Transcore	Traffic and Transport
 Wood & Grieve	Electrical Engineering & Communications
 Whelans	Surveying
 Aircraft Noise	Airport Master Planning Consultants

Formulation of the RDP has involved consultation between the project team in addition to the Shire of Roebourne, relevant Service Authorities and the Department of Planning as summarised in the Pre-Lodgement Consultation Table attached as **Appendix A**.

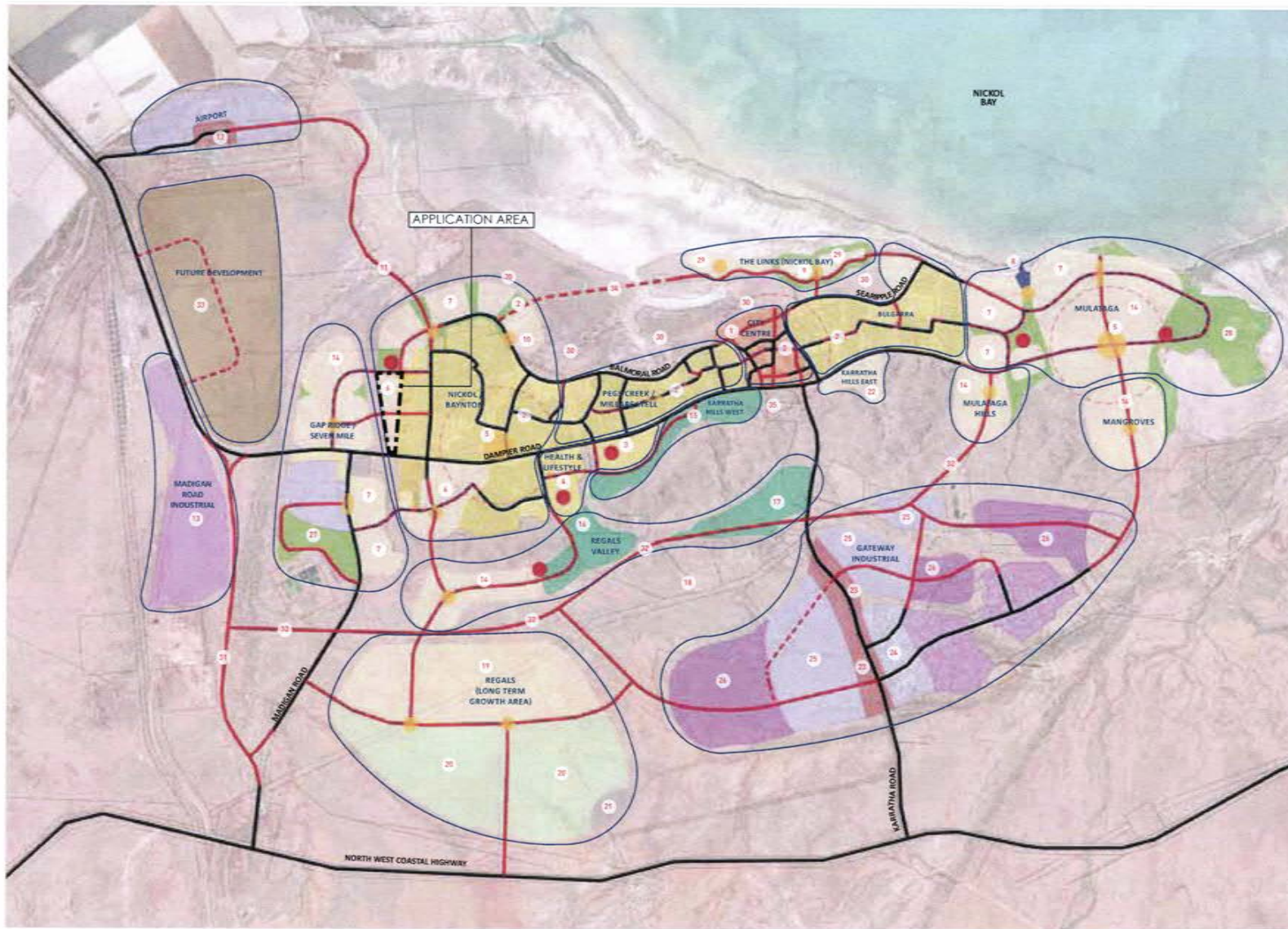
1.4 LAND DESCRIPTION

The land is described as Lot 517 on Deposited Plan 67183 (Volume: LR3159 / Folio: 293). Measuring 24.0852 ha in area, the land is currently unallocated Crown Land that is being converted to freehold now that Native Title Clearance has been achieved. A copy of the Certificate of Title is attached as **Appendix B**.

1.5 PLANNING FRAMEWORK

The land forms a significant part of City Precinct 4 (Gap Ridge/Seven Mile), as identified within the "*Karratha City of the North*" (2010) document, as a short term development prospect capable of delivery within the next 1-5 years. The document goes on to indicate that development is expected to consist of small lot development with pockets of medium density and Transient Workforce Accommodation (TWA). Projected dwelling figures for the total Precinct 4 area are listed in the document as being 1,287 new dwellings and 370 TWA's, servicing an estimated population increase of 3,314.

Currently zoned 'Rural' under the Shire of Roebourne Town Planning Scheme No. 8 (TPS 8), Scheme Amendment (No.20) proposes to rezone the land 'Urban Development' in order to facilitate subdivision and development of the land for residential purposes (refer to **Figure 2**). The Amendment is steadily progressing towards finalisation, with the Shire having resolved to adopt the Amendment for final approval at its meeting on the 14th February 2011. The proposal is now before Department of Planning awaiting a recommendation on Ministerial Approval.



1. Town Centre revitalised and expanded with new links to include link from Balmain Road to Seaplane Road.
2. Existing communities linked with bus and cycle routes. Traffic calming to limit traffic volumes and speed.
3. Leisure and Learning Centre to consolidate and integrate major new facilities.
4. Health and wellbeing centre campus.
5. New local retail and commercial centres to service daily needs and eastern and western neighbourhoods.
6. Expansion of existing neighbourhoods.
7. Proposed neighbourhoods to address immediate population demands.
8. Waterfront development with potential for swimming lagoon focus.
9. New country club and international hotel.
10. Expanded caravan park and resort.
11. New link to airport and Karraatha gateway feature and developments.
12. Airport hotels and commercial with surrounding logistic services area.
13. New heavy industrial area (in progress).
14. City growth neighbourhoods.
15. Hillside research and development facility, apartments and villa development integrated into landscape.
16. Education related playfields, health and education, staff accommodation, retirement development and short stay accommodation compatible with power station.
17. Tourism uses, adventure tour buses and short stay accommodation compatible with power station.
18. Power station.
19. Long term future residential neighbourhoods.
20. Rural living lots.
21. Potential cemetery use.
22. Hillside apartments and villa development integrated into landscape.
23. Urbanised industrial area lining gateway boulevard.
24. Industrial area converted to light industrial with workers camps and short stay accommodation.
25. Future light industrial area.
26. Future heavy industrial area.
27. New playfield potentially using treated waste water.
28. Future playfield area with potential for second public golf course and mangrove estuary enhancement.
29. Elevated course estate with reconfigured international quality golf course.
30. Ecological and landscape enhancement zone as foreground to view of Nickol Bay and Burnup.
31. Western bypass road.
32. New south of Karraatha Hills bypass.
33. Land for future non urban city uses.
34. Possible northern bypass link and causeway. Possible inclusion of a lock to create lagoon.
35. Nickol Bay layout and cultural centre incorporating water tanks and indigenous heritage trails.

- LEGEND**
- City Centre
 - Enhanced Existing Residential (Potential for increased density)
 - New Residential Neighbourhoods
 - New District Open Space
 - Institutional
 - Industry
 - Light Industry/Administration/Accommodation
 - Logistics / Short Stay Accommodation with Airport
 - Rural
 - New Important Connection
 - Activity Centre
 - High School
 - Bus Route
 - Future Investigation Area


Source: Karratha, City of the North (2011)

CITY GROWTH PLAN

Nickol West

A Pindan Pty Ltd Project

0km 0.5 1.5km
 s: NTS@A4
 d: June 2011
 j: 10/032







Clause 6.4.1 of TPS 8 stipulates that, in considering a planning application with the 'Urban Development' zone, the Council may require the preparation of a Development Plan addressing the matters listed in Clause 6.4.2 of the Scheme. Following a period of public review, in 2006 the Shire of Roebourne approved, and the Western Australian Planning Commission endorsed, the Balmoral Road Nickol West Development Plan on the basis that the document satisfactorily addressed that criteria.

Applications to modify the Development Plan (other than minor variations deemed not to prejudice progressive subdivision of the area), are required to demonstrate similar compliance with the requirements of TPS 8. The purpose of this document is to fulfil that requirement.

1.6 CONTEXT ANALYSIS

1.6.1 DISTRICT CONTEXT








"Karratha, City of the North" sets the strategic planning context of the Nickol West Development Plan and surrounding area (refer to **Figure 3 – City Growth Plan**). Significant elements of that document include:

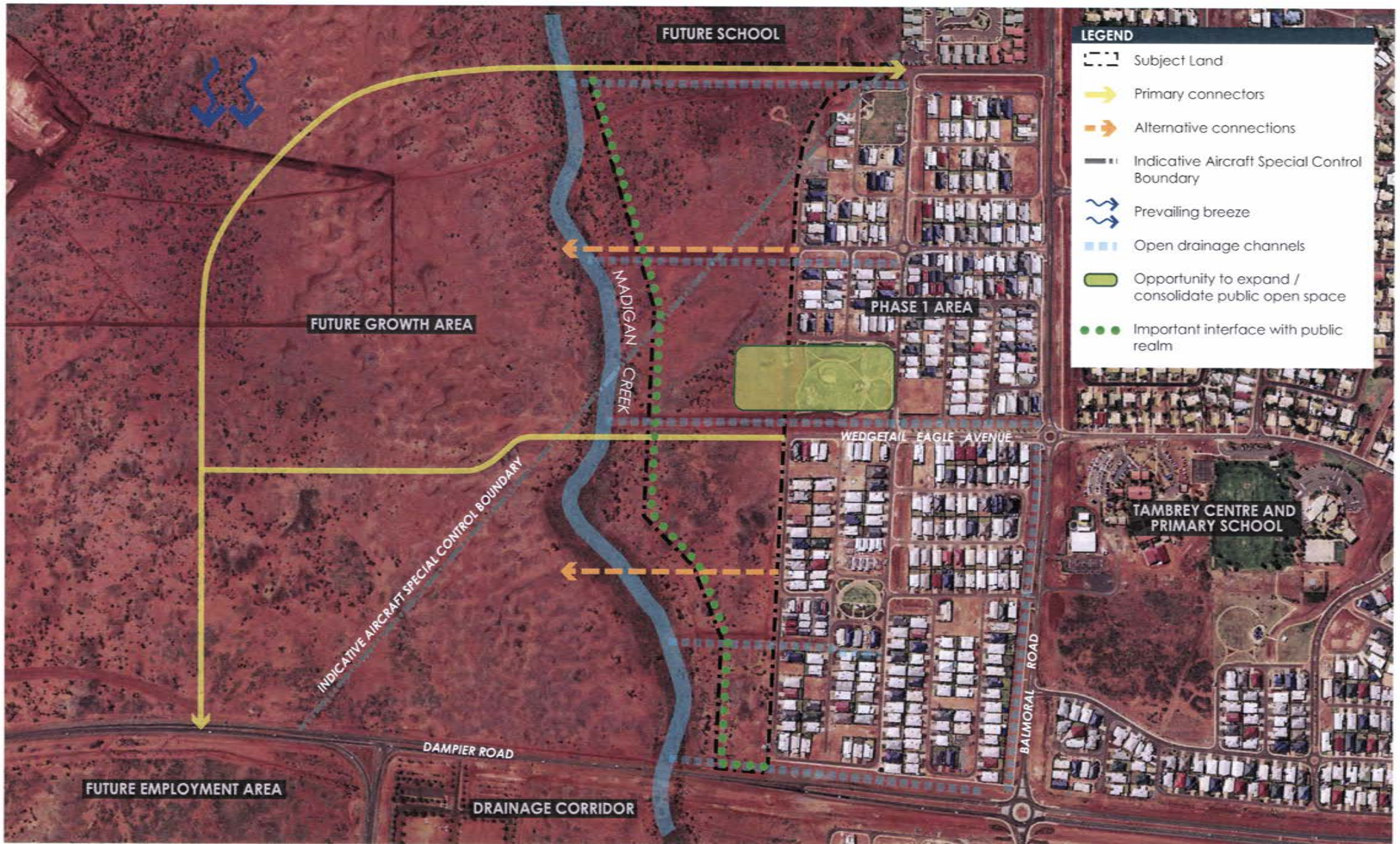
-  The identification of large Townsite expansion areas to the north, west and south of the site;
-  A stated intent to consolidate commercial activity within a revitalised Town Centre;
-  The Tambrey Centre, Bathgate Road Mixed Use Centre and immediate area accommodating local convenience retail and educational requirements; and
-  Establishment of a future employment area, southwest of the site on the opposite side of Dampier Road;

1.6.2 ISSUES AND OPPORTUNITIES

The site analysis issues and opportunities are shown diagrammatically on **Figure 4**.

Key elements of the site that need to be taken into account when planning for Lot 517 include:

-  Pilbara climatic conditions and how this influences drainage as well as car use and the use and maintenance of public open space (POS);
-  The comprehensive road and drainage network established in Phase 1 of the Nickol West area, including provision for connections west across Madigan Creek;
-  Opportunities to improve land efficiency and housing diversity to accommodate the burgeoning need for residential accommodation created by the resource boom;
-  Recognition of the reduced POS standard adopted in the existing DP, and Council's desire to further consolidate future POS with the large reserve established in Phase 1;
-  The need to establish an appropriate built form and public domain interface with Madigan Creek;
-  The high level of local boat and car ownership necessitating the requirement for a reasonable proportion of large lots with wide frontages; and the
-  Influence of noise on development, from aircraft using Karratha Airport and haulage along Dampier Road.



ISSUES AND OPPORTUNITIES

Nickol West
A Pindan Pty Ltd Project

N
0m 40 80 120m
s: 1:8000@A4
d: June 2011
j: 10/032



2 SITE CONDITIONS & ENVIRONMENT

2.1 ENVIRONMENTAL ASSETS & CONSTRAINTS

The land the subject of the RDP is vacant with only limited degraded remnant vegetation that, similar to Phase 1, will largely be removed as part of the subdivision works.

2.2 LANDFORM & SOILS

Existing ground conditions are typically a layer of rocky-gravelly-clayey material overlaying rock at depth of approximately 1m to 2m below ground surface level with the depth generally decreasing closer to Dampier Road. Pockets of Gilgai clay material are expected to be encountered during site preparation, and will need to be removed and replaced with engineered fill in order for the land to be made suitable for development.

Future lots will be need to be earthworked to provide finished surface levels that suit servicing requirements and major storm event flood routing. Earthworks will consist of onsite cut-to-fill of suitable material and the importation of fill as necessary to achieve the required finished levels. It is important to note that the western edge of the land, and in particular the northwest corner, will need to be lifted significantly to accommodate gravity sewer requirements discussed further in **Section 3.8.3** below.

2.3 GROUNDWATER & SURFACE WATER

The site is relatively flat with overland drainage flowing from east to west via drainage channels established to accommodate the Phase 1 development.

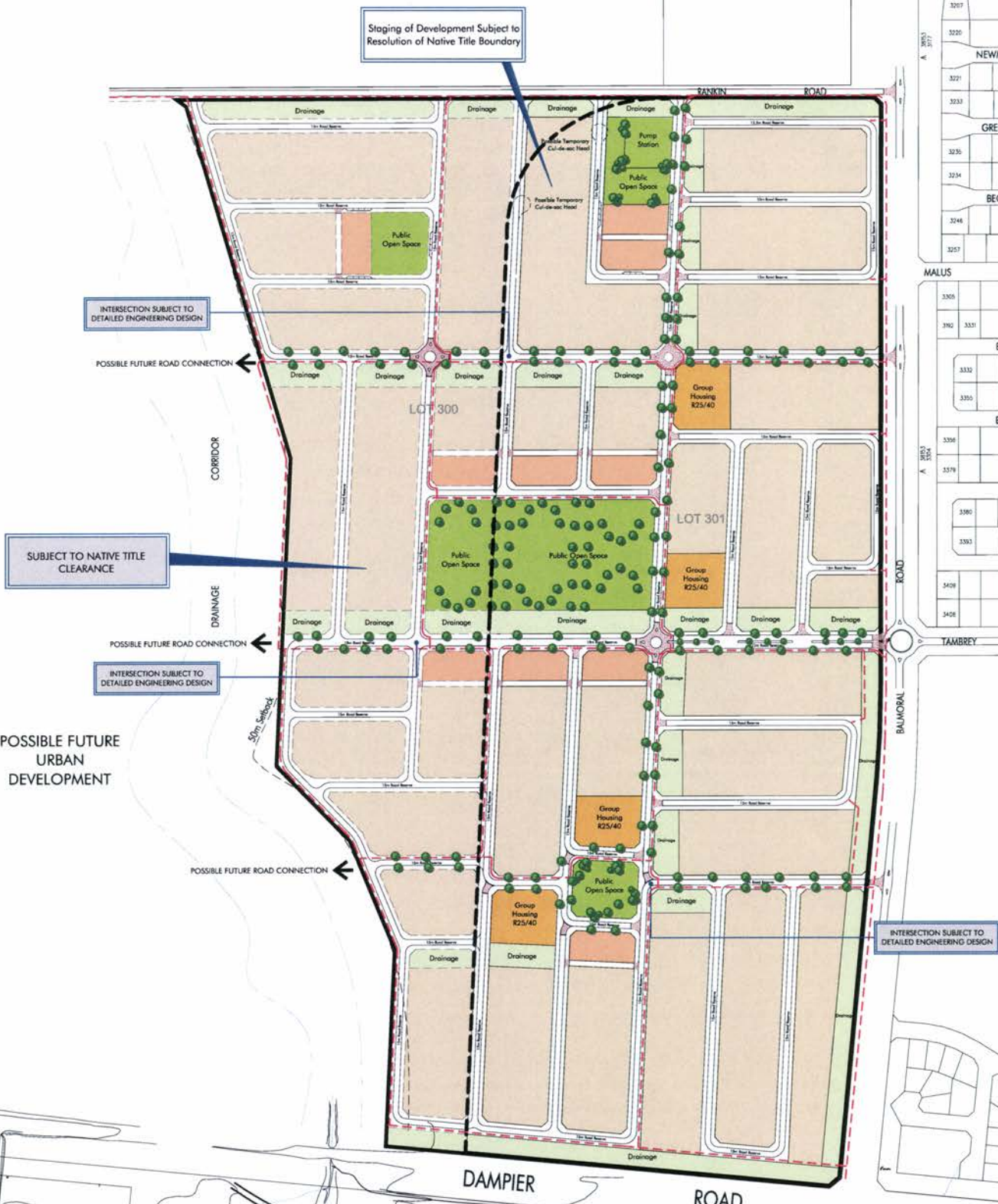
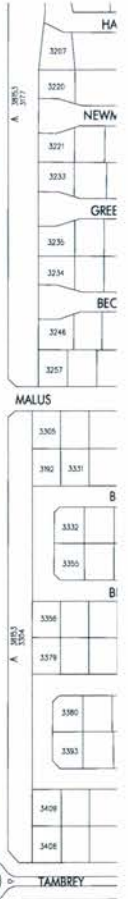
There are two studies currently underway that have relevance to development of this land. The Madigan Creek Flood Study establishes the 100 year flood level adjacent to the site and forms part of the Local Water Management Strategy prepared for the Madigan Creek Development Plan currently being considered by the Shire. Submitted to the Department of Water in February 2011, its finalisation is understood to be held up pending resolution of the Karratha Coastal Vulnerability Study which in part, examines the backwater effects of storm surges on the flood levels of Madigan Creek.

Notwithstanding the unfinished status of these documents, the levels described in **Section 3.8.3** to facilitate gravity sewer to this development requires lot levels at the northern end of the site to be raised far above predicted flood levels having regard for both studies.

2.4 NOISE

2.4.1 AIRCRAFT NOISE

TPS 8 identifies an 'Airport Noise Restriction' Special Control Area (SCA) encompassing the northern half of the property, requiring Council when considering planning applications to ensure it is satisfied that *"aircraft noise will not unduly impact on the proposed use or the development is specifically constructed to attenuate the impact of aircraft noise in accordance with Australian Standard AS2021"*.



LEGEND

	SUBJECT LAND (69ha)		PUBLIC OPEN SPACE
	BURRUP MAITLAND NATIVE TITLE AGREEMENT BOUNDARY (23ha)		DRAINAGE
	R17.5		DUAL USE/SHARED PATHS
	R30		
	R25/40		


Source: Burgess Design Group (Aug 2006)

EXISTING DEVELOPMENT PLAN
 Nickol West
 A Pindan Pty Ltd Project

NTS@A4
 d: June 2011
 j: 10/032

figure **05**

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Airport Master Planning Consultants was commissioned by OTAN KARRATHA in cooperation with the Shire of Roebourne (as owners and managers of the facility) to determine Australian Noise Exposure Concept (ANEC) contours around Karratha Airport. Subsequent to this work the Shire commissioned preparation of the Karratha Airport Master Plan and Land Use Plan 2013-2033 which now identifies Australian Noise Exposure Forecast (ANEF) contours on which land use planning decisions can be based.

Located some 2.5km south-southeast of the airport at its closest point the RDP is well outside the area of concern, and thus any restriction on land use, or the imposition of Memorials on Title requiring development to incorporate the 'quiet house' principles set out in *AS2021 (Acoustics – Aircraft Noise Intrusion – Building Siting & Construction)* is unnecessary.

A copy of the initial report including relevant assumptions and extent of the resultant ANEC contours, plus relevant extracts of the Karratha Airport Master Plan and Land Use Plan 2013-2033 are attached as **Appendix C**.

2.4.2 MOTOR VEHICLE NOISE

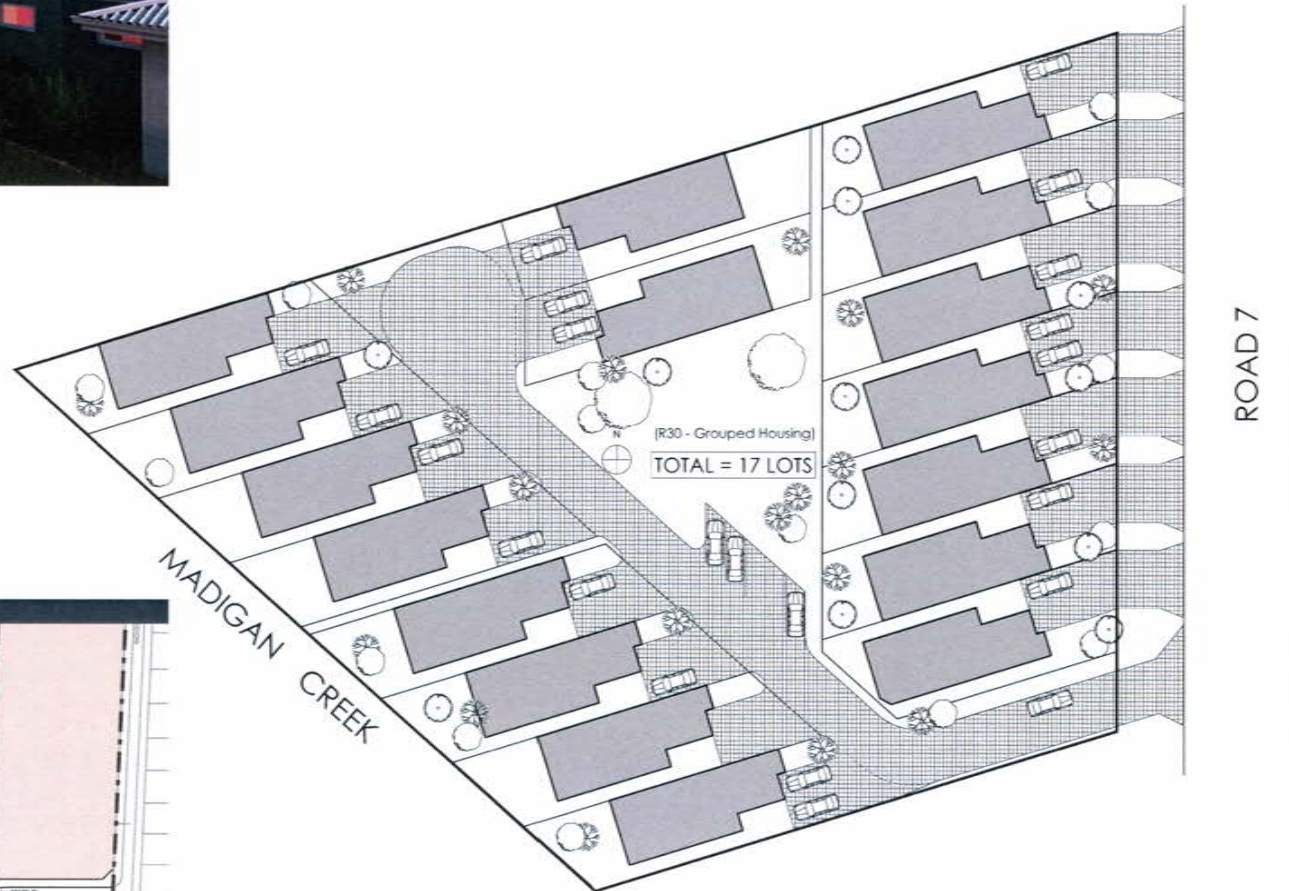
Given the width of Lot 517 adjacent to Dampier Road is only 85m, practical options for containing traffic noise in this area of the plan are severely limited. Consistent with the practice established for development located further west along Dampier Road, again OTAN KARRATHA have advised of a willingness to accept imposition of a condition of subdivision approval requiring Section 70 Memorials on Title requiring housing within 80m of the road to be in accordance with *AS3671 (Acoustics – Road Traffic Noise Intrusion – Building Siting & Construction)*. In practice, due to the width of the drainage reserve and internal subdivisional road adjacent to Dampier Road through this area, memorials will only be required for the first row of lots looking southward across the reserves towards Dampier Road.

2.5 HERITAGE

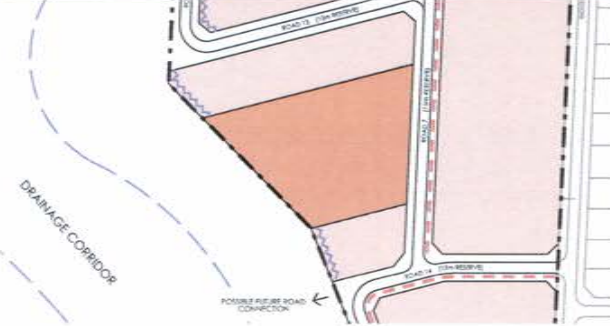
A heritage study has been completed, inclusive of an ethnographic survey that has revealed that there are no heritage or cultural features of significance on the land.

This outcome was confirmed by the Aboriginal Cultural Materials Committee, whom at a meeting on the 2nd March 2011 decided that area 21291 (a Clam Shell suspected of having indigenous heritage significance), was not a site of significance that will be registered for preservation by the Department of Indigenous Affairs.

FOR ILLUSTRATIVE PURPOSES ONLY



LOCATION PLAN



Source: Pindan [2011]

R30 GROUPED HOUSING CONCEPT

Nickol West
A Pindan Pty Ltd Project

s: NTS@A4
d: June 2011
j: 10/032

figure
07

3 DEVELOPMENT PLAN



A copy of the existing, approved Development Plan (DP) appears as **Figure 5** whilst a copy of the Revised Development Plan as it relates to Lot 517 is included as **Figure 6**.

3.1 LAND USE

Consistent with the existing DP, land use in the RDP across Lot 517 is limited to a mix of low to medium density 'Residential' development, interspaced with POS, road and drainage reservations.

3.2 RESIDENTIAL

Reflective of the change in market attitudes and the escalating need for residential accommodation however, the RDP proposes two important changes to Residential Densities, being:

-  To lift the base residential coding across approximately two thirds of the site, from 'R17.5' to 'R20'; and
-  To increase the amount of land identified for medium density accommodation in the form of 'R30' single lot and grouped housing product and a special 'R60'-coded multiple or grouped dwelling site in a high amenity location between Madigan Creek and an enlarged and enhanced central POS facility.






3.2.1 'R17.5' & 'R20' DENSITY CODES – LOW DENSITY SINGLE RESIDENTIAL

The result of increasing the base density from 'R17.5' to 'R20' is that the RDP will accommodate around 190 single residential lots varying between 440m² and 800m² in area. Maintenance of the 60 – 70m street block depths established in the existing DP allows for lot depths of between 30 – 40m, whilst frontages will vary between 14 – 20m, allowing for the creation of a wide variety of lot sizes, including many that can accommodate the inclusion of a swimming pool and/or additional storage for boats and larger sized vehicles.

3.2.2 'R30' DENSITY CODE – MEDIUM DENSITY DEVELOPMENT

Six sites ranging from 2,900m² to 6,500m² in area are coded 'R30' in the RDP. Collectively they have the potential to accommodate between 60-80 dwellings based on the 300m² average lot area requirement of the 'R30' code.

All of the sites are positioned in areas of high amenity, with three positioned directly opposite the central POS reserve and three adjacent to Madigan Creek. An example of how the site's might be laid out should they be developed as grouped housing is included as **Figure 7**. Notable design considerations include:

-  Dwellings being designed to address and overlook all surrounding streets and POS in order to maximize surveillance and achieve an attractive streetscape
-  Use of quality external materials for all structures, including carports that match the main dwelling;
-  The majority of private car parking areas being provided behind the front building line;
-  Boundary treatments adjacent to Madigan Creek allowing for a level of casual surveillance between the development and adjoining reserve; and
-  Use of quality landscaping, particularly within common property areas.

FOR ILLUSTRATIVE PURPOSES ONLY



LOCATION PLAN



Source: Pindan (2011)

R60 MULTIPLE HOUSING CONCEPT

Nickol West
A Pindan Pty Ltd Project

s: NTS@A4
d: June 2011
j: 10/032

figure
08

3.2.3 'R60' DENSITY CODE – MEDIUM DENSITY DEVELOPMENT

A further 'R60'-coded site, measuring 9,280m² in area, is located in the prime position in the middle of the estate. The site extends between, and enjoys expansive views over, the western end of the central POS reserve, Madigan Creek and beyond. Based simply on a 0.6 plot ratio for Multiple Dwellings, or the 180m² average lot area requirement of the 'R60' code for Grouped Dwellings, the site has the potential for around 50 dwellings to be developed on this site involving terrace or semi-detached dwellings up to two storeys in height.

A preliminary Multiple Dwelling concept for the 'R60' site, embracing the same design principles outlined for the 'R30' development, is included as **Figure 8**.

Increasing the amount of land available for medium density residential development will assist in diversifying housing choice and improving housing affordability in a manner that is compatible with the existing residential amenity of the area. It will also facilitate a more sustainable approach to land development and infrastructure provision and will aid in supporting planned and existing businesses and community facilities within the Karratha Townsite.

3.2.4 DETAILED AREA PLANS

In recognition of the importance of establishing an appropriate interface with Madigan Creek, Detailed Area Plans are to be prepared prior to development of single lots that either abut, or have a secondary road frontage directly opposite the Creek's reserve. This requirement will be imposed as a condition of subdivision approval, with the relevant detail to be determined in consultation with the Shire through the clearance process.

3.3 MOVEMENT NETWORK

Transcore was engaged to prepare a Traffic Assessment Report of the RDP proposed modified movement network. A summary of the report is provided below. A full copy of the report can be found at **Appendix D**.

3.3.1 PERMEABILITY & ACCESSIBILITY

The RDP essentially replicates the Approved DP although minor changes to the road network, an increase in dwelling yield and greater housing variety are all features of the new plan that warrant evaluation in comparison to the approved DP.

Overall the road layout maintains a high level of interconnectivity with the surrounding area, with relatively short and straight street blocks being arranged in a manner that achieves a high degree of legibility, permeability and walkability in accordance with the principles of Liveable Neighbourhoods (LN).

The skeleton of the internal road system, inclusive of major east-west links from within the Phase 1 area, and the accommodation of four possible future connections across Madigan Creek are all retained in the RDP.

3.3.2 TRAFFIC VOLUMES, ROAD CROSS SECTIONS & RESERVE WIDTHS

Based on a region-specific trip rate of 8.5 trips per dwelling and the dwelling numbers discussed in **Section 3.2**, Transcore estimate an increase of approximately **700** daily vehicular trips (from **2,000** to **2,700**) for a typical weekday as a result of the changes proposed in the RDP. The total daily vehicular traffic includes both inbound and outbound trips.

LEGEND

PROPOSED ROAD HIERARCHY

- Neighbourhood Connector B
- Access Street B
- - - Access Street B Reserve
- Access Street D




Source: Transcore Traffic Assessment Report (May 2011)

MOVEMENT NETWORK
 Nickol West
 A Pindan Pty Ltd Project

s: 1:5000@A4
 d: 25 June 2013
 j: 10/032






figure
09

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The distribution and assignment of the subdivision-generated traffic was then modelled based on the actual location of the development, the existing road network and the location of various attraction nodes distributed across the wider Karratha region. Analysis of the traffic model demonstrates that traffic patterns and volumes generated by the RDP are similar to those of the existing DP. Whilst minor traffic volume fluctuations in comparative road links do occur as a result of the road network changes (refer **Figures 2 & 3 of Appendix D**), Transcore advise that they are not significant.

The projected traffic volumes were then used to determine a road hierarchy and typical road reservations using LN standards. Illustrated in **Figure 9**, key elements of the hierarchy are described below:

-  Rankin Road will in time form an important westward connector road carrying volumes in excess of 3,000 vpd. LN classifies this road as 'Neighbourhood Connector B' requiring a 19.4m wide reserve comprising of a 7m carriageway and 6.2m verges that can accommodate 2.1m wide parking lanes on both sides of the road. The RDP proposes extension of the 20m wide reserve and the 7.4m wide carriageway established within the Phase 1 area which accommodates the passing of two cars whilst a vehicle is parked on one side of the road.
-  Earmarked as a secondary connection through to future development west of Madigan Creek, the westward extension of Wedgetail Eagle Road is the only other road expected to carry volumes in excess of 1,000 vpd. LN classifies this road as 'Access Street B' requiring a 17.9m wide reserve comprising of a 5.5m carriageway and 6.2m wide verges that can again accommodate 2.1m wide parking lanes on both sides of the road. East of the roundabout the RDP proposes extension of the existing 7.4m carriageway within an 18m wide reserve. The pavement width west of the roundabout will be reduced to 7m, however an 18m road reserve width will be maintained to allow for the carriageway's potential widening as a future point in time.
-  LN classifies the balance of the road network as 'Access Street D' requiring 14.2m reserve widths encompassing a 6m wide carriageway and 4.1m verges. The RDP proposes construction of 6m carriageways within a slightly wider 15m reservation, with the 4.5m verges allowing greater flexibility in the accommodation of services and landscaping, facilitating seamless integration with the Phase 1 area.
-  Adjacent to public reserves such as Madigan Creek and the central POS reservation, LN allows verge widths be reduced to 1m as a result of there being no need to accommodate service alignments for the development of adjacent land. The RDP proposes 13m reserve widths adjacent to Madigan Creek including a 2.5m verge on the creek side, a more generous width that can accommodate street trees and visitor parking embayments without the infrastructure extending outside the reserve.
-  A 14m reserve width is proposed along the western boundary of the POS, including a 3.5m verge on the POS side. In this instance the additional metre will allow for the location of lighting within the road reserve on the POS side. 15m reserve widths are maintained on the northern and southern boundaries of the park consistent with the reserves established within the Phase 1 area.

Ultimately, subdivisional roads will be designed in accordance with the requirements of the Shire, with specialist geotechnical investigations being undertaken to establish requirements for pavement design to ensure that the pavement construction suits the existing clayey sub-grade.

3.3.3 TRAFFIC MANAGEMENT

As per the existing DP, the majority of internal subdivision intersections are proposed as priority-controlled T-intersections, with only two four-way intersections requiring the use of roundabouts. Again, those locations have not changed being where the two central east-west through connections (*Ridge Crescent & Wedgetail Eagle Avenue*) intersect with the primary north-south aligned internal road (*Butcherbird Drive*).

Predicted hourly traffic volumes through the various intersections are well below indicative AUSTRROADS thresholds, meaning sufficient capacity would be available and further detailed assessment or capacity analysis of any intersection is not warranted. This confirms that the internal road network layout ensures satisfactory permeability and efficient traffic distribution throughout the subdivision with no bottlenecks or traffic congestion.

3.3.4 PEDESTRIAN & CYCLIST NETWORK

The RDP proposes to complete the dual use path (DUP) network established within Phase 1 of the DP area, with routes identified alongside key east-west and north-south aligned roads connecting back to the, the central POS reservation, Dampier and Balmoral Roads and the broader Karratha Townsite path network beyond.

The network facilitates safe and efficient pedestrian and cyclist movement throughout the development in line with the recommendations of the Karratha Master Plan document (*Karratha Revitalisation Project, 2010*).

3.4 PUBLIC OPEN SPACE

Under the existing DP, a reduced provision of 5.8% POS has been approved across the total Nickol West DP area. Within Lot 517, 1.2208ha of land (approximately 5.1% of the total landholding) is identified as being required across two reserves:

- 📍 An 8,250m² expansion of the central POS reserve located central to the total DP area; and
- 📍 A 3,958m² stand alone site located in the northern portion of Lot 517.

The RDP maintains this obligation in terms of total land area. At the Shire's request however, the small northern reserve has been removed and Lot 517's total POS requirement is consolidated within the central reservation.

Taking advantage of the additional land area available to that reserve, its western end has been reshaped in the RDP to create a curved feature that accommodates long views towards the POS from both the north and the south along Butcherbird Drive. Shire Officers have advised of a desire for a public art feature to be accommodated within the reserve. Located central to the reserve's extension at the termination of these vistas the public art has the potential to act as a beacon that attracts residents towards and entices them to use this important community asset.

The increased size and configuration of the central reserve can accommodate a senior sized rectangle playing field. Landscape designs for the reserve and ancillary works required to accommodate this function will be negotiated with the Shire at the subdivisional stage of development.

Despite removal of the northern reserve, future residents will have ready access to open space, particularly once the substantial drainage areas that create a sense of openness throughout the estate and Madigan Creek itself are taken into consideration.



3.5 URBAN WATER MANAGEMENT

Notwithstanding the requirements of the WAPC's Better Urban Water Management (2008) document, the Department of Water has advised that a Local Water Management Strategy is not required for the Revised DP however an Urban Water Management Plan (UWMP) will be required as a condition of subdivision approval. The UWMP will need to complete the comprehensive drainage system established for Phase 1 of the Nickol West area, taking into account the outcomes of both the Karratha Coastal Vulnerability Study and Madigan Creek Flood Study.

3.6 EDUCATION FACILITIES

Consistent with the outcomes of the 2006 Development Plan process, no educational facilities are proposed within Lot 517. Instead future resident's educational needs will be accommodated within the existing Tambrey Primary School located immediately to the east of the Phase 1 area.

Karratha Senior High School and St. Lukes College represent the government and private secondary education facilities servicing the entire Town. In time, the "*Karratha, City of the North*" document envisages the creation of a further high school immediately to the north of the RDP area.

When assessing the original DP, the Department of Education and Training advised that existing facilities have sufficient capacity to accommodate the likely need generated by the total Nickol West Development Area.

3.7 ACTIVITY CENTRES

No commercial facilities are proposed in the Revised DP area, as they would be unsustainable. Instead, future development will support and reinforce the existing activity centre network, being the Tambrey Centre's local tavern and recreational facilities, the neighbourhood mixed business development on Bathgate Road and district level facilities provided in the Karratha Town Centre.





In time, the employment centre to the southwest of the site will also be an important attractor, hence the importance of accommodating future connections with development on the western side of Madigan Creek which will include the next access point onto Dampier Road.

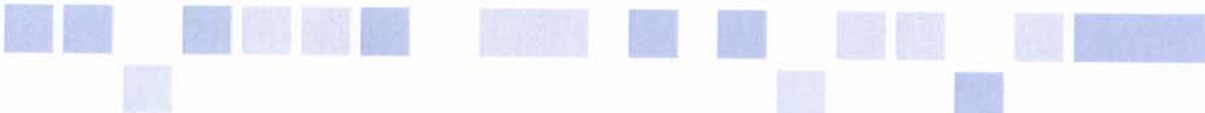
3.8 INFRASTRUCTURE COORDINATION, SERVICING & STAGING

The Civil Group was engaged to prepare a Servicing Report for the RDP. A summary of the report is provided below with a plan showing the location of existing services and proposed connection points included at **Figure 10**. A full copy of the report can be found at **Appendix E**.

3.8.1 EARTHWORKS

Development earthworks levels are driven by balancing the major design requirements of:

-  Lot elevations and road levels being sufficient to allow for major storm event flood routing;
-  Lot levels being sufficient to allow for gravity sewer connection;
-  Quantity of imported fill material being minimised; and the
-  Depth of service excavations in rock being minimised.



Current indications are that the minimum lot development levels for Karratha required to accommodate coastal storm surges including the effect of global warming, will be in the order of 7.7m AHD. A minimum level of 10.5m – 10.6m AHD is required to suit gravity sewer connections (well above the predicted storm surge), meaning that this is the critical design element that will determine minimum fill levels within the RDP area.

The clay content of the typical soils in Karratha exhibit varying degrees of shrink/swell characteristics that must be catered for within the structural detailing of all building footing and structural elements. It is anticipated that Lot Classifications in accordance with *AS2870 (Residential Slabs and Footings – Construction)* will typically be M-D or S across the site. A geotechnical investigation has been commissioned to evaluate the site before subdivision works commence, and will target actions to accommodate site classification improvements (where possible). Upon completion of the civil works the targeted achievements suggested by the geotechnical investigation will then be checked.

3.8.2 SEWER

The RDP falls into the gravity sewer catchment of the Karratha Wastewater Pumping Station (WWPS) No.6 located within the Phase 1 development area on Falcon Parade. This WWPS currently discharges wastewater via a pressure main to the Karratha Wastewater Treatment Plant (WWTP) No.2 located west of Madigan Road and requires a minimum lot level of 10.5m – 10.6m AHD to allow the gravity sewer scheme and sewer pump station emergency overflow arrangements to function correctly.

The Water Corporation has advised that it is to upgrade various main sewers and facilities in Karratha to increase the capacity of its waste collection and disposal systems to suit the demand for residential and industrial developments. The requirement for the upgrade of the town's wastewater treatment plants will depend on the timing of sewer flows from many developments across Karratha, including the RDP land.

The latest planning concept prepared for Karratha suggests that WWTP No.2 will be taken out of service after WWTP No.1 (located south east of the Karratha Townsite) undergoes a major upgrade. When this occurs, wastewater flows from this area are planned to be re-directed to the upgraded WWTP No.1. These major, wastewater capital works form part of a multi-million dollar upgrade of the town's sewerage system and will be completed by the Water Corporation to suit development demand. Importantly, none of the works are a prerequisite to development of the RDP land.

3.8.3 WATER

The RDP is located within the Karratha gravity water supply scheme which sources bulk potable water from the Water Corporation's West Pilbara Water Supply Scheme. The West Pilbara Water Supply Scheme relies on surface water collection via Harding Dam and groundwater extraction from the Millstream aquifer. Both these sources of water are constrained with the Harding Dam relying on rainfall associated with tropical cyclones to refill (which by nature is spasmodic in occurrence), and the Millstream aquifer having pumping limits in order to preserve the environmental integrity of its location.

The townsite water scheme will be augmented in the short-term by construction of a desalination plant on the Burrup Peninsula, which is scheduled to be brought on-stream in early 2013. The timing of the desalination plant is not expected to pose a constraint to the release of lots within the RDP area.

Water reticulation connections for the RDP will be provided via extension and connection to existing mains located in Wedgetail Eagle Avenue, Kingfisher Way, Woodswallow Bend and Brolga Meander (refer **Figure 10**).

3.8.4 DRAINAGE

Karratha is located in a region subject to intense rainfall associated with tropical cyclones. This, together with the high soil clay content, results in extreme flow rates generated by stormwater runoff during rainfall.

To accommodate high stormwater flow rates individual lot levels are typically graded to direct stormwater towards adjacent roadways, which in turn convey runoff by open gutter flow to appropriately positioned open drains and creek lines. Piped drainage systems are not used (except for culvert road crossings within the drainage reserves), as they would have insufficient capacity to convey required flow rates.

The RDP includes the extension and/or realignment of five (5) east-west falling open drains through the site, that provide an outfall for the Phase 1 Nickol West Development Area together with discharge points for the RDP land.

As discussed in **Section 3.5** above, the requirement to prepare a UWMP is anticipated as a condition of subdivision approval. Preliminary discussions with the Department of Water (DoW – Peter Kata, 23/02/2011) has resulted in the scope of work to be included in the UWMP being refined to include copies of the various engineering stormwater and earthworks drawings, along with an accompanying report that demonstrates that:

- ☒ all lots are filled above the road level;
- ☒ no gutters are to be provided on houses;
- ☒ all roof runoff is directed to the roads;
- ☒ all roads convey all runoff to the major open drains through the area; and
- ☒ open drains discharge the runoff into the various water courses.

These requirements for stormwater management are typical of developments in Karratha and across the north-west of WA.

3.8.5 ELECTRICITY

The existing Karratha Townsite power high voltage supply scheme is an 11kV network of underground and overhead cables fed from zone substations located on Millstream Road in Bulgarra and Dampier Highway in Millars Well.

Phase 1 of the Nickol West Development Area is fed via two distribution feeders – the Koolinda Feeder (from the north) and the Millstream West Feeder (from the south-east). Horizon Power have advised that the feeder cables have sufficient capacity to service the RDP land, notwithstanding their upgraded design standard requiring a power supply allowance of 10kVA to be provided per standard residential lot in all future power supply schemes. The previous design allowance of 6kVA per lot was found to be too low to match the load generated by frequent refrigerated air-conditioning use.

Horizon Power has recently obtained funding for the upgrade of the town power supply scheme to 22kV as part of the Pilbara Underground Power Project (PUPP) and this work is now underway. The current programme sees the Nickol and existing Nickol West Development Area being converted to 22kV within about 12 months, although current works have moved slowly and it is likely that the projected timeframe will be exceeded.

3.8.6 GAS

Gas reticulation will not be provided due to the absence of a Townsite reticulated gas supply network.



3.8.7 TELECOMMUNICATIONS

The provision of telecommunications to the site will be achieved by connection to the proposed new systems to be installed by NBN Co. Development to the east of the site is currently provided with ADSL broadband supply.

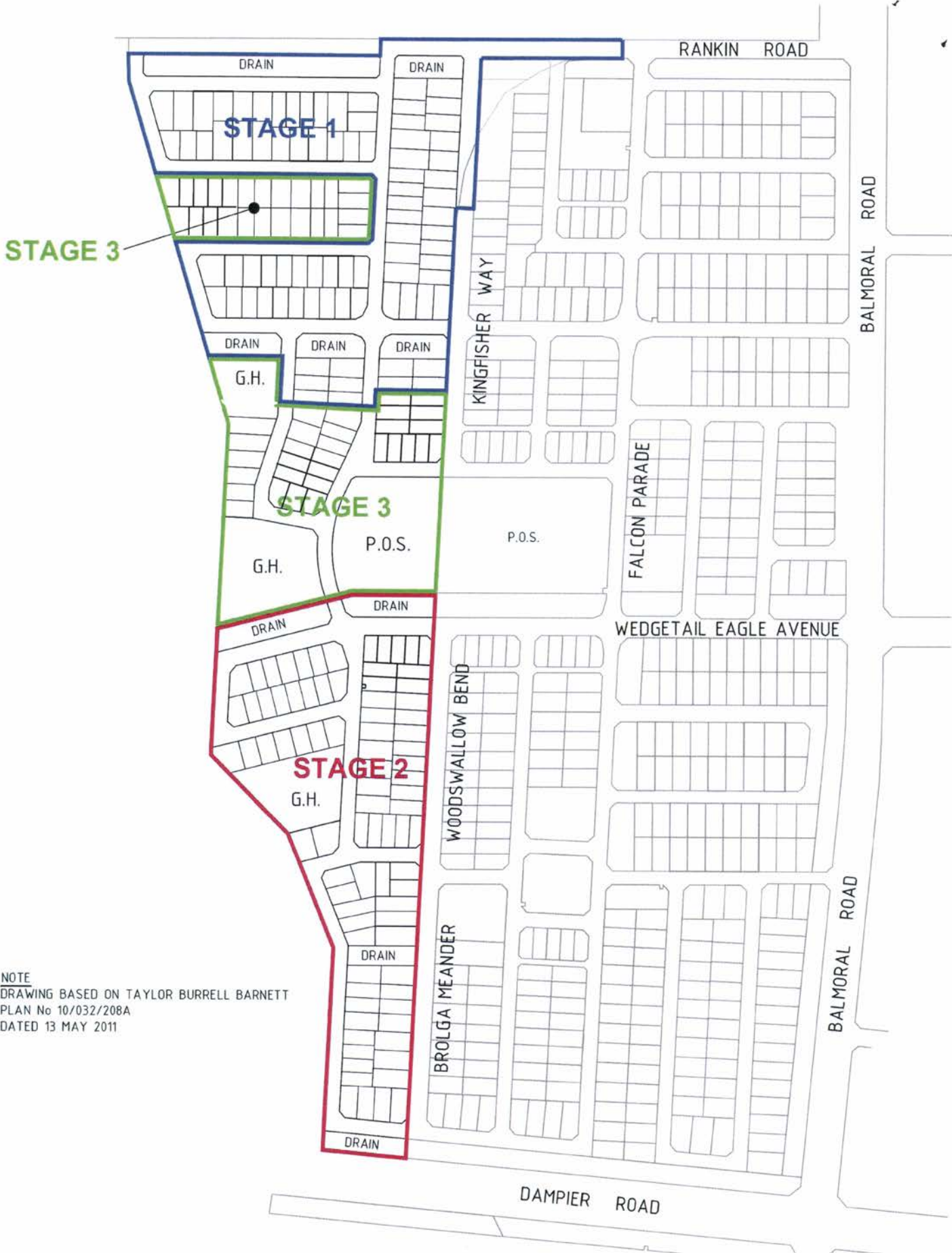
3.8.8 TIMEFRAMES & STAGING

Based on the location and availability of existing services, development will commence in the north of the site and proceed south towards Dampier Road. OTAN KARRATHA envisage that development of Lot 517 will proceed in three roughly equal stages.

Stage 1 encompasses all of the 'R17.5' coded land within the northern third of the site, and forms the subject of a subdivision application based on the road network and densities that appear on the existing approved DP. Application reference #144065 is currently before the Western Australian Planning Commission for determination, with OTAN KARRATHA keen to obtain approval and complete major subdivisional works prior to the next wet season at year's end.

Stage 2, encompassing the southern third of the site is expected to commence in March/April 2012, with the Stage 3 area (encompassing the 'R60' and four of the 'R30' coded grouped dwelling sites), to roll on immediately after the completion of Stage 2 in June/July 2012.

Service authorities have been advised of the above programme and have responded by advising that they are confident that service capacity will be available as and when required to service the development. A copy of the Indicative Staging Plan is illustrated in **Figure 11**.



NOTE
 DRAWING BASED ON TAYLOR BURRELL BARNETT
 PLAN No 10/032/208A
 DATED 13 MAY 2011

INDICATIVE STAGING PLAN
 Nickol West
 A Pindan Pty Ltd Project

TAYLOR BURRELL BARNETT

s: NTS@A4
 d: 25 June 2013
 p: 10/032/021

figure 11

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4 STATUTORY PLANNING IMPLEMENTATION

4.1 CONCLUSION

The Revised Development Plan (as it relates to Lot 517) addresses the requirements specified in Council's Town Planning Scheme, has been designed in accordance with accepted urban design principles, and has clear regard for the identified issues and opportunities that affect the site. As a consequence the development of Lot 517 will result in a high quality coordinated residential development being created.

The RDP has been designed to integrate well with Phase 1 and urban development further to the east, in addition to future planning for the development of land west of Madigan Creek. Adoption of this Revised DP will ultimately provide for the development of approximately 300 new dwellings on 24ha of land recently cleared of Native Title, as an important westward extension of the Karratha Townsite.

4.2 NEXT STEPS

Rezoning of the land from 'Rural' to 'Urban Development' is expected to be approved by the Minister for Planning and gazetted in June 2011. Upon completion of this process there is no impediment to subdivision approval and development of the Stage 1 area, which will occur directly in accordance with the 2006 approved DP.

Application for subdivision approval of the balance RDP area will be lodged for WAPC approval following completion of the RDP advertising process and Council's consideration of any submissions received. The intent is to facilitate concurrent WAPC processing of the RDP and the Stage 2 & 3 subdivision application towards the end of 2011.



APPENDIX A
PRE-LODGEMENT CONSULTATION SCHEDULE

Pre-Lodgement Consultation

AGENCIES	Consultation (Yes/No)	Date of Consultation	Contact Person	Form of Consultation	Summary of Outcome
Shire of Roebourne	Yes	2nd March 2011	Leah Alexander	Meeting @ Shire Offices	PINDAN outlined their DP Revision and Subdivision Staging intentions. Council Officers requested preparation of noise and traffic studies to address the Aircraft Special Control Area and modifications to the approved road network.
		30th March 2011	David Pentz	Meeting @ Shire Offices	Council Officers gave 'in principal' support for increased residential densities, the amended road design and proposed interface with Madigan Creek. They also suggested a review of POS distribution across the site and advised of a preference for consolidation within the central POS reservation.
		18th April 2011	David Pentz	Telephone & Email	Confirmed 'in principal' officer support for consolidated POS Reservation and general structure of the Revised Development Plan.
		30th May 2011	Chris Sayer	Telephone & Email	Agreement reached for the Revised DP to mandate preparation of a DAP on the western interface, as a condition of subdivision approval.
		1st June 2011	Chris Sayer	Telephone & Email	Agreement reached over the use reduced verge and road reservation widths adjacent to the creek and POS reservations.
Department of Planning	Yes	3rd March 2011	Ken Dawson	Meeting @ DoP Headquarters	PINDAN outlined their DP Revision and Subdivision Staging Intentions. DoP confirmed its expectations of the documentation required.
Department of Water	Yes	23rd February 2011	Peter Kata	Telephone	Discussed requirement for LWMS and content of underlying UWMP.
		28th February 2011	Bill Till	Telephone	Discussed requirement for LWMS and content of underlying UWMP.
		1st April 2011	Peter Kata	Telephone	Confirmed no need for LWMS and content of UWMP.
Water Corporation	Yes	1st February 2011	John Todd	Meeting @ Water Corp (Leederville)	Initial consultation to discuss extent and size of development, issues relating to water supply, waste water disposal and expected delivery programme.
		2nd March 2011	Andrew Ducuss	Meeting @ Water Corp (Karratha)	Initial consultation with regional office to discuss the project, its timing and various construction aspects.
		29th March 2011	John Todd, Mark Busher	Meeting @ Water Corp (Leederville)	Discussed options relating to water supply, waste water disposal (including timing of Water Corp regional infrastructure) and provided information relating to lot yields and delivery programme.
		28th April 2011	John Todd	Meeting @ Water Corp (Leederville)	Discussed options relating to waste water disposal.
		various dates	John Todd	Telephone	Ongoing consultation regarding extent and timing of works.
Horizon Power	Yes	22nd March 2011	Marty Panting	Telephone	Consultation regarding power servicing & network capacity.
NBN Co	Yes	20th April 2011 + various other dates	Peter Gerring	Email & Telephone	Consultation regarding fibre optic servicing & pit & pipe design.



APPENDIX B
CERTIFICATE OF TITLE

WESTERN AUSTRALIA



REGISTER NUMBER 517/DP67183	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF CERTIFICATE OF CROWN LAND TITLE

VOLUME **LR3159** FOLIO **293**

UNDER THE TRANSFER OF LAND ACT 1893 AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED

The undermentioned land is Crown land in the name of the STATE of WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

R. Roberts

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 517 ON DEPOSITED PLAN 67183

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

- 1. L373320 TAKING ORDER. THE DESIGNATED PURPOSE OF SUBDIVISION AND SALE AS TO PORTION ONLY REGISTERED 13.7.2010.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP67183 [SHEET 1,2].
PREVIOUS TITLE: LR3147-166, LR3147-165, LR3147-164, LR3147-163, LR3147-162, LR3147-161.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA: SHIRE OF ROEBOURNE.
RESPONSIBLE AGENCY: DEPARTMENT OF REGIONAL DEVELOPMENT AND LANDS (SLSD).

NOTE 1: K841251 CORRESPONDENCE FILE 50849-2007-01RO

VER	AMENDMENT	AUTHORISED BY	DATE
2	DP REPLACED, AUDIT AMENDMENTS	G.R. CAMPBELL	28.4.2010

ALL DIMENSIONS FROM (A) TO (B) AND (C) TO (D)
IN A CLOCKWISE DIRECTION ARE ORIGINAL

LOT	FORMER PL/TENURE	ON PLAN/DIAGRAM	TITLE
LOT 511 & 512	PL LOT 506	DP 55255	C/T 3147/166
LOT 513	PL LOT 504	DP 55255	C/T 3147/164
LOT 514	PL LOT 501	DP 55255	C/T 3147/161
LOT 515	PL LOT 502	DP 55255	C/T 3147/162
LOT 516	PL LOT 503	DP 55255	C/T 3147/163
LOT 517	PL LOT 501	DP 55255	C/T 3147/161
	PL LOT 502	DP 55255	C/T 3147/162
	PL LOT 504	DP 55255	C/T 3147/164
	PL LOT 505	DP 55255	C/T 3147/165
	PL LOT 506	DP 55255	C/T 3147/166

TYPE	CROWN
PURPOSE	SUBDIVISION
PLAN OF	
LOTS 511 - 517	

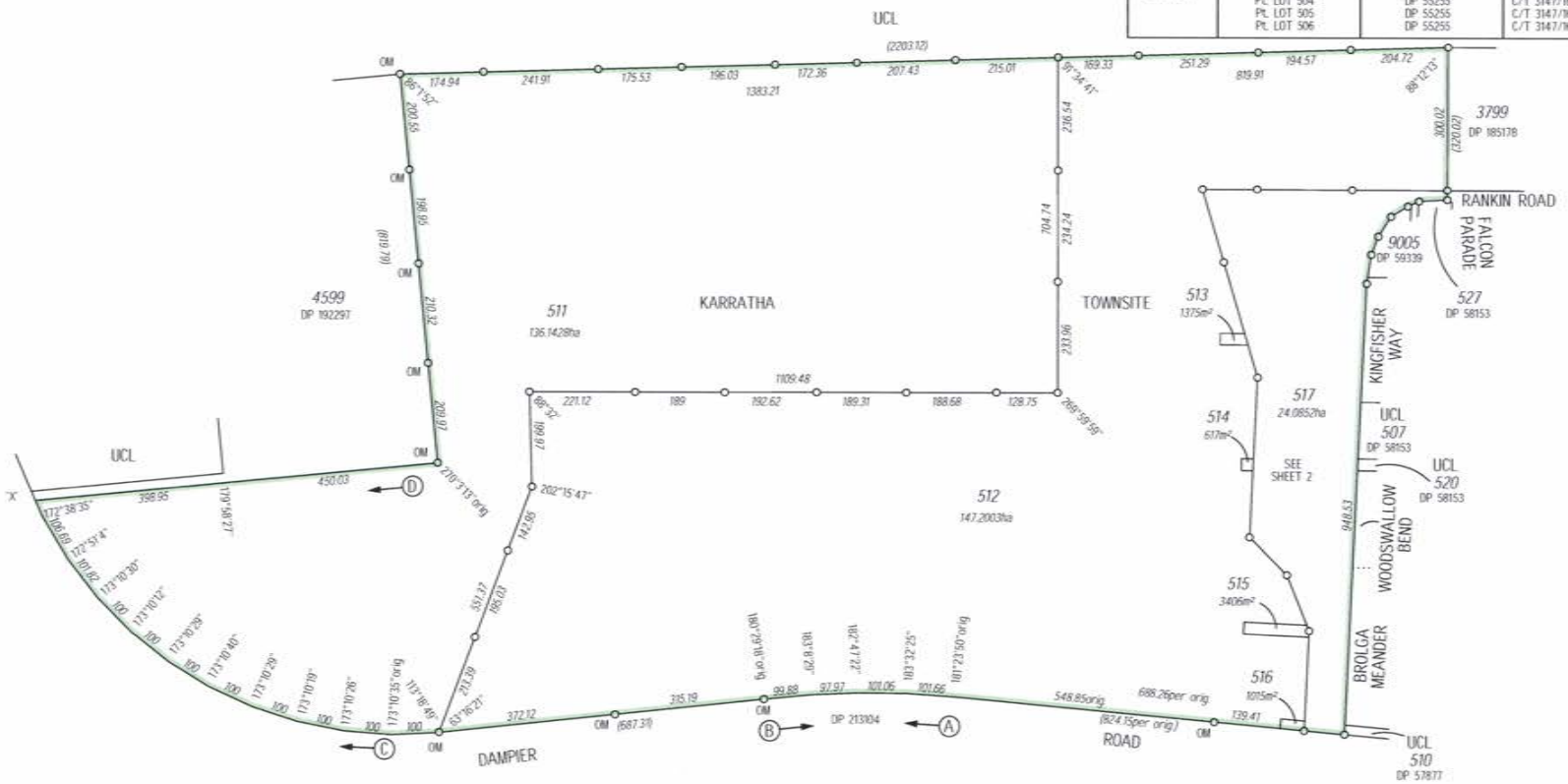
DISTRICT	DE WITT	SSA	Y66/110
TOWNSITE	KARRATHA	FORMER TENURE	SEE TABLE ABOVE
DPI FILE	50849-2007	LOCAL AUTHORITY	SHIRE OF ROEBOURNE
LOCALITY	GAP RIDGE, NICKOL	INDEX	ON BHS(2) 27.26, 27.27
INDEX	ON BHS(2) 27.26, 27.27	FIELD BOOK	113519 113520 (SWR 8008) (SWR 8001)

SCALE: 1:7500 AT A2 SIZE		ALL DIMENSIONS ARE IN METRES	
SURVEYOR'S CERTIFICATE	Reg 54	SURVEYOR'S CERTIFICATE	Completed
I, GAVIN ROBERT CAMPBELL, hereby certify that this is accurate and is a correct representation of the survey and the boundaries from measurements (where applicable) undertaken for the purposes of this plan and that it complies with the relevant statute laws in relation to which it is lodged.		I hereby certify that this compiled plan is a correct and accurate representation of the survey of subject land, and that it complies with the relevant statute laws in relation to which it is lodged.	
Checked/Sealed	Date	Printed/Sealed	Date

SUBMITTED & DRAWN BY: WHELANS (WA) PTY LTD 15/11/09 10:44:33 15/11 www.wheplans.com.au		APPROVED BY: WESTERN AUSTRALIAN PLANNING COMMISSION EXEMPT FROM WAPC APPROVAL
LOGGED	TYPE OF VALIDATION	APPROVED
DATE	FULL NAME	DATE
FOR AND	LEGAL COMPONENT	DATE
ADDRESS No:	PROJECT PLANNING	DATE
	CHECKED CORRECT	Delegated under: S 18 P 3 ACT 1988
	UCL	

IN ORDER FOR DEALINGS	
SUBJECT TO	
FOR REGISTER OF PLANS & SURVEYS / AUTHORIZED LAND OFFICER	DATE
APPROVED	
REGISTER OF PLANS & SURVEYS / AUTHORIZED LAND OFFICER	DATE


Landgate
 Western Australian Land Information Authority
 DEPOSITED PLAN
67183
 SHEET 1 OF 2
 PERSON 2



ENLARGEMENT 'X'
NOT TO SCALE

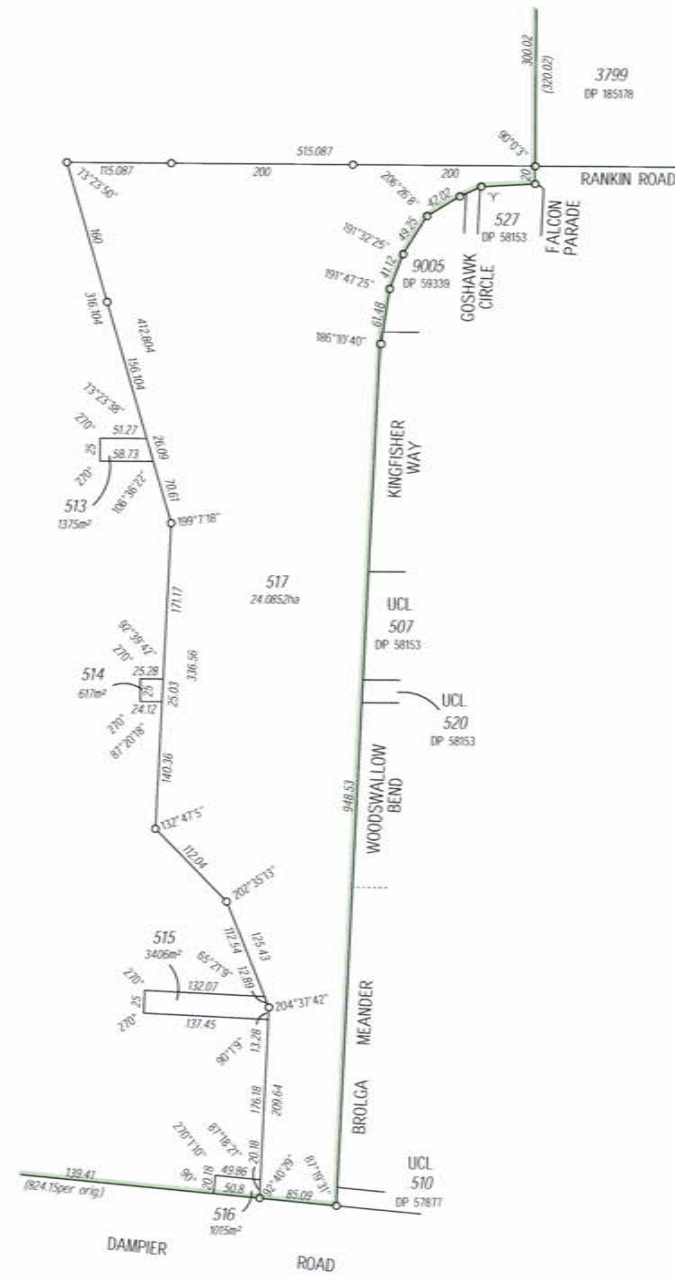
LOTS 511 & 513-516 SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES



projects 10 1080 1080 1080 1080
DP 8042 001 1080 20

FOR HEADING SEE SHEET 1
FOR INTERESTS AND NOTIFICATIONS SEE SHEET 1

512
SEE SHEET 1
KARRATHA TOWNSITE



SCALE: 1:4000 AT A2 SIZE ALL DISTANCES ARE IN METRES			
Issued: _____	Date: _____		
APPROVED BY: WESTERN AUSTRALIAN PLANNING COMMISSION			
FILE: EXEMPT FROM WAPC APPROVAL			
Designated Under S.W.P.A.B. ACT 2006			
DATE: _____			
SHEET: 2 OF 2		DEPOSITED PLAN	
PERSON: 2		67183	



APPENDIX C
ANEC STUDY – INITIAL REPORT & KARRATHA
AIRPORT MASTER PLAN 2013-33 EXTRACTS



Airport Master Planning Consultants Pty Ltd
PO Box 6349
North Ryde Australia 2113
30 May 2011

Mr Daniel Taylor
Development Manager
Pindan
PO Box 93
Belmont
WA 6984

Dear Daniel,

Karratha Airport – ANEC Study Initial Report

This evaluation takes a brief look at the calculated aircraft noise impacts (using the Integrated Noise Model) on a proposed residential development site (the site) approximately 2,800 meters to the south of the Karratha runway. Two impacts were evaluated: the likely ANEC contours generated by aircraft activity at Karratha Airport and the noise generated by individual aircraft flights. It is stressed that this evaluation is preliminary and none of the assumptions used in it's preparation have been confirmed with local authorities.

In undertaking this initial evaluation a conservative approach was followed to allow the likely maximum effect of aircraft noise exposure on the proposed development site to be gauged. The evaluation does need refining mainly using input from local authorities and in the description of the data modelled those refinements are suggested.

Australian Noise Exposure Concept contours

Two sets of ANEC contours were generated: the first for the current aircraft activities (**Figure 1**) and one for the forecast year 2027/28 (**Figure 2**).

A highly simplified set of flight tracks was modelled:

- To/from Perth – Great Circle bearing 183.5 and distance 673nm;
- To/from Darwin – Great Circle bearing 60.8 and distance 951nm; and
- A fixed wing circuit training track to the south of the runway.

(The track system needs considerable amplification to include the common local area and regional tracks as well as appropriate inter-state tracks.)

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The main features of the above tracks were:

- All arriving aircraft were assumed to follow in inbound track to 5nm Karratha and then track to join a 2nm final (a visual approach).
- All departing aircraft turned off the runway centerline just past the upwind end of the runway and then tracked to be on-course by 5nm;
- The fixed wing circuit had a downwind leg off-set by 1nm from the runway centre-line.

(The track geometry needs to be modified to suit local practices including any track divergences to avoid specific localities.)

Aircraft movement data, available since the Control Tower became operational, indicate that for the three months (Jan, Feb & Mar 2011) there were:

- 2,472 (9,888 yearly) aircraft movements by aircraft > 7 tons;
- 2,290 (9,160 yearly) aircraft movements by aircraft < 7 tons;
- And numerous helicopters not included in this study as it is understood that the great majority operate to the north-west and so have little influence on this evaluation.

The following assumptions have been included to convert the above to the traffic modelled for the present time:

- The aircraft > 7 tons are all Jets or turbo-props (Jorl);
 - The aircraft < 7 tons are all piston engine (PE);
 - For the Jorl 64.2% are scheduled (RPT) and 35.8% charter (CHTR) / non/scheduled;
 - For the RPT: route is 95%/5% Perth/Darwin, Day/Night split 85% / 15%;
 - For the charter: route is 60%/40% Perth/Darwin, Day/Night 85%/15%;
 - RPT aircraft types: 52% B737-800, 15% B717, 8% F100, 20% EMB190 & 5% F50;
 - Charter aircraft are 100% medium turbo-props (DHC6-Twin Otter);
 - For the Piston aircraft: 70% travel flights, 30% circuit training; travel flights 50%/50% Perth/Darwin route; Day/Night 90%/10%: Circuits all to the south, 100% Day; and
 - For the PE aircraft the types were 30% twin and 70% single engine.
- (All the above assumptions need careful checking with Local Authorities.)

For the forecast year 2027/28 traffic it has been assumed that the JorT aircraft flights will double. The revenue passengers are forecast to more than double however increases in aircraft size are expected to account for some of this growth. For the PE the growth is assumed to be 50%.

The following assumptions have been included to convert the above to the traffic modelled for the present time:

- For the Jorl 64% are scheduled (RPT) and 36% charter (CHTR) / non/scheduled;
- For the RPT: route is 95%/5% Perth/Darwin, Day/Night split 85% / 15%;
- For the charter: route is 60%/40% Perth/Darwin, Day/Night 85%/15%;
- RPT aircraft types: 10% B787-800, 10% A350, 30% B737-800, 30% A321-232, 10% EMB190 & 10% DHC830;
- Charter aircraft are 100% medium turbo-props (DHC6-Twin Otter);

- For the Piston aircraft: 70% travel flights, 30% circuit training; travel flights 50%/50% Perth/Darwin route; Day/Night 90%/10%: Circuits all to the south, 100% Day; and
- For the PE aircraft he types were 30% twin and 70% single engine.
(All the above assumptions need careful checking with Local Authorities.)

The yearly average runway usage assumed was 65% R08 and 35% R26.

Using the above assumptions the resultant ANECs for both the present aircraft movements and those forecast for 2027/28 have been produced and are attached.

Individual Aircraft Flights

Four types of jet aircraft, thought to represent the likely large jets, in either domestic or international services at this time or for the forecast year were modeled. They were for the current time the Boeing 737-800 and the Airbus A321-232 commonly used in the eastern states on high density routes. For the forecast year 2027/28 the Boeing 787-800 Dreamliner and the Airbus A350 were selected as these types while not yet in service are being actively considered for introduction into service by several Low Cost Carrier airlines and presumably would be equally attractive aircraft for services into Karratha.

The flights modelled were for an arrival from Perth to runway 08 undertaking a visual approach and a departure off that runway and turning right (over the site) to join the track to Perth. These are expected to be common flights and provide the most aircraft noise exposure of the various flights modelled. The arrival and departure flights are shown on the same charts with the maximum extent of the 70dB, 75dB and 80dB aircraft noise contours shown.

A further evaluation of individual aircraft noise exposure was to model the flight of a Beech Barron, BEC58P, undertaking circuit training with a down-wind leg off-set from the runway center-line 1 nm towards the proposed development site.

See the attached single event LAMAX contours for a depiction of the predicted aircraft noise in relation to the site.

Conclusion

The extent of the present day ANEC is that the sideline 20 ANEC contour extends about 360m from the runway centre-line to the south and the forecast year 20 ANEC sideline contour about 520m; both well clear of the proposed development site.

The initial conclusion is that while the site will receive some aircraft noise AS2021-2000 Table 2.1 would not preclude it's use for residential purposes.

The study needs to be significantly refined to provide a more definitive answer.

Yours sincerely

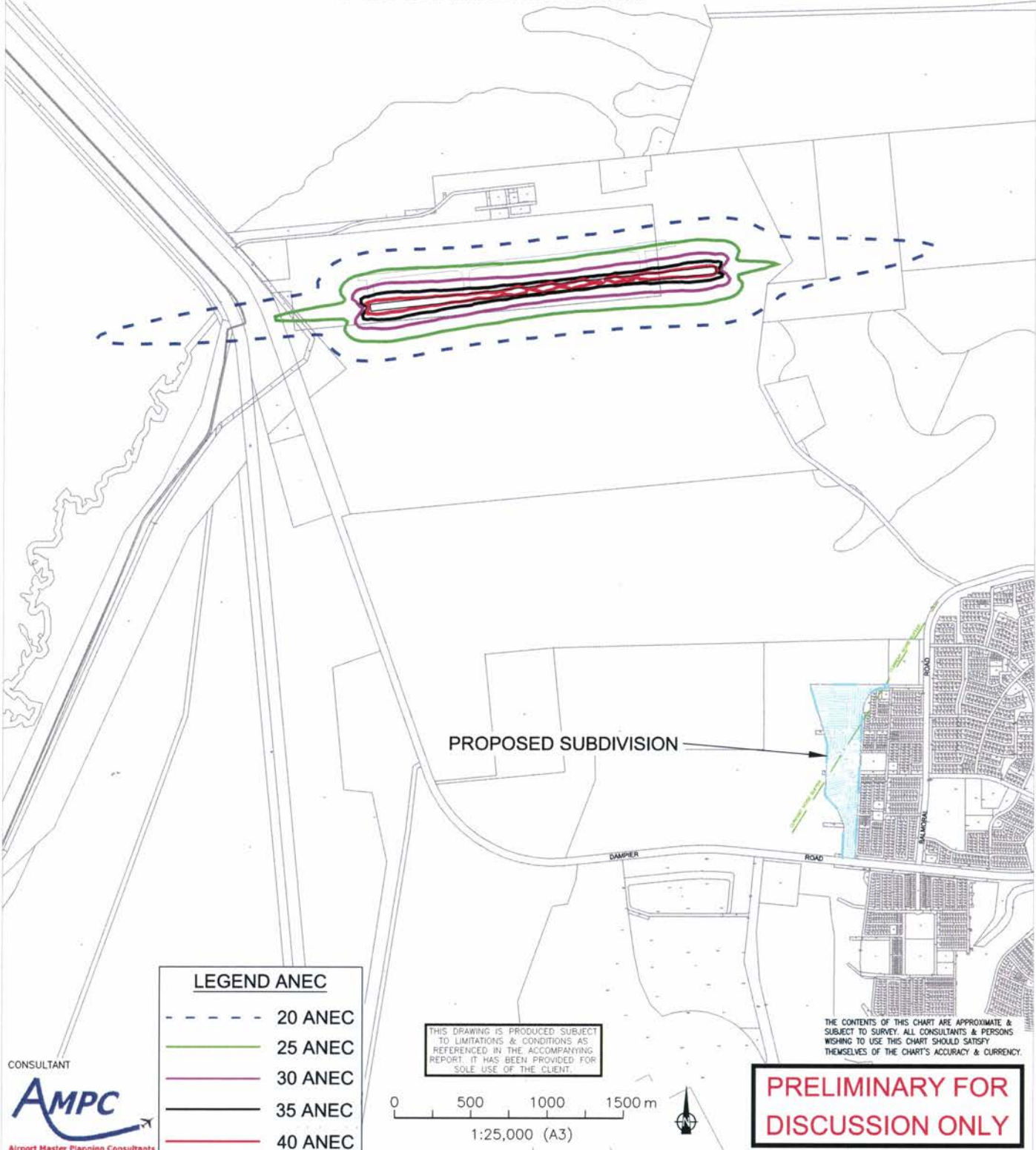
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BUILDING TYPE	ANEF ZONE OF SITE		
	ACCEPTABLE	CONDITIONAL	UNACCEPTABLE
House, home unit, flat, caravan park (Note 1 of AS2021)	Less than 20 ANEF	20 to 25 ANEF (Note 2 of AS2021)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university (Note 1 of AS2021)	Less than 20 ANEF	20 to 25 ANEF (Note 2 of AS2021)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1 of AS2021)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES

- 1) THE ACTUAL LOCATION OF THE 20 ANEF CONTOUR IS DIFFICULT TO DEFINE ACCURATELY, MAINLY BECAUSE OF VARIATION IN AIRCRAFT FLIGHT PATHS. BECAUSE OF THIS, THE PROCEDURE OF CLAUSE 2.3.2 OF THE STANDARD MAY BE FOLLOWED FOR BUILDING SITES OUTSIDE BUT NEAR TO THE 20 ANEF CONTOUR.
- 2) WITHIN 20 ANEF TO 25 ANEF, SOME PEOPLE MAY FIND THAT THE LAND IS NOT COMPATIBLE WITH RESIDENTIAL OR EDUCATIONAL USES. LAND USE AUTHORITIES MAY CONSIDER THAT THE INCORPORATION OF NOISE CONTROL FEATURES IN THE CONSTRUCTION OF RESIDENCES OR SCHOOLS IS APPROPRIATE. (SEE ALSO FIGURE A1 OF APPENDIX A OF AS2021).
- 3) THERE WILL BE CASES WHERE A BUILDING OF A PARTICULAR TYPE WILL CONTAIN SPACES USED FOR ACTIVITIES WHICH WOULD GENERALLY BE FOUND IN A DIFFERENT TYPE OF BUILDING (E.G. AN OFFICE IN AN INDUSTRIAL BUILDING). IN THESE CASES TABLE 2.1 OF THE STANDARD SHOULD BE USED TO DETERMINE SITE ACCEPTABILITY, BUT INTERNAL DESIGN NOISE LEVELS WITHIN THE SPECIFIC SPACES SHOULD BE DETERMINED BY TABLE 3.3 OF THE STANDARD.
- 4) THE STANDARD DOES NOT RECOMMEND DEVELOPMENT IN UNACCEPTABLE AREAS. HOWEVER, WHERE THE RELEVANT PLANNING AUTHORITY DETERMINES THAT ANY DEVELOPMENT MAY BE NECESSARY WITHIN EXISTING BUILT-UP AREAS DESIGNATED AS UNACCEPTABLE, IT IS RECOMMENDED THAT SUCH DEVELOPMENT SHOULD ACHIEVE THE REQUIRED ANR DETERMINED ACCORDING TO CLAUSE 3.2 OF THE STANDARD. FOR RESIDENCES, SCHOOLS, ETC., THE EFFECT OF AIRCRAFT NOISE ON OUTDOOR AREAS ASSOCIATED WITH THE BUILDINGS SHOULD BE CONSIDERED.
- 5) IN NO CASE SHOULD NEW DEVELOPMENT TAKE PLACE IN GREENFIELD SITES DEEMED UNACCEPTABLE BECAUSE SUCH DEVELOPMENT MAY IMPACT AIRPORT OPERATIONS.



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LEGEND ANEC	
--- (dashed blue)	20 ANEC
— (green)	25 ANEC
— (purple)	30 ANEC
— (black)	35 ANEC
— (red)	40 ANEC

THIS DRAWING IS PRODUCED SUBJECT TO LIMITATIONS & CONDITIONS AS REFERENCED IN THE ACCOMPANYING REPORT. IT HAS BEEN PROVIDED FOR SOLE USE OF THE CLIENT.

PRELIMINARY FOR DISCUSSION ONLY

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CLIENTS
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 BUILDING ON PARTNERSHIPS PROPERTY FINLDS MANAGEMENT

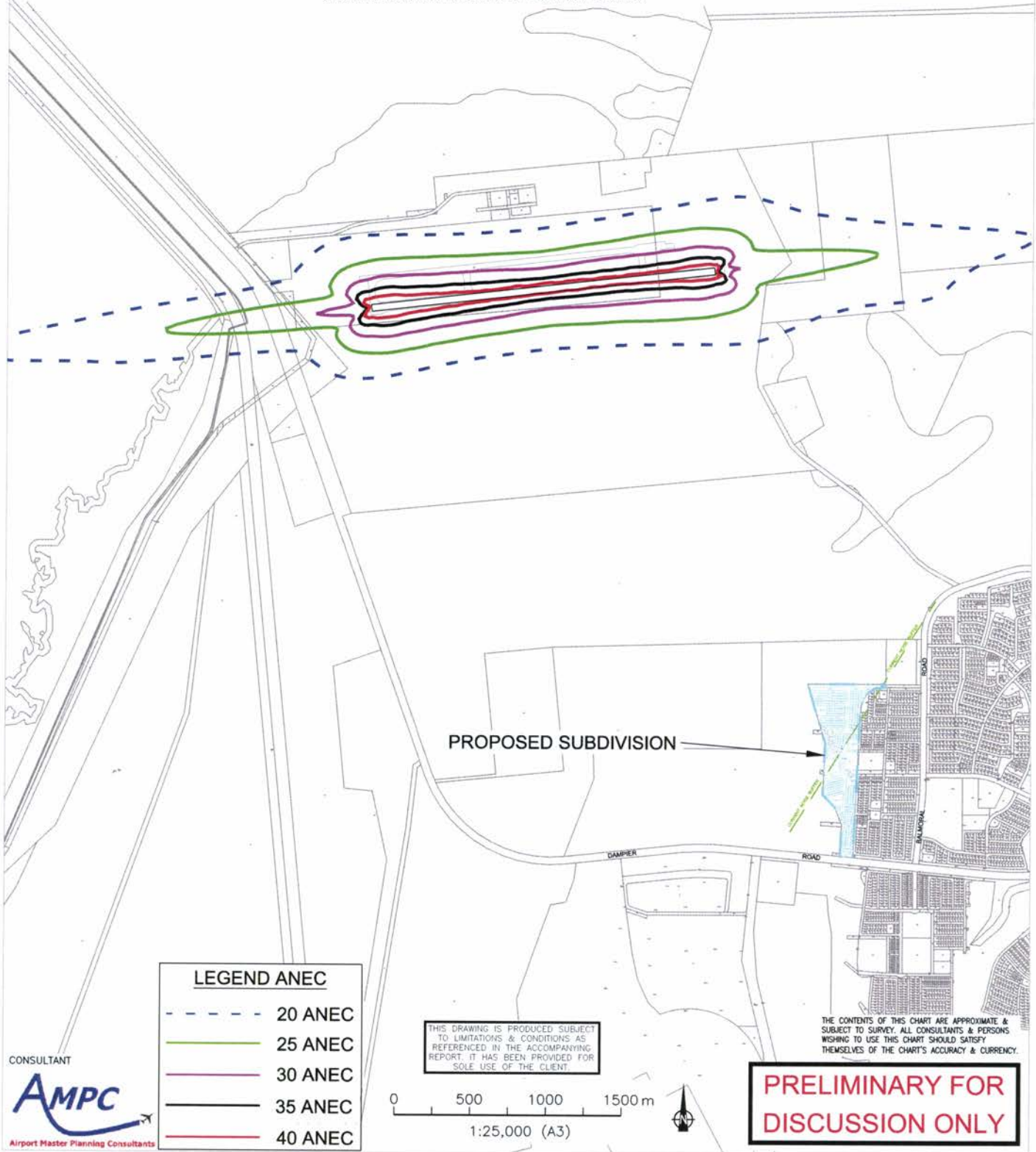
KARRATHA AIRPORT - ANEC STUDY
 ANEC - CURRENT AIRCRAFT ACTIVITIES
 DRG No. FIGURE 1

AS2021 - TABLE OF BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES

BUILDING TYPE	ANEF ZONE OF SITE		
	ACCEPTABLE	CONDITIONAL	UNACCEPTABLE
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF (Note 2 of AS2021)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF (Note 2 of AS2021)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1 of AS2021)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES

- 1) THE ACTUAL LOCATION OF THE 20 ANEF CONTOUR IS DIFFICULT TO DEFINE ACCURATELY, MAINLY BECAUSE OF VARIATION IN AIRCRAFT FLIGHT PATHS. BECAUSE OF THIS, THE PROCEDURE OF CLAUSE 2.3.2 OF THE STANDARD MAY BE FOLLOWED FOR BUILDING SITES OUTSIDE BUT NEAR TO THE 20 ANEF CONTOUR.
- 2) WITHIN 20 ANEF TO 25 ANEF, SOME PEOPLE MAY FIND THAT THE LAND IS NOT COMPATIBLE WITH RESIDENTIAL OR EDUCATIONAL USES. LAND USE AUTHORITIES MAY CONSIDER THAT THE INCORPORATION OF NOISE CONTROL FEATURES IN THE CONSTRUCTION OF RESIDENCES OR SCHOOLS IS APPROPRIATE (SEE ALSO FIGURE A1 OF APPENDIX A OF AS2021).
- 3) THERE WILL BE CASES WHERE A BUILDING OF A PARTICULAR TYPE WILL CONTAIN SPACES USED FOR ACTIVITIES WHICH WOULD GENERALLY BE FOUND IN A DIFFERENT TYPE OF BUILDING (E.G. AN OFFICE IN AN INDUSTRIAL BUILDING). IN THESE CASES TABLE 2.1 OF THE STANDARD SHOULD BE USED TO DETERMINE SITE ACCEPTABILITY, BUT INTERNAL DESIGN NOISE LEVELS WITHIN THE SPECIFIC SPACES SHOULD BE DETERMINED BY TABLE 3.3 OF THE STANDARD.
- 4) THE STANDARD DOES NOT RECOMMEND DEVELOPMENT IN UNACCEPTABLE AREAS. HOWEVER, WHERE THE RELEVANT PLANNING AUTHORITY DETERMINES THAT ANY DEVELOPMENT MAY BE NECESSARY WITHIN EXISTING BUILT-UP AREAS DESIGNATED AS UNACCEPTABLE, IT IS RECOMMENDED THAT SUCH DEVELOPMENT SHOULD ACHIEVE THE REQUIRED ANR DETERMINED ACCORDING TO CLAUSE 3.2 OF THE STANDARD. FOR RESIDENCES, SCHOOLS, ETC., THE EFFECT OF AIRCRAFT NOISE ON OUTDOOR AREAS ASSOCIATED WITH THE BUILDINGS SHOULD BE CONSIDERED.
- 5) IN NO CASE SHOULD NEW DEVELOPMENT TAKE PLACE IN GREENFIELD SITES DEEMED UNACCEPTABLE BECAUSE SUCH DEVELOPMENT MAY IMPACT AIRPORT OPERATIONS.



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KARRATHA AIRPORT - ANEC STUDY
ANEC - FORCAST YEAR 2027/28

DRG No. **FIGURE 2**

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6.0 PLANNING IMPLICATIONS

6.1 AIRCRAFT NOISE

The consideration of airport noise impacts is an important factor in the development of individual Airport Master Plans. An understanding of the noise impact on land adjoining the airport provides valuable information to local government authorities for development planning of adjacent land uses and in setting building code requirements. A thorough understanding of both existing and future noise impacts from airport operations is essential to the development of land use zone planning schemes around airports. It is also important for the general public to be able to understand possible future noise impacts in a wider sense, to assist individuals in making their own assessment of their possible responses e.g. constructing built forms to mitigate noise penetration.

The provision, in this section of the Master Plan, of information on projected noise impacts for Karratha Airport, is intended, firstly, to enable SoR to make informed choices for the development and implementation of the airport Master Plan and the Town Planning Scheme to ensure that:

- Airport operations are protected long term from stakeholder conflicts due to the encroachment of inappropriate development into noise affected zones;
- The amenity of other surrounding developments is not adversely affected by aircraft noise; and
- Sensitive receptors are located in areas of acceptable aircraft noise.

However, additional information over and above that required by the statutory planning framework has also been provided, to assist non-experts including the general public in gaining a better understanding of future aircraft noise in relation to Karratha Airport.

The noise forecasts in this section have been developed based on an understanding of aircraft flight paths developed from consultation with aircraft operators and air traffic control. It should be noted that the selection and adoption of the specific flight path for any particular movement is the responsibility of the aircraft pilot and Airservices Australia, taking into account safety, weather and other considerations, and thus actual flight paths may vary on occasion from the standard flight paths assumed in the modelling.

6.1.1 THE ANEF SYSTEM

The principal means of assessment of potential aircraft noise exposure at a given site in Australia is based on the Australian Noise Exposure forecast (ANEF) system. The ANEF system was developed in the early 1980s based on a social survey of the reaction of people around several Australian airports to noise from aircraft. The ANEF combines the effects of the intensity, duration and number of noise events as well as incorporating a penalty for events at night which is illustrated by contours.

The ANEF is intended to be used to guide the long-term decisions of land-use planners about types of compatible development in areas that may be subject to significant levels of aircraft noise in the future. Additionally, the ANEF system is the basis of *Australian Standard AS 2021-2000 Acoustics – Aircraft noise intrusion – Building siting and construction (AS2021-2000)* which provides guidance on the protection of new buildings against aircraft noise intrusion and on the acoustical adequacy of existing buildings in areas near aerodromes.

Although the ANEF system is considered suitable for land-use planning purposes it is not without its limitations. The ANEF system is a 'one size fits all' approach to land use planning. The ANEF criteria for acceptable land use are the same whether the land is in the vicinity of a major international airport or a small regional aerodrome without jet aircraft. The system does not take into consideration local conditions, for example an airport on a Greenfield site is treated the same as one which has already been developed.

Additionally, the ANEF is a complex metric which combines the effects of loudness, duration and frequency of noise events to develop a measure of the cumulative noise dose and does not illustrate the noise from a specific noise event which is what the non-expert can readily relate to.

The ANEF noise contours have been developed using the Integrated Noise Model (INM) version 7.0(c). The model has been constructed to produce the Australian Noise Exposure Forecast (ANEF) metric defined in AS2021-2000.

6.1.2 AUSTRALIAN NOISE EXPOSURE FORECAST

The ANEF is a contour map based on forecast aircraft movements and is the only contour map under the ANEF system which is intended to have status in land-use planning decisions.

The ANEF has been prepared based on the forecast number of movements to 2031-32. Overall, the 2031-32 forecast has been estimated to reach approximately 67,000 movements per annum.

The draft Karratha Airport ANEF contours developed as part of this Master Plan are shown in **Figure C** at **Appendix B**. The inputs used to develop the contours have been agreed and the contours and model have now been sent for endorsement by Airservices Australia in the manner of endorsement approved by the Minister for Infrastructure, Transport, Regional Development and Local Government on 17 April 2012.

The ANEF shows the contours that are significant under AS2021-2000 including the 20, 25, 30 and 35 ANEF:

- The 30 and 35 ANEF contours are contained within the existing airport boundary and do not extend beyond the aircraft movement area of the airport;
- The 25 ANEF contour is largely contained within the existing airport boundary, extending over the boundary to the east over mud flats and to the west over the Dampier Highway and salt flats. Within the airport boundary some of the proposed GA and aviation support development sub-division falls within this contour; and
- The 20 ANEF contour also extends over the boundary to the east over mud flats and to the west over the Dampier Highway and salt flats. The contour extends slightly over the airport boundary to the north over undeveloped land. Within the airport boundary some of the proposed GA and aviation support, aviation-related and light industrial sub-division falls within this contour.

AS2021-2000 indicates that the following building types are acceptable within the following ANEF contours:

- 20 ANEF: Residential, school, university, hospital, nursing home;
- 25 ANEF: Hotel, Motel, Commercial
- 30 ANEF: Light Industrial
- All ANEF: Other industrial.

The land uses proposed by this Master Plan are compliant with those set out under AS2021-2000 for each ANEF level. Any sensitive land uses proposed, such as hotel accommodation, are located outside of the relevant contour.

6.1.3 N60 AND N70 CONTOURS

The ANEF system is generally recognised as being the most technically complete description of aircraft noise in use in the Australian context and the ANEF is the only metric recognised under AS2021:2000. However, it is also widely recognised that the ANEF system is not easily translated into the important factors which affect how individuals react to aircraft noise: the number of over flights and the loudness of individual events. This is due to the way the ANEF combines the effects of loudness, duration and frequency of noise events to develop a measure of the cumulative noise dose.

'Number above', or 'N', contours illustrate the average number of events per day louder than a certain sound level. In the case of the N60, this level is 60 dB (A). The single event level of 60 dB(A) is specified in Australian Standard AS2021:2000 as the indoor design sound level for normal domestic areas in dwellings and 70 dB (A) is the noise level at which conversation is disturbed within a house with the windows open.

As stated above the ANEF system is a 'one size fits all' in that it does not take into consideration building requirements which respond to local conditions. For example buildings in Karratha are constructed to withstand Category 5 Cyclones and very hot climatic conditions; additional insulation and thicker glass are

typical. These requirements have the potential to make buildings in Karratha more impervious to exterior noise events. The AS2021-2000, 'N' Contours and therefore this report have not considered these local factors.

Different sources having the same dB (A) level generally sound about equally loud. The decibel scale is non-linear: a change of 1 dB(A) or 2 dB(A) in the level of a sound is difficult for most people to detect, whilst a 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness, a 10 dB(A) change corresponds to an approximate doubling or halving in loudness.

Some sound levels typically associated with some common activities are shown in **Table 4**.

Table 4: Typical Noise Levels

Activity	Typical Noise Level dB(A)
Quiet Room	30
Rainfall	50
Conversation at 2m	60
Washing Machine	65 – 70
Inside Car, Windows Closed, 50km/h	68 – 73
Main Road	70
Vacuum Cleaner	85 – 90
Very Loud Rock Music	120

Although the noise levels shown in **Table 5** do not specifically relate to noise caused by aircraft, they remain a good benchmark for an individual to compare with when interpreting the noise information in the following sections. One of the characteristics of noise is that, unless two noise sources are of approximately the same intensity (within a few dB(A) of each other) the intensity of the combined noise sources is effectively the same as the loudest source only. For that reason, it would be difficult to distinguish the noise of a main road (70 dB(A)) or washing machine (65-70 dB(A)), for example, above that of a vacuum cleaner (85-90 dB(A)).

Contours such as the N60s and N70s assist the community to better understand the impacts of aircraft noise by giving individuals the ability to interpret aircraft noise based on actual counts of aircraft events with a noise profile greater than a certain level over a range of flight paths. The provision of 'Number Above' contours has been recently recommended by Department of Infrastructure, Transport, Regional Development and Local Government (previously the Department of Transport and Regional Services) in a discussion paper entitled *Guidance Material for Selecting and Providing Aircraft Noise Information*.

The Western Australia Environmental Protection Agency recognises this and 'number above' noise contours (N60 and N70 contours) are generally requested by them in relation to any potential rezoning of surrounding land. They have also proven to be a good way to produce a 'whole of airport' picture of single event aircraft noise patterns which can be easier for the general public to understand.

The 'Number Above' noise contours are produced using the Transparent Noise Information Package (TNIP).

N60 and N70 contour plans for Karratha Airport based on the 2031-32 forecast traffic have been produced and are shown in **Figure D** and **Figure E** respectively.

Figure D shows some areas within the airport boundary and areas outside of the airport boundary, to the east and west, are expected to experience between 65 and 95 events of 60 dB (A) or greater on an average day in 2031-32. Affected areas outside of the airport site are currently either salt plains or mudflats and unlikely to ever be developed. Precincts within the airport site with potentially sensitive land uses, such as hotel and other accommodation, are unlikely to be impacted by a significant number of events.

Figure E shows the majority of the airport site is expected to experience between 5 and 50+ events of 70 dB (A) or greater on an average day in 2031-32. Undeveloped land to the east and west of the airport are also expected to experience between 5 and 50+ events of 70 dB (A) or greater on an average day in 2031-

32. Future proposed suburbs to the north of Balmoral road, as set out in the Karratha City of the North Plan, may experience 5 events of 70 dB (A) or greater on an average day in 2031-32 on the northern fringes.

As indicated in **Table 5**, a number of other typical daily tasks are likely to exceed these noise levels several times per day in 2031-32.

6.2 LAND USE PLANNING

The following sections set out requirements and restrictions that should be considered in relation to new development on the airport site and the land surrounding the airport site. To ensure that airport development and operations are not restricted the requirements set out here should be incorporated as required into future town planning schemes.

6.2.1 BUILDING HEIGHT RESTRICTIONS

Figure F at Appendix B provides an Obstacle Limitation Surface (OLS) plan that indicates limits on building and other object heights surrounding the airport. This has been developed based on a 2,500 metre long, Code 4 precision approach runway. This has been upgraded from the existing OLS plan, which accounts for a Code 4 non-precision approach runway, to ensure that all future potential operations can be safe-guarded for. The new OLS plan is based on a 1.6% take-off surface as opposed to a 2% take-off surface, as advised by CASA MOS Part 139. This plan should be reviewed to understand if any existing buildings and/or objects impinge on the future OLS. It should also be incorporated into future town planning schemes to ensure that any future developments do not impact on the OLS.

6.2.2 BIRD & WILDLIFE HAZARD

Birds (and other wildlife) on or around airfields should be regarded as a potential hazard to aircraft safety. The majority of aircraft collisions with birds occur near the airfield during take-off, landing and associated phases. For example, birds can be sucked into aircraft jet engines causing damage that may impact on the pilot's ability to manoeuvre the aircraft.

The prevention of bird strike requires careful consideration during master planning phase to identify potential land uses that may attract birds. Master planning considerations include the land use inside the boundaries of the airport and the surrounding land uses that should be avoided to reduce the risk of bird strike. It is essential that the SoR planners incorporate this into future town planning schemes to minimise the bird strike threat associated with land use.

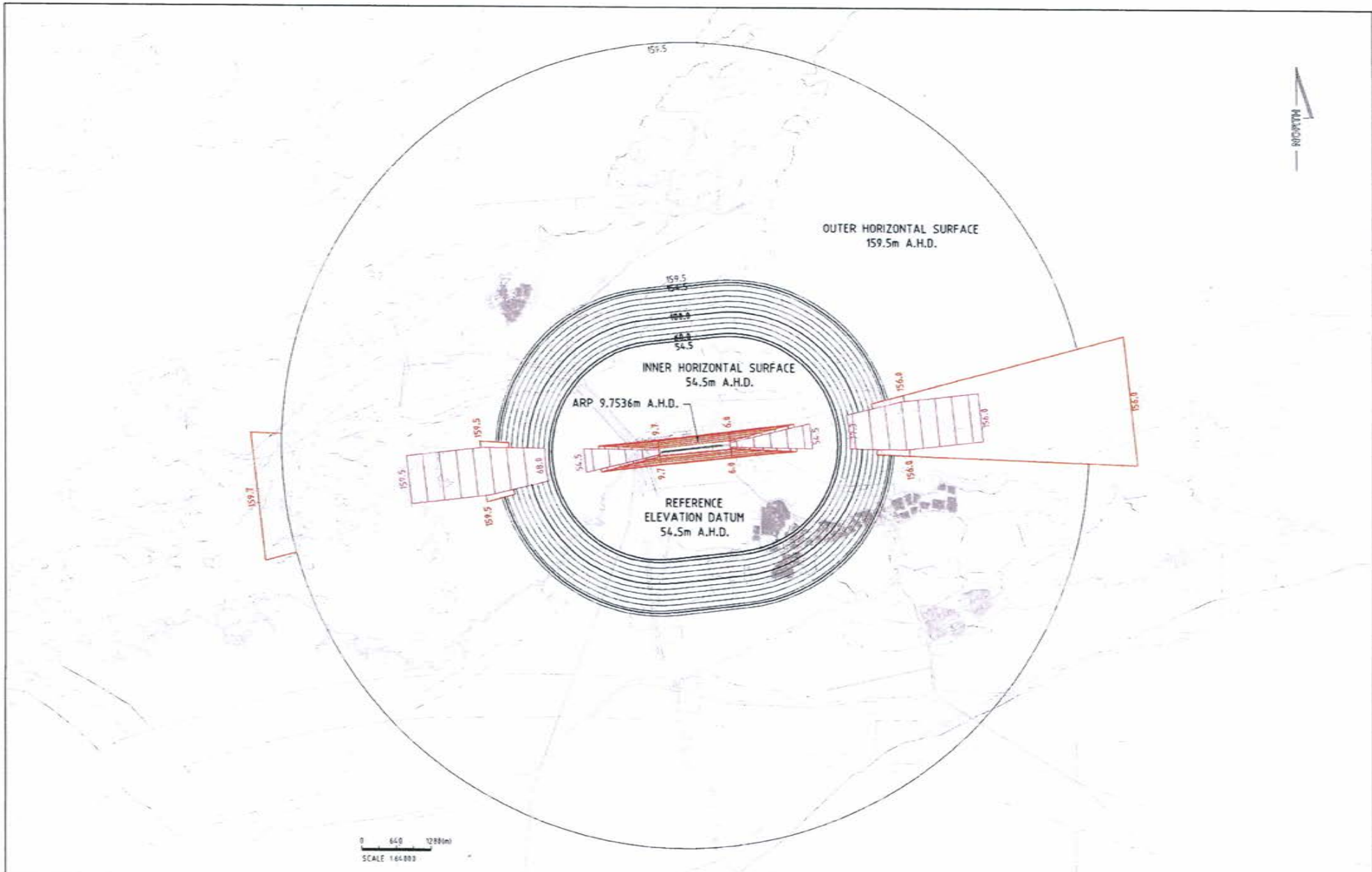
While consideration of land uses within and adjoining the airport is essential for decreasing bird strike risk, operational procedures and control measures are applied to reduce the existing threat of birds. Targeted maintenance and management activities are necessary to reduce of habitat or food sources that attract birds.

Master Plan Considerations

Land use and the environment surrounding aerodromes can attract birds and bats. Waterways, agriculture, landfills and even golf courses often provide attractants that contribute to transit issues where birds and bats traverse the airfield while moving between nesting areas and feeding or foraging sites. Development near airfields that provides refuge, feeding or breeding opportunities for large numbers of birds or bats contributes to an increased risk of bird strike.

Figure G in Appendix B shows the boundaries of buffer zones, within which certain activities around Karratha Airport should be controlled as set out within **Table 6**. Land use development restrictions within these boundaries should be implemented by the SoR.

Table 5 below identifies land uses that have the potential to attract large birds (water fowl, raptors) that pose a risk to aircraft operation.



Project
**PRELIMINARY DRAFT 2013
 KARRATHA AIRPORT MASTER PLAN
 AND LAND USE PLAN**

Client
SHIRE OF ROEBOURNE

Title
BUILDING HEIGHT RESTRICTIONS PLAN

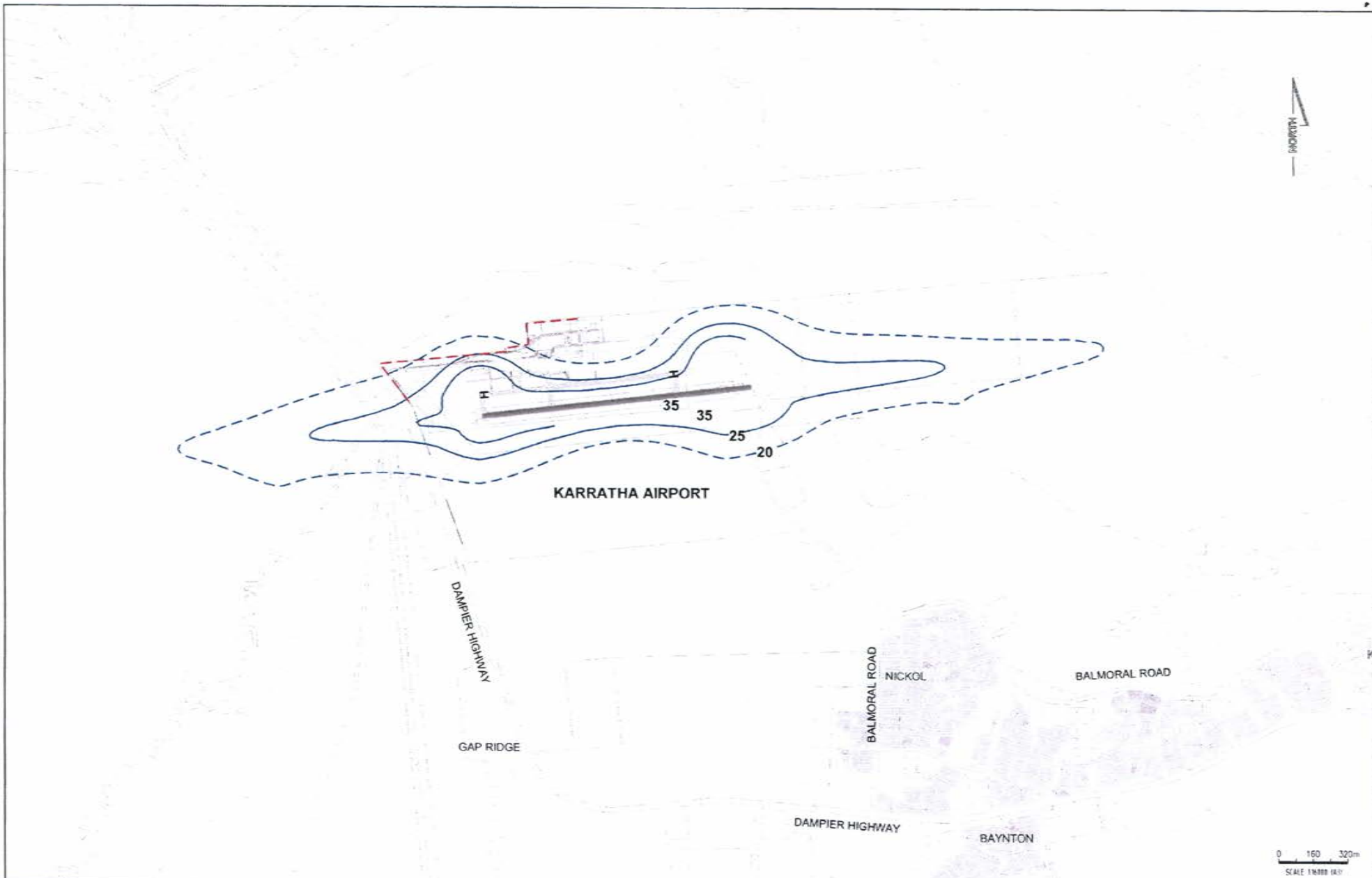


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Rev	Date	File Ref
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1	30/05/13	
0	10/04/13	

Drawn LT Checked JSS Approved BJH Rev Date File Ref B12C54 Sheet 1 of 1



Project
**PRELIMINARY DRAFT 2013
 KARRATHA AIRPORT MASTER PLAN
 AND LAND USE PLAN**

Client
SHIRE OF ROEBOURNE

Title
2032 ANEF CONTOURS



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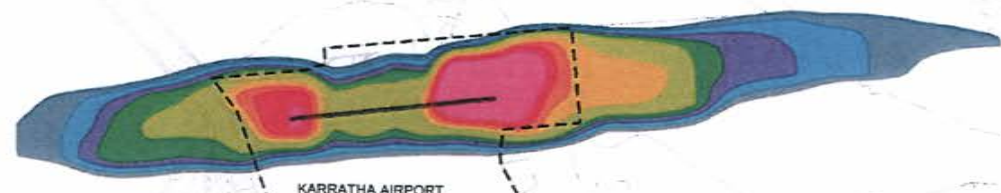
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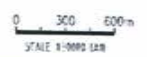
LEGEND

- 65-70 EVENTS PER AVERAGE DAY
- 70-75 EVENTS PER AVERAGE DAY
- 75-80 EVENTS PER AVERAGE DAY
- 80-85 EVENTS PER AVERAGE DAY
- 85-90 EVENTS PER AVERAGE DAY
- 90-95 EVENTS PER AVERAGE DAY
- 95-100 EVENTS PER AVERAGE DAY
- 100-105 EVENTS PER AVERAGE DAY
- 105+ EVENTS PER AVERAGE DAY

NB: N60 CONTOURS REPRESENT THE EXPECTED NUMBER OF EVENTS OF 60dB(A) OR GREATER.



TYPICAL NOISE LEVELS	
ACTIVITY	TYPICAL NOISE LEVEL dB(A)
Quiet Room	30
Conversation at 2m	60
Washing Machine	65-70
Main Road	70
Vacuum Cleaner	85-90



Project
**PRELIMINARY DRAFT 2013
 KARRATHA AIRPORT MASTER PLAN
 AND LAND USE PLAN**

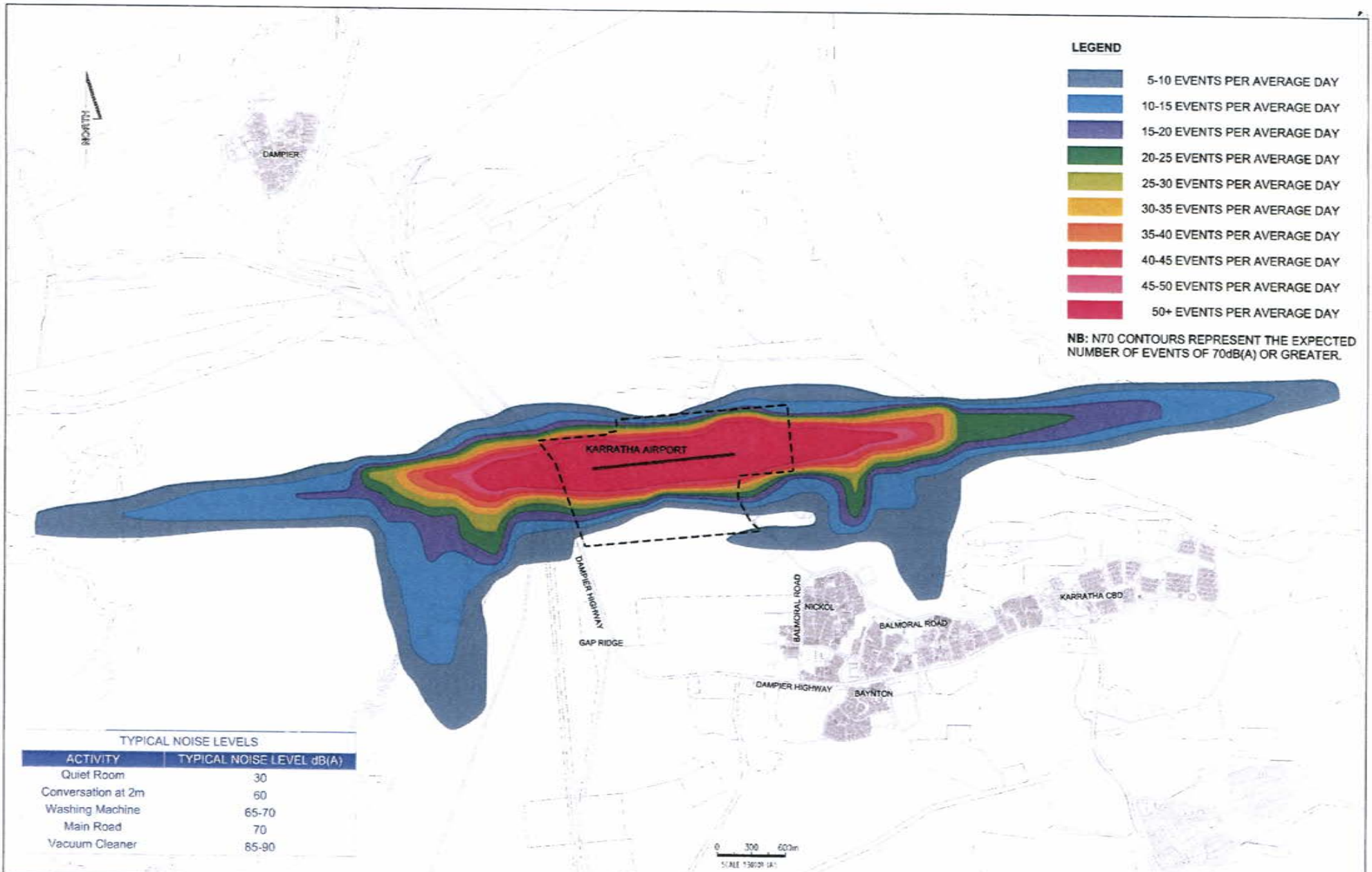
Client
SHIRE OF ROEBOURNE
 Title
2033 N60 CONTOURS



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Figure No	FIGURE D
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Rev	Date
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- LEGEND**
- 5-10 EVENTS PER AVERAGE DAY
 - 10-15 EVENTS PER AVERAGE DAY
 - 15-20 EVENTS PER AVERAGE DAY
 - 20-25 EVENTS PER AVERAGE DAY
 - 25-30 EVENTS PER AVERAGE DAY
 - 30-35 EVENTS PER AVERAGE DAY
 - 35-40 EVENTS PER AVERAGE DAY
 - 40-45 EVENTS PER AVERAGE DAY
 - 45-50 EVENTS PER AVERAGE DAY
 - 50+ EVENTS PER AVERAGE DAY

NB: N70 CONTOURS REPRESENT THE EXPECTED NUMBER OF EVENTS OF 70dB(A) OR GREATER.

TYPICAL NOISE LEVELS	
ACTIVITY	TYPICAL NOISE LEVEL dB(A)
Quiet Room	30
Conversation at 2m	60
Washing Machine	65-70
Main Road	70
Vacuum Cleaner	85-90

Project
**PRELIMINARY DRAFT 2013
 KARRATHA AIRPORT MASTER PLAN
 AND LAND USE PLAN**

Client
SHIRE OF ROEBOURNE

Title
2033 N70 CONTOURS



CNO NOISE LEVEL 3
 120 MINIMUM SECTOR
 10 000 10 000 10 000 10 000

STERLING 181 3004 1000 LES HED 10 11
 FACULTY 1071 3250 5501 AIN 1000000
 EMAIL WAIR@REHBEIN.COM.AU AIN 1000000

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APPENDIX D
TRAFFIC ASSESSMENT REPORT



**PROPOSED RESIDENTIAL SUBDIVISION PLAN
NICKOL WEST, KARRATHA**

TRAFFIC ASSESSMENT REPORT

transport planning • traffic engineering • project management

**Proposed Residential Subdivision Plan
Nickol West, Karratha**

Traffic Assessment Report

Prepared for:
Taylor Burrell Barnett

June 2011

Prepared by:
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Document history and status

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V Baltic	r01b	B Bordbar	31/05/2011	Second Revision
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Author: Vladimir Baltic
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Client: Taylor Burrell Barnett
Name of project: Nickol West Subdivision Plan, Karratha
Document version: r01c
Project number: t11.041

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APPENDIX A: APPROVED BRNWDP

APPENDIX B: REVISED BRNWDP (INCLUDES REVISED NW PLAN)

1 INTRODUCTION

Transcore has been requested by Taylor Burrell Barnett to prepare a Traffic Assessment (TA) report for the proposed residential development known as "Nickol West" (hereafter NW), located on Lot 517 Dampier Road in Karratha, Shire of Roebourne. The proposed residential development comprises a mix of individual and group housing lots and forms part of the approved Balmoral Road Nickol West Development Plan (BRNWDP).

Since the approval of the BRNWDP (including the NW as its integral part) in 2006, Pindan has reviewed the Approved Development Plan and proposes a Revised plan which addresses the increased need for housing in the region. Accordingly, the Revised NW features improved land efficiency whilst providing a greater variety of housing forms.

This TA report focuses on the internal subdivision movement network with a particular emphasis on the implications of the proposed amendments to the original approved NW.

Transcore has developed a strategic EMME3 transport model for the Karratha and Dampier region is utilised to establish the traffic volumes on the internal subdivision road network for both development options – Approved and Revised NW plans.

The EMME3 modelling results are further used to recommend road classifications and reservations for the subdivision road network in accordance with WAPC *Liveable Neighbourhood* guidelines and with respect to the balance of the BRNWDP which has already been constructed. The report also makes recommendations on the pedestrian and cyclist facilities to serve the subdivision area and integrate with the surrounding existing and future facilities.

The Approved BRNWDP and the proposed Revised BRNWDP plan, comprising the Revised NW subdivision plan, are attached in **Appendix A** and **B** of this report.

2 EXISTING SITUATION

The subject site (Nickol West development) occupies an area of approximately 24ha which is located at the western side of Karratha town site and approximately 400m west of the Dampier Road/Balmoral Road West intersection. The subject land is bounded by Dampier Road to the south, Rankin Road to the north (presently not constructed), Madigan Creek to the west and the existing eastern portion of Balmoral Road Nickol West residential development to the east. Once fully developed, NW subdivision would integrate seamlessly with the already constructed eastern portion of the BRNWDP (refer **Figure 1**).



Figure 1: Aerial view of the locality

Dampier Road is an important regional road connecting Dampier and Karratha town sites with North West Coastal Highway and providing direct or indirect access to major local industrial, transport, tourism and other important nodes such as: Burrup Industrial Area, Burrup Peninsula, Karratha Industrial Estate, Dampier Salts, Rio Tinto Railway Terminal and Karratha Airport.

Dampier Road is generally constructed to an 8m wide two-lane, two-way undivided carriageway standard, with 1.0m sealed verge and wide gravel shoulders. Dampier Road entails speed limits between 60km/h (in vicinity of the subject site) and 110km/h (open road) depending on actual road conditions. Dampier Road is classified as *Primary Distributor*¹ road and is presently under care and control of Main Roads WA. There are no pedestrian facilities on Dampier Road at this vicinity except for the short section fronting BRNWDP site.

¹ According to Main Roads WA *Functional Road Hierarchy* classification

The latest traffic volumes and percentage of heavy vehicles data was obtained from Main Roads WA for various sections of Dampier Road and presented in **Table 2**.

Section of Dampier Rd	Date	Average Daily Traffic	HV %
South of Millstream Rd	Apr 2008	8,385	12%
West of Balmoral Rd West	Mar 2008	9,360	9%
West of Madigan Rd	Apr 2008	9,025	12%

Table 2. Traffic count information for Dampier Road

As evident from the latest traffic count data, current standard of Dampier Road is reaching its practical capacity and as a result, Main Roads WA are in the process of upgrading this road to dual divided carriageway standard.

Main Roads WA has commenced concept development, design and construction work on Dampier Road between Balmoral Road East and Burrup Road intersections. The objective of the project is to ensure efficient and a safe level of service and enable sustainable future traffic growth.

Generally, the new carriageway of duplicated road runs parallel to the existing carriageway with a typical cross-section of 2 X 3.5m lanes with up to 2m wide shoulders (depending on cycling needs) and a 7m wide central median.

Stage 1A of this project (section between Balmoral Road East and Balmoral Road West) is already completed. Stage 1B (section between Balmoral Road West and Burrup Road intersection) is presently at the final design and early procurement stage.

Balmoral Road (West) is a approximately 7m wide single carriageway road with 1m sealed shoulders and wide gravel verges and operates under 80km/h speed limit regime. It entails a pedestrian footpath along its western verge including a shared path along its eastern verge north of Tamberey Drive. Balmoral Road is classified as *Local Distributor*² road under care and control of Shire of Roebourne.

The latest available traffic information for Balmoral Road, sourced from the Shire, is presented in **Table 3**.

Section of Balmoral Road	Date	Average Weekday Traffic	HV %
North of Dampier Rd	Apr 2009	4,150	11%
Near caravan park	Apr 2009	2,100	16%
East of Bathgate Rd	Apr 2009	6,150	8.5%

Table 3. Traffic count information for Balmoral Road

² According to Main Roads WA *Functional Road Hierarchy* classification

Dampier Road and Balmoral Road form a three-way, dual lane roundabout intersection with Balmoral Road terminating on its approach to Dampier Road.

The intersection crash history data for the Dampier Road/Balmoral Road West intersection for the five-year period to 31 December 2009, sourced from the Main Roads WA web site, is summarised in **Table 4**.

Intersection		State Frequency Rank	State Cost Rank	Total Crashes	Casualty
Dampier Rd/Balmoral Rd		2679	1019	6	0
Rear End	Right Angle	Pedestrian	Cycle	Wet	Night
0	4	0	0	0	1

Table 4. Crash history for Dampier Road/Balmoral Road intersection

Although there has been a total of six crashes recorded at this intersection, the State frequency and cost rankings suggest that these crashes are typical of this type of intersection considering type, function and traffic volumes on these roads.

There are no public transport services operating within the town apart from the school buses and the community bus service operating between Point Samson and Dampier. This service is sponsored by Shire of Roebourne, Public Transport Authority and Rio Tinto. It operates twice a day on Saturdays and Sundays (recently extended to Tuesdays and Thursdays) linking Point Samson, Wickham, Roebourne, Karratha and Dampier.

3 PROPOSED DEVELOPMENT

The proposed NW residential subdivision occupies an area of approximately 24ha immediately west of the existing eastern portion of BRNWDP development. NW is intended to interface with the already constructed residential subdivision to form integrated road, pedestrian and cyclist network.

The Approved NW plan comprises a mix of low (R17.5) and medium (R30) density residential development totalling 235 lots and several P.O.S./Drainage areas distributed across the site. The internal road network comprises four major east-west links (westbound extension of existing roads within BRNWDP), one major north-south link and a grid of local roads.

The external subdivision accessibility of the Approved NW plan is proposed via westbound extension of the existing BRNWDP east-west road links which connect to the Balmoral Road West to the east of the development. These roads include: Rankin Road, Ridge Elbow and Wedgetail Eagle Avenue. The development does not take direct access from Dampier Road.

The proposed Revised NW plan is essentially replicating the Approved version of the plan; however, minor road network changes, increase in lot yield and greater housing variety feature in the revised plan. The lot yield schedule proposed in the Revised NW is shown in the **Table 5**.

Lot type	Quantity
Individual lots (400m ² - 900m ²)	186 dwellings
Grouped housing site (R30)	86 dwellings
Grouped housing site (R60)	50 dwellings
Total	322 dwellings

Table 5. Lot yield for the proposed Revised NW subdivision

The skeleton of internal road system proposed in the Approved NW with the major east-west links to the BRNWDP is retained in the Revised NW design. Majority of the internal subdivision intersections are still in the form of priority-controlled T-intersections with two four-way intersections within the subdivision proposed to be controlled by roundabouts.

The proposed Revised NW development plan allows for four possible future westbound road connections across Madigan Creek to future developments to the west. These connections are marked up in the Revised NW development plan attached in **Appendix B**.

The pedestrian and cyclist path network proposed in the Approved NW plan is practically retained in the Revised NW plan with minor modifications to suit the new road layout. The excellent pedestrian/cyclist connectivity with the adjoined eastern section of the BRNWDP is also maintained.

4 TRAFFIC ANALYSIS

This section of the report provides a comparison of the estimated daily traffic generation of the Approved NW and the proposed Revised NW plans. The estimated traffic will further be assigned to the internal Revised NW road network and used to determine the internal road hierarchy and the road reservation requirements.

4.1 *Traffic Generation/Distribution*

In order to estimate the future traffic that would be generated from the NW subdivision plan (both Approved and Revised), Transcore's strategic Karratha and Dampier Regional EMME3 transport model was utilised.

For the purpose of this TA, region-specific trip rate of 8.5 trips per dwelling was applied to establish the total traffic generation from the proposed residential subdivision. This trip rate was established through numerous analysis and surveys undertaken within Karratha during the development process of the EMME3 transport model.

EMME3 transport model was utilised to ascertain both Approved and Amended NW options so that comparison between the two traffic scenarios can be carried out.

Accordingly, the subdivision plan area is estimated to generate approximately **2,000** and **2,700** daily vehicular trips for a typical weekday for the Approved and Revised NW plans, respectively. The total daily vehicular traffic includes both inbound and outbound trips.

The distribution and assignment of the subdivision-generated traffic was based on the actual location of the subject development, the existing road network and the location of various attraction nodes distributed across the wider Karratha region.

Accordingly, forecast traffic volumes for both Approved and Revised NW subdivision options are illustrated in **Figures 2** and **3**.



Figure 2. Anticipated total daily traffic for the Approved NW subdivision plan

The detailed analysis of subdivision traffic, road hierarchy and pedestrian/cyclist path networks for the Revised NW subdivision plan are carried out in the following sections of the report.

4.2 Intersection Capacity Analysis

Table 2.4 from AUSTRROADS "Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings" document illustrates the traffic volume thresholds above which a detailed intersection capacity assessment is required.

Assuming that typical peak hour traffic represents approximately 10% of the total daily traffic volume, it is confirmed that uninterrupted traffic flow conditions can be expected at all key internal subdivision intersections. As hourly traffic volumes through intersections are below the indicative thresholds indicated in **Table 6**, sufficient capacity would be available and detailed assessment or capacity analysis is not warranted (refer **Figure 3** for Revised NW daily traffic projections).

Major Road type	Major Road Flow (vph ³)	Minor Road Flow (vph)
Two-lane	400	250
	500	200
	650	100
Four-lane	1,000	100
	1,500	50
	2,000	25

Table 6. Traffic volume threshold for detailed intersection analysis

It is further confirmed that the internal road network layout ensures satisfactory permeability and efficient traffic distribution throughout the subdivision with no bottlenecks or traffic congestion.

4.3 Internal Subdivision Road Network Assessment

Preliminary assessment of the internal Revised NW road network was undertaken to identify if there are any potential traffic operational or safety issues with the proposed design. The assessment considered the projected traffic volumes, the length of the roads and the intersection treatments. Accordingly, the following should be considered during the detail design stage of the project to further improve traffic operations and safety on the internal subdivision road network:

- Delineation such centre carriageway line marking through the 90-degree bends should be considered to provide guidance and avoid undesirable and hazardous corner-cutting movements. The design of these bends should allow for lane correct traversing of traffic;

³ vph - vehicles per hour, typically represent 10% of total daily traffic volume

- Provision of intersection threshold traffic management measures at two t-intersections along the central spine road;
- Ensure that driveways to the properties located in the immediate vicinity of the intersections are set back as much as practically possible from the corner truncations to improve safety and maintain sightlines; and,
- Ensure safe movement of the service and emergency vehicles is achieved throughout the subdivision by the application of appropriate design vehicle.

4.4 Internal Subdivision Road Network Hierarchy

The projected traffic volumes on the internal Revised NW subdivision road network were used to determine the road hierarchy and the typical road reservations.

The review of subdivision traffic projections shows that, in accordance with the WAPC "*Liveable Neighbourhoods*" document, all internal subdivision roads can be classified either as *Access Streets B* or *Access Streets D* with typical road reservations of 17.9m and 14.2m, respectively.

Rankin Road (section within subject subdivision plan) is proposed to retain its existing standard of 7.4m trafficable carriageway only (as per road section within eastern part of BRNWDP). This road is proposed to form an important westbound link to the future developments west of BRNWDP and across Madigan Creek. Accordingly, Rankin Road is anticipated to carry volumes in excess of 3,000vpd and as such a *Neighbourhood Connector* standard is recommended for this road. Typical road reserve for a *Neighbourhood Connector B* road is 19.4m, comprising 7m wide trafficable carriageway with 2.1m on-street parking lanes and 4.1m wide verges on both sides. However, the proponent intends to maintain the existing standard of the established portion of Rankin Road which features in the eastern section of the BRNWDP.

Westbound extension of Wedgetail Eagle road through the subject subdivision (depicted as Road 11 in the NW subdivision plan) is earmarked for possible future connection to the future developments across Madigan Creek. Section of this road west of the proposed roundabout will, in initial stages, carry moderate traffic volumes and as such should be constructed to *Access Street D* standard.

However, if the area west of Madigan Creek is developed and connected to the subject subdivision through the extension of this road, future traffic volumes may exceed the 1,000vpd threshold for the *Access Street D* standard. Accordingly, it is proposed that this section of the Road 11 be constructed as an *Access Street D* with the intention to be upgraded to *Access Street B* standard in the future. Hence, the proposed 18m road reserve shown in the revised NW plan allows for this transition.

The typical road reserve for *Access Street B* entails a 9.7m wide road pavement comprising two 2.1m on-street parking lanes and 4.1m wide verges on both

sides. These streets are designed to carry up to 3,000vpd with a target speed of 40km/h. When fronting P.O.S., access street verge adjacent to P.O.S. may be reduced to 1.0m. This type of the road is not intended for bus routes or to feature bike lanes. The typical cross-section of the *Access Street B* is illustrated in **Figure 4**.

The proponent intends to maintain a carriageway standard of 7.4m for the section of Road 11 east of the proposed roundabout (continuation of Wedgetail Eagle standard within BRNWDP). The section of Road 11 west of the proposed roundabout is proposed to be constructed to a 7.0m carriageway standard with 18m road reserve to allow future road upgrade, if required.

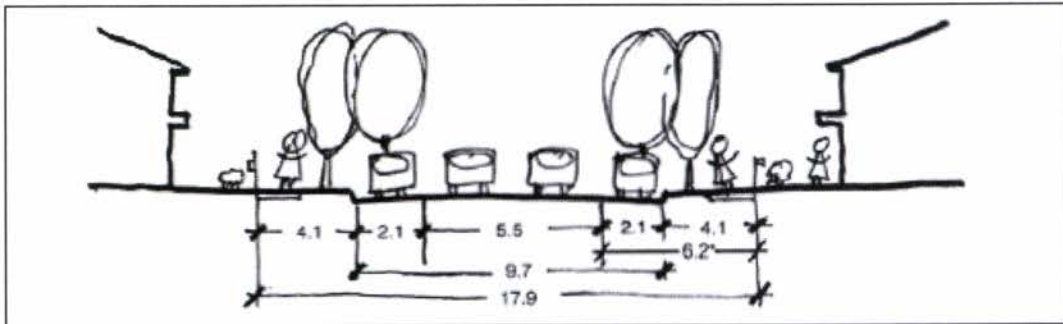


Figure 4. Access Street B – (wider access street) with target speed of 40 km/hr (<3,000vpd)

The typical road reserve for *Access Street D* entails a 6m wide road pavement with 4.1m wide verges on both sides. As such, maximum desirable traffic volume for this type of streets is 1,000vpd. The typical cross-section of the *Access Street D* is illustrated in **Figure 5**.

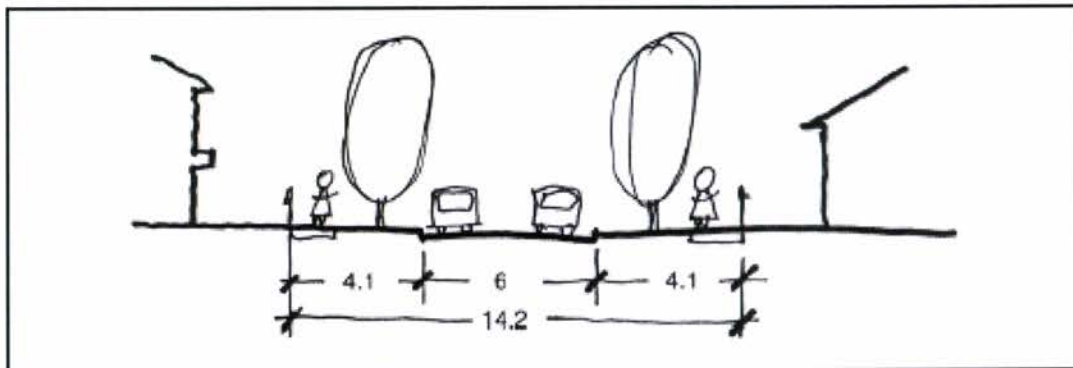


Figure 5. Access Street D – narrow yield (give way) street with target speed of 30 km/hr (<1,000vpd)

The revised NW development plan (refer **Appendix B**) allows for *Access Street D* road reserve of 15m, comprising 6m carriageway and 4.5m verge on both sides, so to allow for easy accommodation of services and landscaping and seamless integration with the eastern portion of BRNWDP where this practice is already established.

Narrower access streets are typically intended for shorter lengths and low parking demand. When fronting P.O.S., access street verges may be reduced to 1.0m effectively reducing the road reserve to 11.1m. Low speed environment enables on street cycling; however, in this case a shared path is proposed along one side of some Access Streets as it provides access to the recreational facilities and links to the existing shared path system within the eastern section of BRNWDP.

Accordingly, the proposed internal subdivision road classification is illustrated in **Figure 6** (overleaf).

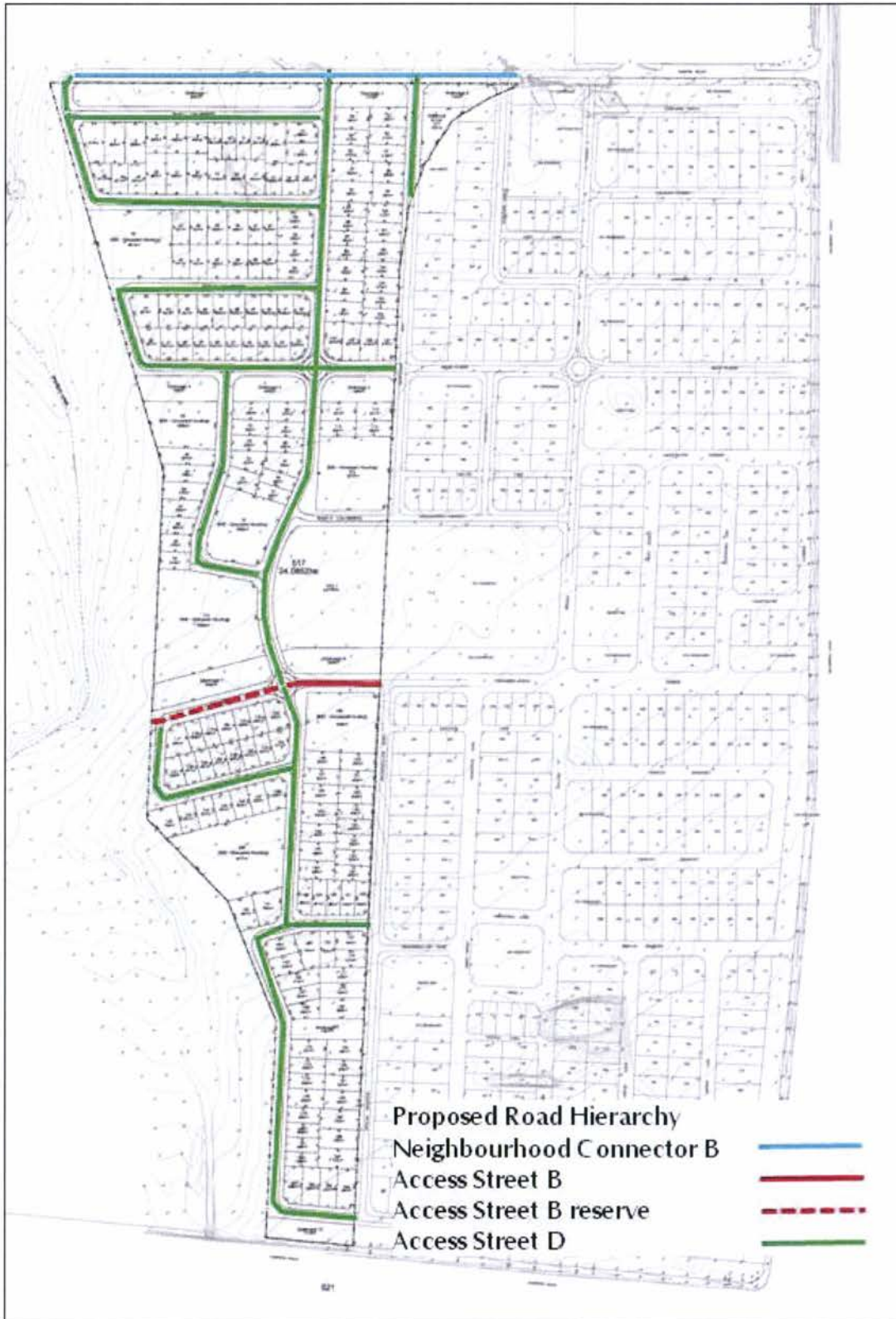


Figure 6. Proposed internal Revised NW road hierarchy

4.5 Pedestrian and Cyclist Network

The proposed Amended NW shared path network was developed to integrate with the existing path system within the eastern portion of BRNWDP. The westbound continuation of BRNWDP's east-west shared paths through the subject site is proposed in order to provide interface between the NW and eastern portion of BRNWDP. The proposed shared path system was also developed with respect to the recommendations made in the strategic Karratha Master Plan document (Karratha Revitalisation Project, 2010).

The proposed shared path network forms a pedestrian/cyclist system which facilitates safe and efficient movements within the subdivision as well as provides for integrated path system over the entire BRNWDP area. Refer **Figure 7** overleaf.

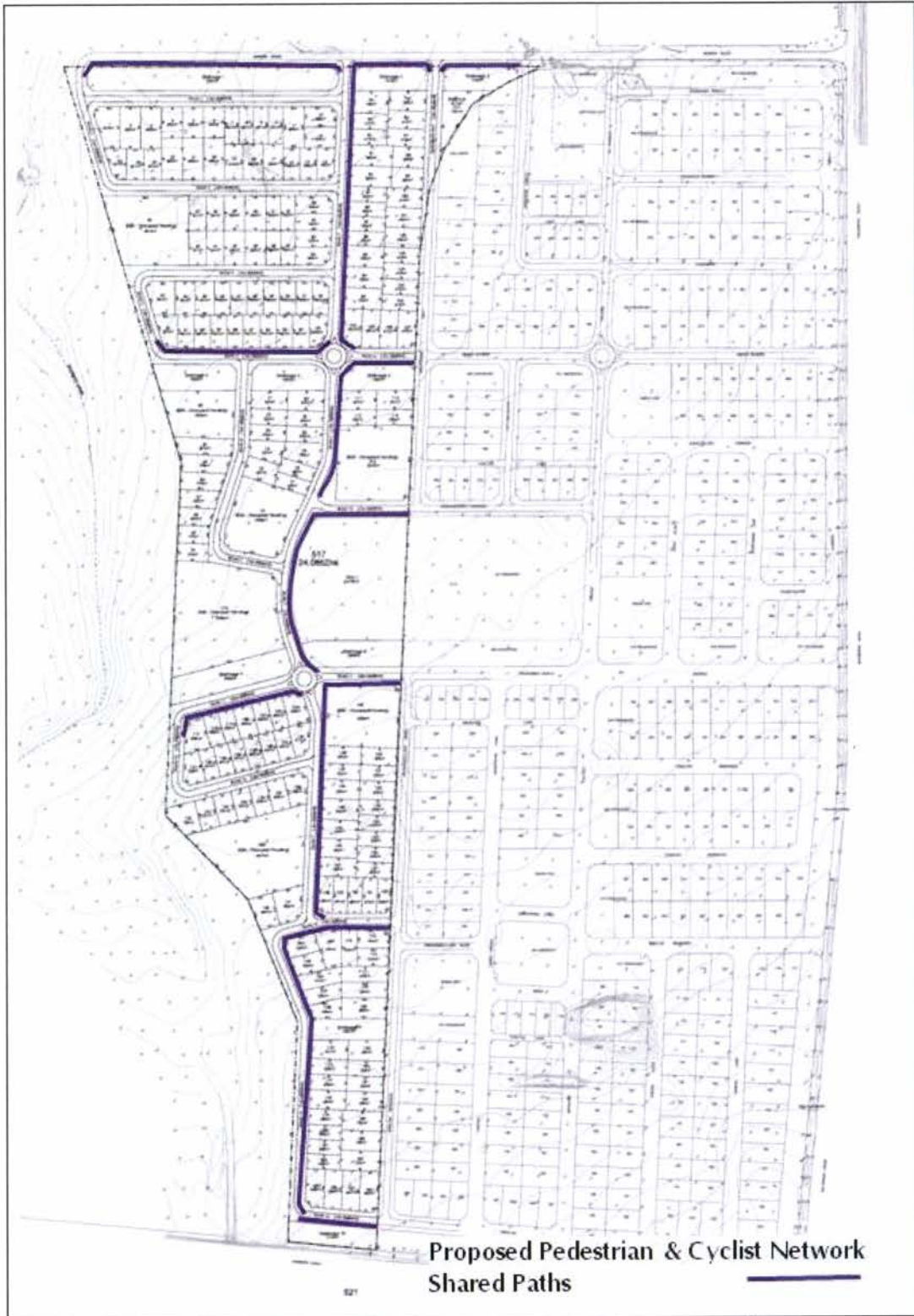


Figure 7. Proposed Revised NW shared path network

APPENDIX A
APPROVED BALMORAL ROAD NICKOL WEST DEVELOPMENT
PLAN



APPENDIX B

**PROPOSED REVISED BALMORAL ROAD NICKOL WEST
DEVELOPMENT PLAN**

**(INCLUDES REVISED NICKOL WEST SUBDIVISION CONCEPT
PLAN)**





APPENDIX E
SERVICING REPORT

26 May 2011

Taylor Burrell Barnett
PO Box 8186
Subiaco WA 6904



the**civil**group

Attention Mr David Reynolds

Dear Sir

**NICKOL WEST KARRATHA
Servicing Report**

This servicing report has been commissioned by Pindan Pty Ltd to support the application to amend the Development Plan for this land. The subject land is located to the west of the existing Nickol West development, which is bounded on its east by Balmoral Road. The subject land is bounded by Dampier Highway, Broлга Meander, Kingfisher Way, Rankin Road and Madigan Creek.

The site is readily developed and various service requirements are outlined in this report.

Earthworks and Geotechnical Conditions

The existing ground conditions at Nickol are typically a layer of rocky-gravelly-clayey material, overlaying rock at depth of approximately 1 to 2 m below ground surface level. The depth to rock beneath the surface tends to decrease as the location nears Dampier Highway. Some pockets of Gilgai clay material may be encountered during site preparation, and this will be removed and replaced with engineered fill in order to be suitable for development. The Shire of Roebourne's technical services staff have indicated that acid sulphate soils are not expected to be an issue on this site.

The clay content of the typical soils in Karratha exhibit varying degrees of shrink/ swell characteristics that must be catered for within the structural detailing of all building footing and structural elements. It is anticipated that Lot Classifications in accordance with AS2870 for the site would typically be M-D or S. A geotechnical investigation has been commissioned to evaluate the site before subdivision works commence, and will outline the site works required to make improvements to the site classification. On completion of the civil construction works, the targeted achievements suggested by the geotechnical investigation will be checked.

Development earthworks levels are typically driven by balancing major design requirements of:

- Lot elevations and road levels being sufficient to allow for major storm event flood routing
- Lot levels being sufficient to allow for gravity sewer connection
- Quantity of imported fill material being minimised
- Depth of service excavations in rock being minimised

Current indications are that the minimum lot development levels for Karratha because of the coastal storm surge, including the effect of global warming, will be in the order of 7.7 mAHD. A more detailed study of storm surge levels (or more correctly a Coastal Vulnerability Study) is currently the work of JDA Consultant Hydrologists commissioned by the Shire and due to be published in May 2011.

JDA has confirmed that this site will not be affected by the forecast storm surge. We do not consider that Nickol West Development site has any additional fill requirements directly relating to coastal storm surge. As noted below, the site must be filled to a minimum level requirement of 10.5 - 10.6 mAHD to suit the gravity sewer connections, well above the predicted 7.7 mAHD storm surge level, and this will control the minimum fill levels in any event.

Wastewater

The subject site is located within the Water Corporation Sewerage Operating Licence Area.

The proposed Nickol West development falls into the gravity sewer catchment of the Karratha Wastewater Pumping Station (WWPS) No 6 located in Falcon Parade. This WWPS discharges wastewater via a pressure main to the Karratha Wastewater Treatment Plant (WWTP) No 2 located west of Madigan Road.

A gravity sewer connection for the proposed Nickol West Development Site is located at the northern end of Falcon Parade adjacent to Rankin Road. Sewer catchment planning for the site requires a minimum lot level of 10.5 - 10.6 mAHD in the proposed development to allow the gravity sewer scheme and sewer pump station emergency overflow arrangements to function correctly.

The Water Corporation is to upgrade various main sewers and facilities in Karratha to increase the capacity of its waste collection and disposal systems to suit the demand for residential and industrial developments. The requirement for the upgrade of the town's wastewater treatment plants will depend on the timing of sewer flows from many developments across Karratha, including this Nickol West development. The latest planning concept prepared by the Corporation for Karratha suggests that WWTP No. 2 will be taken out of service after WWTP No1 (located south east of the Karratha townsite) undergoes a major upgrade. When this occurs, wastewater flows from the Nickol area are planned to be re-directed to the upgraded WWTP No 1. These major wastewater capital works form part of a multi-million dollar upgrade of the town's sewerage system and the works will be completed by the Water Corporation to suit the development demand. None of these major works, however, is a prerequisite for the development of the subject land.

Water Supply

The subject land is located within a Water Corporation Water Operating Licence Area.

Water reticulation connections for the proposed Subject Land would be by connection and extension from existing mains located in Wedgetail Eagle Avenue, Kingfisher Way, Woodswallow Bend and Brolga Meander.

The Karratha gravity water supply scheme sources bulk potable water from the Water Corporation's West Pilbara Water Supply Scheme.

The West Pilbara Water Supply Scheme relies on surface water collection via the Harding Dam and groundwater extraction from the Millstream aquifer. Both of these sources of water have significant constraints. The Harding Dam relies on rainfall associated with tropical cyclones to refill, which by nature is spasmodic in occurrence. The Millstream aquifer has pumping limits in order to preserve the environmental integrity of its location.

The Karratha town site's water scheme will be augmented by construction of a desalination plant on the Burrup Peninsula and this is scheduled to be brought on-stream in early 2013. The timing of the desalination plant is not expected to pose a constraint to release of lots in the subject area.



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Stormwater Drainage

Karratha is located in a region subject to intense rainfall associated with tropical cyclones. This, together with the high soil clay content, results in extreme flow rates generated by stormwater runoff during rainfall.

To accommodate the high stormwater flow rates individual lot levels are typically graded to direct stormwater towards adjacent roadways, which in turn convey the runoff by open gutter flow to appropriately positioned open drains and creek lines. Piped drainage systems will not be provided except for culvert road crossings because they would not have sufficient capacity to convey the required flow rates.

The proposed development includes the provision of east-west falling open drains which provide an outfall for the existing Nickol West development together with discharge points for the subject land.

The requirement to prepare an Urban Water Management Plan (UWMP) is anticipated as a WAPC condition of subdivision. Preliminary discussions have been held with Peter Kata of the Department of Water (DoW) to determine what the DoW would expect or stipulate for a UWMP for this development. The DoW advised that a UWMP for the subject land will need to include copies of the various engineering stormwater and earthworks drawings, along with an accompanying report that demonstrates that –

- all lots are filled above the road level,
- no gutters are to be provided on houses,
- all roof runoff is directed to the roads,
- all roads convey all runoff to the major open drains through the area and
- open drains discharge the runoff into the various water courses.

These requirements for stormwater management are typical of developments in Karratha and across the north-west of WA.

JDA Consultant Hydrologists has recently completed the floodplain mapping of the Madigan Creek north and south of Dampier Highway. Their report (Madigan Creek Flood Study - reference J4755d dated the 17th December 2010) has been sent to the Shire and the Department of Water and is expected to be approved in the near future. The forecast flood levels are lower than the minimum fill level stipulated for the northern portions of the site, and are lower than the natural surface levels in the southern parts of the subject land.

The JDA report concludes that flooding of the subject land is not an issue, provided that the specified minimum fill levels are achieved. Importantly, Madigan Creek is relatively steeply graded, and as a result the coastal storm surge (and even that forecast in 100 years' time) will not affect the subject land or increase the forecast 100-year flood levels in the Creek. A copy of Figure 16 from the JDA report is included in Appendix A.

Power Supply

The existing Karratha town site power high voltage supply scheme is an 11kV network of underground and overhead cables fed from zone substations located on Millstream Road in Bulgarra and Dampier Highway in Millars Well. The existing Nickol West development is fed via two distribution feeders – the Koolinda Feeder (from the north) and the Millstream West Feeder (from the south-east).

Horizon Power has advised that the current 11kV power supply feeder cables in the vicinity of the proposed Nickol Development have the capacity to supply the entire development.



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Stage One consists of 83 residential lots and will be fed via cutting into the existing ring-main feeder cable at the intersection of Goshawk Circle and Falcon Parade, and running new ring-main cable via Rankin Road to a new switchgear within the proposed subdivision. One or two transformers will be installed to reticulate the necessary power to a series of distribution pillars.

A new ring main cable will continue south through subsequent stages of the development, connecting into switchgears as required, and will ultimately terminate into a switchgear at the southern end of the subdivision near Dampier Road, where a new ring-main feeder will be introduced to provide interconnection between two HV supply feeders.

A series of dual voltage (i.e. 11 and 22kV) transformers will also be installed throughout the subdivision to distribute the necessary load. The dual voltage transformers will only be utilised if the subdivision proceeds prior to the finalisation of the Pilbara Underground Power Project (PUPP).

Horizon Power has recently obtained funding for the upgrade of the town power supply scheme to 22kV as part of the PUPP and this work is now underway. Horizon Power has advised that the current programme sees the Nickol Development converted to 22kV within about 12 months. It should be noted, however, that the current works have moved slowly and it is likely that the projected timeframe will be exceeded.

Horizon Power has recently advised that they will require a power supply allowance of 10kVA per standard residential lot for future power supply schemes. Previous design allowances of 6kVA per lot have been found to be too low to match the load generated by air-conditioning.

Telecommunications

The provision of telecommunications to the site will be achieved by connection to the proposed new systems to be installed by NBN Co. The existing development to the east of the subject site is currently provided with ADSL broadband supply.

Gas

No gas reticulation will be provided since Karratha is not provided with a reticulated gas supply network.

Major Infrastructure

All services on or near the subject land are defined as reticulation services. There are no trunk or distribution sewers or water mains in the vicinity of the development. The plan included in Appendix B depicts the location of the wastewater pumping station on Rankin Road, and some water mains and other services that are extended to serve the subject land

Staging

The development is planned to proceed in three stages as delineated on the plan included in Appendix C.

Yours faithfully
The Civil Group WA Pty Ltd



 **Peter Bowyer**
Director

Encl.



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APPENDIX A
EXTRACT FROM
MADIGAN CREEK FLOOD STUDY

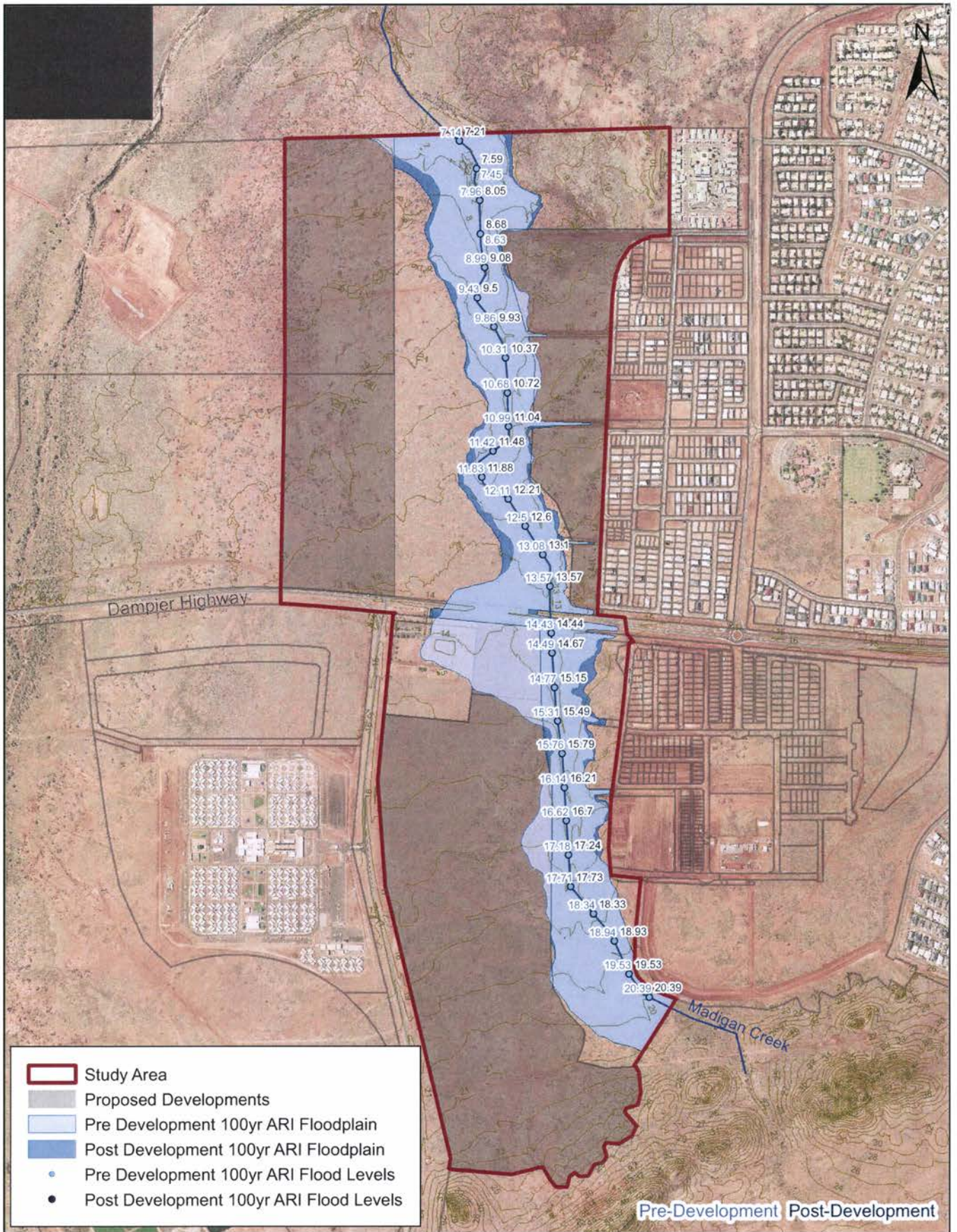
by

JDA Consultant Hydrologists
December 2010



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Data Source: Karratha Aerial Photo (Landgate, 2008)



Job No. J4755
 Scale 1:15,000
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LandCorp
 Madigan Creek Flood Study

Figure 16: Pre and Post-Development 100 year ARI Floodplains

APPENDIX B
EXISTING SERVICES



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LEGEND

- EXISTING SEWER
- EXISTING WATER
- EXISTING POWER
- EXISTING TRANSFORMER & SWITCHGEAR
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARY
- SITE BOUNDARY
- CONNECTION POINT TO EXISTING SERVICES WITH EXTENSION OF INFRASTRUCTURE AS REQUIRED
- - - SEWER
- - - WATER
- - - POWER

NOTE
 DRAWING BASED ON TAYLOR BURRELL BARNETT
 PLAN No 10/032/208A
 DATED 13 MAY 2011

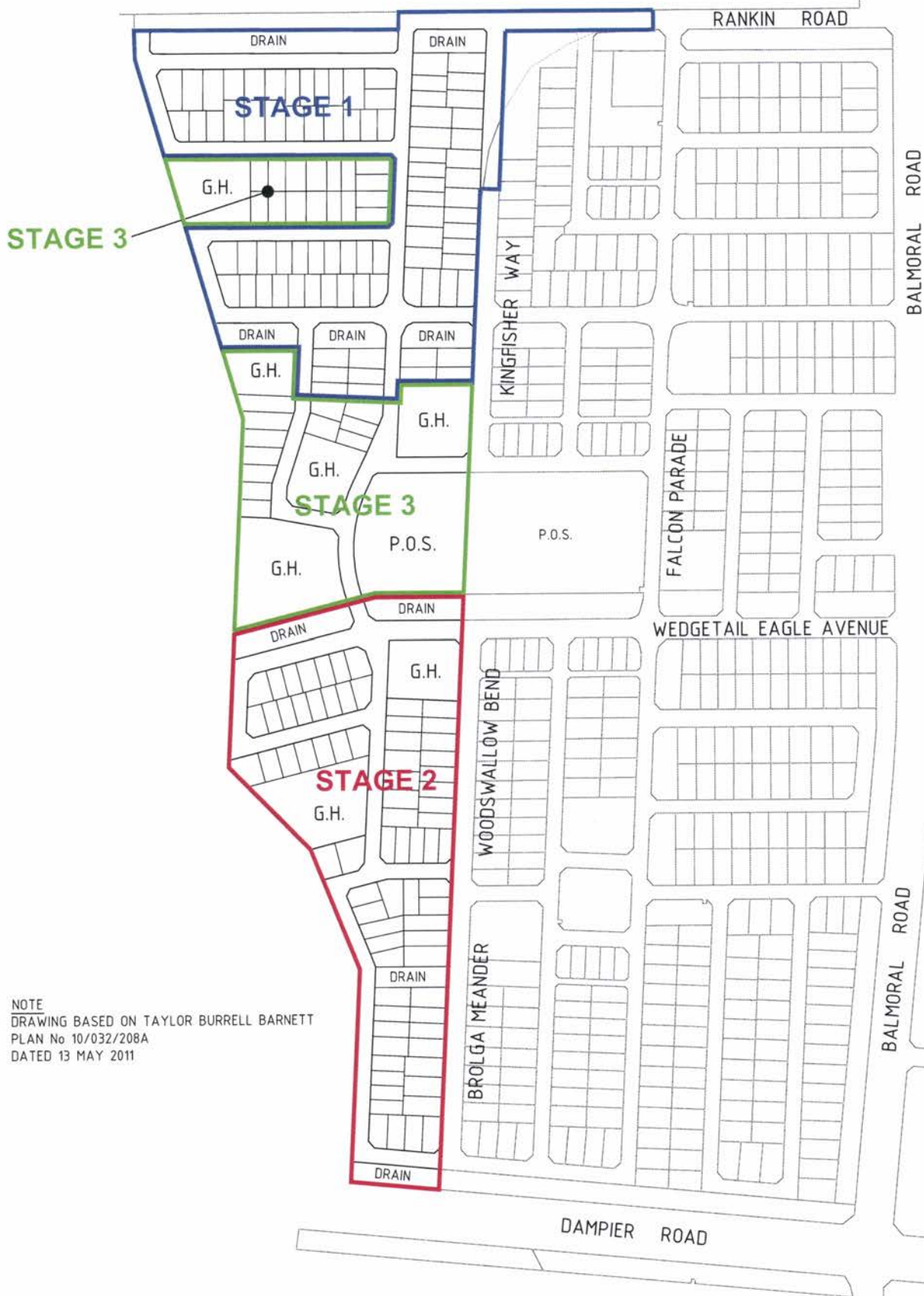
25 MAY 20'

APPENDIX C
PROPOSED STAGING PLAN



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NOTE
 DRAWING BASED ON TAYLOR BURRELL BARNETT
 PLAN No 10/032/208A
 DATED 13 MAY 2011

18 MAY 2011

CLIENT
 PINDAN PTY LTD

TITLE
 NICKOL WEST, KARRATHA
 STAGING PLAN

FIGURE 2

